FINAL

Quality Assurance Project Plan

Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling

Portland Harbor Superfund Site

AECOM Project Number: 60566335
Geosyntec Project Number: PNG0767A

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December 19, 2018

Kenneth M. Tyrrell
PDI Project Coordinator
AECOM Technical Services

Date

QUALITY ASSURANCE PROJECT PLAN (QAPP)

PRE-REMEDIAL DESIGN INVESTIGATION AND BASELINE SAMPLING

PORTLAND HARBOR SUPERFUND SITE

PORTLAND, OREGON

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CROSSWALK TABLE: ELEMENTS OF THE UFP-QAPP AND EPA QA/R-5 IN RELATION TO THIS QAPP

Unified Federal Program (UFP)-QAPP Worksheet	EPA QA/R-5	AECOM/Geosyntec QAPP	Crosswalk to Other Project Documents
#1 Title and Approval Page	A1 Title and Approval Sheet	Title Page	--
#2 QAPP Identifying Information	--	Table of Contents and Section 1	--
#3 Distribution List	A3 Distribution List	Distribution List	--
#4 Project Personnel Sign-Off Sheet		Title Page	--
#5 Project Organization Chart	A4 Project/Task Organization	Section 2 and Figure 2	--
#6 Communication Pathways	--	Figure 3	AECOM/Geosyntec Project Management Plan (internal use document)
#7 Personnel Responsibilities and Qualifications	A4 Project/Task Organization	Section 2 and Figure 2	--
#8 Special Personnel Training Requirements	A8 Special Training/ Certification	Section 3.4	--
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#10 Problem Definition	A5 Problem Definition/ Background	Section 3	--
#11 Project Quality Objectives/Systematic Planning Process Statements	A7 Quality Objectives and Criteria	Section 3.2	--
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#14 Summary of Project Tasks	A6 Project/Task Description	Section 4.1	--
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#16 Project Schedule/ Timeline	--		PDI Work Plan Section 5

Unified Federal Program (UFP)-QAPP Worksheet	EPA QA/R-5	AECOM/Geosyntec QAPP	Crosswalk to Other Project Documents
#17 Sampling Design and Rationale	B1 Sampling Process Design (Experimental Design)	Sections 3.2 and 4.1	--
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#25 Analytical Instrument and Equipment, Maintenance, Testing, and Inspection Table	B6 Instrument/Equipment Testing, Inspection, and Maintenance	Appendix A	--
#26 Sampling Handling System	B3 Sample Handling and Custody	Section 4.3, Appendix A, Appendix B	--
#27 Sample Custody Requirements	B3 Sample Handling and Custody	Section 4.3, Appendix A	--
#28 QC Samples Table	B5 Quality Control	Section 4.6, Tables 6 and 7	--
#29 Project Documents and Records	A9 Documents and Records B10 Documentation/Data Management	Section 3.5 Section 4.10	AECOM/Geosyntec Data Quality Management Plan
#30 Analytical Services	B4 Analytical Methods	Section 4.1 Tables 2a through 2e	--

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#32 Assessment Findings and Corrective Action Responses	C1 Assessments and Response Actions	Section 5.1	--
#33 QA Management Reports	C2 Reports to Management	Section 5.2	--
#34 Data Review Verification (Step 1) Process	D1 Data Review, Verification, and Validation D2 Data Verification and Validation Methods	Section 6	--
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#37 Data Usability Assessment	D3 Reconciliation with User Requirements	Section 6	--

Acronyms:
AECOM = AECOM Technical Services
EPA = United States Environmental Protection Agency
FSP = Field Sampling Plan
Geosyntec = Geosyntec Consultants, Inc
NA = not applicable
PDI = pre-remedial design investigation
QA = quality assurance
QAPP = Quality Assurance Project Plan
QC = quality control
SOP = standard operating procedure
UFP = Unified Federal Program

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Acronyms:
EPA = United States Environmental Protection Agency
ODEQ = Oregon Department of Environmental Quality
QA/QC = quality assurance/quality control
QAPP = Quality Assurance Project Plan
TBD = to be determined

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ACRONYMS AND ABBREVIATIONS

%R	percent recovery
°C	degrees Celsius
µg/L	micrograms per liter
AECOM	AECOM Technical Services
Alt F Mod	Alternative F Modified (EPA–selected remedy in the ROD)
AOC	Agreement Order on Consent
ASAOC	Administrative Settlement Agreement and Order on Consent
BEHP	bis-(2-ethylhexyl) phthalate
bml	below mudline
CFR	Code of Federal Regulations
COCs	contaminants of concern
CPR	cardiopulmonary resuscitation
CRM	certified reference materials
CSM	Conceptual Site Model
D/F	dioxins/furans
D/U Reach	the Downtown Reach and the Upriver Reach
DDx	dichlorodiphenyltrichloroethane (DDT) and its derivatives
DI	deionized
DQIs	data quality indicators
DQMP	Data Quality Management Plan
DQOs	data quality objectives
EDD	electronic data deliverable
EPA	United States Environmental Protection Agency
FSP	Field Sampling Plan
Geosyntec	Geosyntec Consultants, Inc.
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
IDW	investigation-derived waste
LCS/LCSD	laboratory control sample/laboratory control sample duplicates
LPM	laboratory project manager
LWG	Lower Willamette Group
MCPP	methylchlorophenoxypropionic acid
MDL	method detection limit
mg/L	milligrams per liter

MQOs	measurement quality objectives
MS/MSD	matrix spike/matrix spike duplicate
ODEQ	Oregon Department of Environmental Quality
OSHA	United States Occupational Safety and Health Administration
PAHs	polycyclic aromatic hydrocarbons
PARCCS	precision, accuracy, representativeness, completeness, comparability, and sensitivity
PBDEs	polybrominated diphenyl ethers
PCBs	polychlorinated biphenyls
PDA	personal data assistant
PDI	pre-remedial design investigation
PHSS	Portland Harbor Superfund Site
PP	peristaltic pump
PQL	project quantitation limit
Pre-RD AOC Group	Pre-Remedial Design Agreement and Order on Consent Group
PRP	potentially responsible party
PSEP	Puget Sound Estuary Program
QA	quality assurance
QAPP	quality assurance project plan
QC	quality control
RI	remedial investigation
RI/FS	Remedial Investigation/Feasibility Study
RL	reporting limit
RM	river mile
ROD	Record of Decision
RPD	relative percent difference
RPM	remedial project manager
RSD	relative standard deviation
Site	Portland Harbor Superfund Site
SMA	sediment management area
SMB	smallmouth bass
SOP	standard operating procedures
SOW	Statement of Work
Striplin	Striplin Environmental Associates
SWACs	surface weighted average concentrations

TestAmerica	TestAmerica Laboratories, Inc.
TOC	total organic carbon
VOCs	volatile organic compounds

1. INTRODUCTION

The Record of Decision (ROD) described a post-ROD sampling effort for the Portland Harbor Superfund Site (Site or PHSS, Figure 1) located in Portland, Oregon, to delineate and better refine the sediment management area (SMA) footprints, refine the Conceptual Site Model (CSM), update current Site conditions, and support remedial design (United States Environmental Protection Agency [EPA] 2017a). Geosyntec Consultants, Inc. (Geosyntec), with assistance from AECOM Technical Services (AECOM) submitted a detailed Work Plan for Pre-Remedial Design Investigations (PDI) on behalf of a group of industrial parties called the Pre-Remedial Design Agreement and Order on Consent Group (Pre-RD AOC Group). On December 19, 2017, EPA entered into an Administrative Settlement Agreement and Order on Consent (ASAOC) with the Pre-RD AOC Group to conduct the PDI studies at the Site (EPA 2017b). The ASAOC includes the Statement of Work (SOW) and the PDI Work Plan (an attachment to the SOW), which generally describe the field investigation activities, data analyses, schedule, and deliverables for the PDI.

The PDI Work Plan (Geosyntec 2017) provides an overview of studies that will be prepared for the PDI at the PHSS. Environmental samples will be collected during the PDI at the PHSS and upstream. This Quality Assurance Project Plan (QAPP) establishes protocols that are necessary to ensure that the data generated are of a quality sufficient to support the data quality objectives (DQOs) and to ensure that valid conclusions are drawn from the PDI. To the extent practicable, protocols and information from previously approved QAPPs from the remedial investigation (RI) are referenced.

1.1 Objectives

This QAPP is one of several PDI planning documents submitted concurrently in fulfillment of Section 5.7 of the SOW. The QAPP supports the Pre-Remedial Design Investigation and Baseline Sampling programs and provides quality control (QC) elements to satisfy the DQOs for each task as specified in the ASAOC PDI Work Plan. Other concurrently submitted documents include the following:

- Field Sampling Plans (FSPs). Provide details for field sampling locations and procedures for seven project tasks and will be most frequently used by field staff on-site.
- PDI Data Quality Management Plan (DQMP; AECOM and Geosyntec 2018a). Provides details regarding data handling, reporting, database management, and final data upload.
- Health and Safety Plan (HASP; AECOM and Geosyntec 2018b). Identifies all physical, chemical, and biological hazards relevant to each field task and provides hazard mitigators to address these hazards.

1.2 Document Overview

This QAPP has been prepared according to the following EPA guidance documents:

- EPA Requirements of Quality Assurance Project Plans (EPA QA/R-5) (EPA/240/B-01/003, March 2001) (EPA 2001)
- Guidance for Quality Assurance Project Plans (EPA QA/G-5) (EPA/240/R-02/009, December 2002) (EPA 2002a)
- Guidance on Systematic Planning Using the Data Quality Objectives Process (EPA QA/G-4) (EPA/240/B-06/001, February 2006) (EPA 2006)
- Uniform Federal Policy for Quality Assurance Project Plans Part 1 UFP-QAPP Manual, Intergovernmental Data Quality Task Force, March 2005, Version 1 (EPA-505-B-04-900A) (EPA 2005)

The first two documents cited above present a standardized QAPP format; this QAPP has been structured to reflect this format as closely as possible. The following major sections of this QAPP correspond to the sections prescribed in the QAPP guidance documents:

- Group A, Project Management, is addressed in the preceding signature page, table of contents, and Sections 1, 2, and 3 of this QAPP.
- Section 4 addresses Group B, Data Generation and Acquisition.
- Section 5 addresses Group C, Assessment and Oversight.
- Section 6 addresses Group D, Data Validation and Usability.
- Section 7 provides the references cited.

Certain recommended topics from EPA guidance concern field sampling protocols. These protocols are addressed in the task-specific FSPs included as part of the Pre-RD planning documents (and considered attachments to the QAPP); hence, they are briefly described in this QAPP.

2. PROJECT MANAGEMENT

This section presents the organizational structure for the sampling and analysis activities associated with the PDI. The Pre-RD AOC Group, under the oversight of EPA Region 10, is conducting the PDI. The PDI includes planning, fieldwork, laboratory analysis, data management, and data evaluation. The PDI project organization, major task responsibilities, and lines of authority are illustrated in Figure 2. Communication with EPA will be through these individuals. Names and contact information for the individuals listed below as well as other project team members are contained in Table 1.

2.1 EPA Organization and Responsibilities

The EPA is the lead agency for all Portland Harbor in-water PDI activities. EPA will oversee Pre-RD AOC Group activities associated with the PDI as described in the PDI Work Plan (Geosyntec 2017). EPA will coordinate all state, tribal, and agency partner participation per Section 7 of the SOW. The remedial project manager for EPA is Davis Zhen.

2.2 Pre-RD AOC Group Organization and Responsibilities

The Pre-RD AOC Group consists of Arkema Inc., Evraz Inc. NA, The Marine Group, and Schnitzer Steel Industries, Inc. These entities are signatories to the ASAOC. The Pre-RD AOC Group is responsible for conducting the PDI and reporting the results to EPA in documents in accordance with the PDI Work Plan (Geosyntec 2017) and ASAOC and referenced EPA guidance. All official communication with the Pre-RD AOC Group should be through the PDI Project Coordinator (Figure 3).

2.3 Pre-RD AOC Group Team Organization and Responsibilities

Consultants and contractors retained by the Pre-RD AOC Group will perform PDI sampling and analysis activities. The consultant team is responsible for implementation of these tasks at the direction and oversight of the Pre-RD AOC Group. Figure 3 presents the Communication Pathway for the project.

2.3.1 PDI Project Coordinator

Ken Tyrrell of AECOM will be the PDI Project Coordinator and will coordinate the overall PDI efforts. In this role, he will be the primary point of contact for information to and from EPA, on behalf of the Pre-RD AOC Group. In addition, he will oversee and coordinate PDI activities with the Pre-RD AOC Group consultant team and other technical consultants. The PDI Project Manager will report directly to Mr. Tyrrell along with other key team members to ensure that the objectives of the PDI field investigation are communicated to EPA and achieved.

If changes to the PDI FSPs or QAPP are needed, Mr. Tyrrell will discuss proposed changes with the Pre-RD AOC Group and EPA remedial project manager (RPM) or other designated EPA staff.

If immediate changes are needed based on conditions in the field or laboratory, the PDI Project Coordinator will notify the EPA RPM as soon as possible.

2.3.2 PDI Project Manager

Jenny Pretare, Ph.D., of AECOM will be the PDI Project Manager and will be responsible for all facets of the PDI program. Specific responsibilities include the following:

- Provide technical direction and oversight of all contractors.
- Ensure that laboratory capacity is sufficient to undertake the required analysis in a timely manner.
- Ensure adherence to the schedule by tracking sampling, laboratory analysis, validation, and data management tasks.
- Provide solutions to problems if they occur.

Dr. Pretare will conduct final data quality and reporting in compliance with the DQMP (AECOM and Geosyntec 2018a). She will report directly to Mr. Tyrrell, the PDI Project Coordinator.

2.3.3 Project QA/QC Manager

Amy Dahl, PhD of AECOM will be the project quality assurance/quality control (QA/QC) manager and will oversee all aspects of project QA and QC, which may include field and laboratory audits, review of field and laboratory reports, assessment of final data usability, limitations and completeness, review of field and laboratory non-conformance and corrective actions, and data validation oversight. Dr. Dahl will report directly to the PDI Project Manager.

2.3.4 Project Technical Leads

Anne Fitzpatrick of Geosyntec and Betsy Ruffle of AECOM will be the project technical leads. They will oversee all technical aspects of project planning, sample collection, reporting, and data evaluation activities to confirm compliance with the objectives stated in the PDI Work Plan (Geosyntec 2017). Ms. Fitzpatrick and Ms. Ruffle were the primary authors of the SOW and objectives described in the PDI Work Plan (Geosyntec 2017).

2.3.5 Project Field Coordinator

Nicky Moody of AECOM will be the project field coordinator and will be responsible for overall coordination of sampling and analysis tasks in the field. Her key responsibilities will include the following:

- Coordinate the field and laboratory analysis activities.
- Coordinate field support between multiple sampling events.

- Direct all aspects of the sampling events to ensure that the appropriate procedures and methods are used.
- Coordinate with laboratories to ensure the required analyses are conducted in a timely manner.

Ms. Moody will work closely with the PDI Project Manager. If problems occur in the field or if changes to the FSPs or the QAPP are warranted, she will immediately notify the PDI Project Manager. She will be supported by Keith Kroeger of Geosyntec.

2.4 Analytical Laboratory Services

Eight analytical laboratories were selected by the Pre-RD AOC Group to perform the analyses identified by the PDI analytical program. The laboratory selection balances specific analytical capabilities at each location with analytical capacity sufficient to maintain the schedule set forth in the PDI Work Plan (Geosyntec 2017). Tables 2a through 2e show the laboratories performing the specific analyses as well as each of the analytical tests per matrix. Each laboratory maintains an internal QA program and is National Environmental Laboratory Accreditation Program (NELAP)-accredited for the analytical testing assigned to them with the following exceptions. TestAmerica Laboratories, Inc. (TestAmerica) Seattle of Fife, Washington is not currently NELAP accredited for the updated grain size method ASTM D7928 and TestAmerica Burlington is not NELAP accredited for method ASTM D4318 (Atterberg Limits).

2.4.1 ALS Environmental

ALS Environmental of Kelso, Washington, will perform sediment and suspended sediment (from traps) analysis for chlorinated pesticides, polycyclic aromatic hydrocarbons (PAHs), bis-(2-ethylhexyl) phthalate (BEHP), tributyltin, and total solids; fish tissue analysis for BEHP, pentachlorophenol, arsenic and mercury; and surface water analysis (whole water for total fraction) for BEHP, pentachlorophenol, and tributyltin. ALS Environmental of Burlington, Ontario, Canada will perform sediment analysis for chlorinated pesticides in subsurface sediments. The QA manuals for each laboratory and a reference list of laboratory standard operating procedures (SOPs) for these analyses are included in Appendix A.

2.4.2 Analytical Resources Incorporated

Analytical Resources Incorporated (ARI) of Tukwila, Washington will perform surface water analysis for pentachorophenol, total organic carbon (TOC), and dissolved organic carbon. The QA manual for ARI and reference list of laboratory SOPs inclusive of this analysis are provided in Appendix A.

2.4.3 SGS Axys Analytical Services

SGS Axys Analytical Services of Sidney, British Columbia, Canada, will perform fish tissue analysis for chlorinated pesticides, hexachlorobenzene, polychlorinated biphenyl (PCB)

congeners, dioxins and furans (D/Fs), polybrominated diphenyl ethers (PBDEs), and lipids; and will also perform surface water (XAD columns, dissolved fraction, and particulate [total fraction]) analysis for chlorinated pesticides, hexachlorobenzene, PCB congeners, PAHs, and D/Fs. The QA manual and reference list of laboratory SOPs for these analyses are included in Appendix A.

2.4.4 TestAmerica Laboratories, Inc.

TestAmerica Seattle of Fife, Washington, will perform sediment analysis and suspended sediment analysis (from traps) for PCBs (as Aroclors), PAHs, BEHP, tributyltin, total petroleum hydrocarbons–diesel range, metals (arsenic, cadmium, copper, lead, mercury, and zinc), TOC, total solids, and grain size; surface water (whole water) analysis for ethylbenzene, methylchlorophenoxypropionic acid (MCPP), metals (arsenic, calcium, chromium, copper, magnesium, and zinc), dissolved organic carbon, TOC, total dissolved solids, and total suspended solids; porewater/bulk sediment analysis for metals (arsenic and manganese); and porewater analysis for bromide. The QA manual and a reference list of laboratory SOPs for these analyses are included in Appendix A.

TestAmerica of Sacramento, California, will perform sediment and suspended sediment analysis (from traps) for D/Fs. The QA manual and a reference list of laboratory SOPs for this analysis are included in Appendix A.

TestAmerica of Knoxville, Tennessee, will perform sediment and suspended sediment (from traps) analysis for PCB congeners. The QA manual and a reference list of laboratory SOPs for this analysis are included in Appendix A.

TestAmerica of Burlington, Vermont, will perform Atterberg Limits analysis on surface and subsurface sediments. The QA manual and a reference list of laboratory SOPs for this analysis are included in Appendix A.

3. BACKGROUND AND OBJECTIVES

3.1 Site Location and Description

The Portland Harbor Superfund Site is approximately 2,190 acres and extends from river mile (RM) 1.9 to RM 11.8 of the Lower Willamette River. The PDI Study Area extends upstream to RM 28.4 and includes the Downtown Reach and the Upriver Reach (D/U Reach). The shoreline along most of the Portland Harbor area was developed for industrial, marine, commercial, defense, and municipal operations; contaminants from many facilities and combined sewer overflow entered the river system over 100 years of industrialization, resulting in contamination observed in sediment, surface water, and biota tissue. Site background and other Site characteristics are described in detail in the Final Remedial Investigation Report (EPA 2016a).

On December 1, 2000, the Site was listed on the National Priorities List by EPA mainly due to concerns about potential risks to human health and the environment from consuming fish. The most widespread contaminants found at the Site include, but are not limited to, the focused contaminants of concern (COCs), which include PCBs, PAHs, dichlorodiphenyltrichloroethane (DDT) and its derivatives (DDx), and D/F. A remedial investigation and feasibility study (RI/FS) was initiated in 2001 by a small subset of potentially responsible parties (PRPs) known as the Lower Willamette Group (LWG), and completed by EPA in 2016 (EPA 2016a, 2016b). The EPA issued a ROD on January 3, 2017, which detailed the selected final remedy for the in-river portion of the Site. The ROD described a post-ROD sampling effort for the Site to delineate and better refine the SMA footprints, refine the CSM, update current conditions, and support remedial design (EPA 2017a). The PDI is intended to assist in meeting the objectives of the post-ROD sampling effort.

3.2 Data Quality Objectives

To generate data that will meet the PDI objectives, it is necessary to define the types of decisions that will be made, identify the intended uses of the data, and design a data collection program. These are steps in the DQO process. DQOs entail the desired type, range of applicability, and quality of data based on desired decisions and acceptable decision errors. Articulating DQOs is necessary to ultimately obtain sufficient data of known defensible quality for the intended use. The DQO process will assist in determining the necessary quantities, quality, sensitivity, sample handling procedures, and data assessment requirements for the data collected.

The DQO development presented herein adheres to the framework presented in the EPA document “Guidance on Systematic Planning Using the Data Quality Objectives Process” (EPA 2006). The following subsections provide an overview of the seven-step process and DQOs for the PDI. Additional detail for the DQOs for the PDI, showing the seven-step process for each project task, is provided in Table 3.

The goals and input sections below describe the basic elements that are not anticipated to change over the course of the PDI. However, additional details may be added to each as the final FSPs are developed. The final version of this QAPP will be updated to fully describe the inputs and goals for each task described below as well, as detailed in Table 3.

3.2.1 Step 1: State the Problem

The ROD states that a post-ROD sampling effort is conducted to support the remedial design, refine the CSM, and establish a baseline dataset for comparison to post-remedy conditions. This PDI study covers many elements outlined by EPA for post-ROD sampling and data collection, including: surface and subsurface sediment, surface water, sediment porewater, bathymetry, and fish tissue (smallmouth bass [SMB]). The PDI is intended to assist in meeting ROD objectives and to provide the post-ROD sampling data to support the remedial design.

3.2.2 Step 2: Identify the Goals of the PDI

As stated in the PDI Work Plan (Geosyntec 2017), the PDI activities are focused on achieving the following goals:

1) Implement investigation baseline sampling to update existing site-wide data.

2) Gather data to be used as part of baseline dataset for future long-term monitoring.

3) Assist in refining the scope and extent of the remedial actions that will be performed at the Site, including refining SMAs, informing technology assignments consistent with the decision tree in the ROD (Figure 28) throughout the Site, and refining the horizontal and vertical extent of the dredging and capping areas.

4) Collect data to facilitate completion of the third-party allocation by PRPs; this allocation process is independent of EPA oversight.

5) Collect additional data regarding upstream conditions and contaminant loading into the Site.

6) Update and evaluate Site conditions to refine the CSM for all pathways consistent with the ROD, page 106 (Post-ROD Data Gathering).

3.2.3 Step 3: Identify Information Inputs

To achieve the goals of the PDI, the following media-specific information inputs will be collected:

Inputs for Goal 3 – Bathymetry - To develop a detailed bathymetric data set of the Site, a site-wide multi-beam high-resolution sonar survey will be conducted throughout the Site, and the survey will be supplemented with single-beam measurements in nearshore areas to provide

adequate spatial coverage. Details of the bathymetry survey are provided in the Bathymetry Survey FSP.

Inputs for Goal 1 – Sediment - To determine the current baseline river bed conditions throughout the Site, a total of 666 surface sediment samples (428 stratified random samples, 178 targeted samples located in SMA areas, and 60 targeted surface sediment samples co-located with in-water core samples) will be collected and analyzed for the sediment COCs listed in Tables 2a and 2b of this QAPP.

Inputs for Goal 2 – Sediment - To help develop the baseline dataset for long-term monitoring, 428 stratified random surface sediment samples will be collected, and SWACs will be developed throughout the Site (at the spatial scales described in the PDI Work Plan). Samples will be collected and analyzed for the sediment COCs listed in Table 2b of this QAPP. The basis and rationale for placement of the stratified random samples is described in the PDI Work Plan.

Inputs for Goals 3 and 4 – Sediment - To refine the SMA footprints, 238 targeted (non-random) surface sediment samples (178 targeted samples and 60 targeted samples co-located with sediment in-water core samples) will be collected from SMA areas. To refine the horizontal and vertical extent of sediment contamination, 90 sediment core locations within or along the boundaries of the SMA will be collected. Sediment samples will be analyzed for the sediment COCs listed in Tables 2a and 2b of this QAPP. These data will be used collectively with the recent surface sediment samples and historical subsurface data to refine the SMA footprints. Some of the stratified random samples may also be used to refine the SMA footprints if their locations happen to fall near and/or within the Alt F Mod footprint. See the FSPs for sediment grab and core placement rationale.

Inputs for Goal 6 – Sediment - To the extent that PDI surface sediment samples fall near sediment sample locations evaluated in earlier studies, these samples will be used to evaluate changes in concentrations. Segment-wide, area-wide, and site-wide SWACs may also be evaluated for changes over time.

Inputs for Goal 5 – Upriver Sediment - To provide information on the sediment loads entering the Site, sediment traps will be deployed at RM 11.8 and RM 16.2 (Downtown Reach) over three flow conditions. A total of 60 surface sediment samples (30 samples from Downtown Reach and 30 samples from Upriver Reach) will be collected targeting representative % fines and TOC content to Site sediments. The sediment trap and upstream surface sediment samples will be analyzed for the sediment COCs listed in Table 2b of the QAPP (full ROD COC list for sediment) and select samples for geotechnical parameters (Atterberg Limits). Proposed sampling locations are presented in the Surface Water and Sediment Trap FSP and the Surface Sediment Sampling FSP. These data will be supplemented with upriver surface sediment and surface water data lines of evidence.

Inputs for Goals 1 and 2 – Surface Water - To determine the current baseline surface water conditions, seven composite water samples (vertically and horizontally composited) will be collected from five transects distributed across the Site, and two upriver transects, one in the Downtown Reach and one in the Upriver Reach over three flow conditions. A total of 21 samples will be collected from either the low-volume peristaltic pump (PP) or high-volume XAD sampling methods. The surface water samples will be collected at proposed locations on Figure 2 of the Surface Water and Sediment Trap FSP and analyzed for the surface water COCs listed in Table 2c of the QAPP. Table 2c illustrates which analytes will be collected by the PP method or the XAD method. The PP method can collect a whole water sample or a field filtered sample for dissolved metals. The XAD method collects a dissolved water sample and a dry solids sample, which allow the total concentrations to be calculated.

Inputs for Goal 5 – Background Porewater - To determine background porewater concentrations of naturally occurring arsenic and manganese, eight porewater samples will be collected during low-flow summer conditions. The porewater samples will be analyzed for arsenic and manganese as listed in Table 2d.

Inputs for Goals 1 and 2 – Fish Tissue - To determine current levels of fish tissue COCs in resident SMB at the Site, a total of 95 SMB samples will be collected from four segments across the Site. The SMB samples will be analyzed for the fish tissue COCs listed in Table 2e.

Inputs for Goal 5 – Upriver Fish Tissue - To characterize upriver concentrations of COCs in resident SMB, a total of 40 SMB samples will be collected throughout the D/U Reaches (20 in the Downtown Reach and 20 in the Upriver Reach). The SMB samples will be analyzed for the fish tissue COCs listed in Table 2e.

Inputs for Goal 6 – Fish Tissue - To update statistically based evaluations of PCB differences and changes in fish tissue, the PDI SMB data will be statistically compared to the SMB data collected in 2012 and other time periods as appropriate.

Inputs for Goal 6 – Fish Tracking - To determine temporal and spatial movements of SMB at the Site, an array of acoustic receivers will be placed throughout the Site from spring 2018 to spring 2019.

3.2.4 Step 4: Define the Boundaries of the Study

The Site extends from RM 1.9, near the mouth of the Willamette River, upstream to RM 11.8 (Figure 1). The temporal boundary for the study will be to complete field sampling activities by winter 2019. The upriver boundary of the sampling area extends from RM 11.8 up to RM 28.4. No samples will be collected downstream of the Site or the Multnomah Channel; however, a bathymetry survey will be performed up the mouth of the channel to the Sauvie Island Bridge to ensure adequate data resolution within the Site.

3.2.5 Step 5: Develop the Analytical Approach

The field investigation component of the PDI will collect site-specific data integral to achieving the goals of the study listed above. Data will be collected from the bathymetric survey, surface and subsurface sediment, sediment traps, surface water, porewater, SMB fish tissue, and fish tracking sampling events at the Site and D/U Reaches. Data will be evaluated using the analytic approaches or "if/then" statements listed in Table 3 of this QAPP. They reflect the decision statements that are based on the data inputs for each task as listed above.

Samples of each of the matrices listed above will be collected from the locations presented in the figures contained in each task-specific FSP and analyzed for the parameters listed in Tables 2a through 2e; results will be assessed against the ROD cleanup levels listed in Tables 2a through 2e of this QAPP.

3.2.6 Step 6: Specify Performance or Acceptance Criteria

The measurement performance criteria for data associated with the specific analyses include precision, accuracy, representativeness, completeness, comparability, and sensitivity (PARCCS). To meet PARCCS requirements, QC criteria are provided in the standard field and laboratory methods. These criteria include the use of the following:

- Field duplicates, laboratory duplicates, laboratory control sample/laboratory control sample duplicates (LCS/LCSD), and matrix spike/matrix spike duplicate samples (MS/MSD) to assess precision
- Matrix spikes, LCS, surrogates, calibration results, and field and method blanks to assess accuracy and bias
- Field sampling design and sample collection SOPs to determine representativeness
- Standard methods and the consistent use of field and laboratory SOPs, method detection limit (MDL) studies, and calibration to achieve comparability
- Blanks, including field and laboratory QC blanks, to determine and assess sensitivity, cross-contamination, and bias

Specific objectives for each PARCCS criterion are established to develop sampling protocols, applicable documentation, sample handling procedures, and measurement system procedures that will be used during field activities associated with the PDI. These are described in more detail in Section 3.3, and the criteria are presented in Tables 2a through 2e.

3.2.7 Step 7: Develop the Plan for Obtaining Data

The PDI strategy is based upon the ROD, the scope of work contained in the PDI Work Plan, and technical information contained in the individual FSPs. The basis of the sampling design and rationale for the PDI tasks are presented in Section 3 of the PDI Work Plan (Geosyntec 2017),

and the specific sediment, surface water, porewater, and fish tissue sampling locations to be sampled are identified in their task-specific FSPs. Some of these proposed locations, especially upriver surface sediment sampling locations, will be confirmed after field reconnaissance surveys have been completed.

3.3 Quality Objectives and Criteria of Measurement

3.3.1 PARCCS Overview

This QA program addresses both field and laboratory activities. Quality assurance objectives are formally measured through the computation of performance measures known as data quality indicators (DQIs), which are in turn compared to pre-defined Measurement Quality Objectives (MQOs) specific to the project objectives (EPA 2002a). The DQIs for measurement data are expressed in terms of PARCCS. Evaluation of DQIs provides the mechanism for ongoing control and evaluation of data quality throughout the project, and ultimately will be used to define the data quality achieved for the various measurement parameters. The field QA/QC program will be accomplished through the collection of field duplicates, equipment (rinsate) blanks, field blanks, MS/MSD, and trip blanks, as applicable. The analytical QA/QC program will be assessed through the internal laboratory QC performed, including but not limited to method blanks, LCS recoveries, surrogate recoveries, and MS/MSD recoveries. The following sections describe the DQIs in greater detail, with a discussion of the associated MQOs.

3.3.2 Precision

Precision refers to the reproducibility or degree of agreement among duplicate measurements of a single analyte. The closer the numerical values of the measurements, the more precise the measurement. Poor precision stems from random errors (i.e., mechanisms that can cause both high and low measurement errors at random). Precision is usually stated in terms of standard deviation, but other estimates, such as the coefficient of variation (relative standard deviation), range (maximum value minus minimum values), and relative range are common and may be used pending review of the data.

During the collection of data using field methods and/or instrumentation, precision is checked by reporting several measurements taken at one location and comparing the results. Precision will be determined from replicate/duplicate samples and will be expressed as the relative percent difference (RPD) between replicate/duplicate and parent sample results, computed as follows:

$$RPD = \frac{X_1 - X_2}{(X_1 + X_2)/2} \times 100$$

where X_1 and X_2 are reported concentrations for each replicate sample and subtracted differences represent absolute values. For field duplicates, the precision goals for this project are as follows: 1) RPD = 50% for solid samples; and 2) RPD = 30% for liquid samples. Field duplicates will not

be collected for fish tissue or for surface water analyses collected using high volume sampling method. For laboratory duplicates (chemistry), the RPD goals are defined by the laboratory acceptance criteria determined from control limits or defined by the specific method. With regard to grain size analysis, laboratory triplicates and relative standard deviation (RSD) goals are defined by the laboratory acceptance criteria as defined by the specific method.

Precision will be determined through the collection of field duplicates and the analysis of MS/MSD and LCS/LCSD pairs for the work performed at the Site. The overall precision of measurement data is a mixture of sampling and analytical factors. Analytical precision is much easier to control and quantify than sampling precision; there are more historical data related to individual method performance, and the "universe" is not limited to the samples received in the laboratory. In contrast, sampling precision is unique to the project. Sampling precision will be measured through the laboratory analysis of field duplicate samples. For field duplicates, homogenized samples from the sample collection device will be split into two samples for analysis to assess sample homogenization and matrix heterogeneity variability (sediment). Laboratory precision will be measured through the analysis of MS/MSD pairs, LCS/LCSD pairs, and laboratory duplicate pairs. Laboratory duplicate pairs are used to assess the precision or variability of the laboratory process.

3.3.3 Accuracy and Bias

Accuracy refers to the degree of difference between measured or calculated values and the true value. The closer the numerical value of the measurement comes to the true value, or actual concentration, the more accurate the measurement. The converse of accuracy is bias, in which a systematic mechanism tends to consistently introduce errors in one direction or the other. Bias in environmental sampling can occur in one of three ways; these mechanisms and their associated diagnostic and management methods are as follows:

- High bias, which can stem from cross-contamination of sampling, packaging, or analytical equipment and materials. Cross-contamination is monitored through blank samples, such as equipment blanks, field blanks, trip blanks, filter blanks, and method blanks. These samples assess the potential for cross-contamination from, respectively, sampling equipment, ambient conditions, packaging and shipping procedures, field filters, and laboratory equipment. Data validation protocols provide guidance for data qualification based on blank contamination.
- Low bias, which can stem from the dispersion and degradation of target analytes. An example is the volatilization of chlorinated solvents during field sampling. The effects of these mechanisms are difficult to quantify. Sampling accuracy can be maximized, however, by the adoption and adherence to a strict field QA program. Specifically, sampling procedures will be performed following the standard protocols described in the FSPs; for example, eliminating headspace in sampling vials for volatile organic compounds (VOCs) will reduce the potential for dispersion of VOCs during sampling.

Through regular review of field procedures, deficiencies will be documented and corrected in a timely manner.

- High or low bias can occur due to poor recoveries, poor calibration, or other system control problems. The effects of these mechanisms on analytical accuracy may be expressed as the percent recovery of an analyte that has been added to the environmental sample at a known concentration before analysis. Analytical accuracy in the laboratory will be determined through the analysis of surrogates, LCSs, and MS/MSDs. As with blank samples, data validation protocols provide a structured formula for data qualification based on high or low analyte recoveries outside of the laboratory and/or method acceptance limits.
- Accuracy, when potentially affected by high or low recoveries as described in the third bullet above, is presented as percent recovery (%R), which is defined as:

$$\% R = \frac{Spiked\ Sample\ Concentration - Sample\ Concentration}{Spike\ Concentration} \times 100$$

- Accuracy goals for analytical results are presented as upper and lower control limits for LCS and MS/MSD percent recovery in Tables 2a though 2e. Laboratory control limits will be used for the accuracy goals for surrogates. The current values are presented for informational purposes only. Data review/validation will be based on the most current laboratory control limits in effect at the time of analysis.

3.3.4 Representativeness

Representativeness is defined by the degree to which the data accurately and precisely describe a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. If the results are reproducible, the data obtained can be said to represent the environmental condition. Representativeness is ensured by collecting sufficient numbers of samples of an environmental medium, properly chosen with respect to place and time. The precision of a representative set of samples reflects the degree of variability of the sampled medium as well as the effectiveness of the sampling techniques and laboratory analysis. The Pre-RD AOC Group in collaboration with EPA has developed a statistically robust and valid multi-media PDI sampling program that will achieve many of the ROD objectives. The statistical basis for development of the sediment and tissue sampling scope is described in Appendices B and C respectively of the approved PDI Work Plan (Geosyntec 2017). Based on these analyses, the PDI samples are expected to represent current conditions within the Site.

3.3.5 Completeness

Completeness is defined as the percentage of measurements made that are judged to be valid measurements. The completeness goal is essentially the same for data uses in that sufficient amounts of valid data are to be generated.

There are limited historical data on the completeness achieved by individual methods. However, based on historical datasets associated with the EPA's Contract Laboratory Program, data have been found to be 80% to 85% complete on a nationwide basis.

The percent completeness for each set of samples will be calculated as follows:

$$\% \, Completeness = \frac{Valid \ Data}{Total \ Data \ Planned} \times 100$$

The QA objective for completeness for the parameters will be 90%.

3.3.6 Comparability

Comparability expresses the confidence with which one data set can be compared to another data set measuring the same property. Comparability is ensured using established and approved analytical methods, consistency in the basis of analysis (wet weight, volume), consistency in reporting units (micrograms per liter [µg/L], milligrams per liter [mg/L]), and analysis of standard reference materials. Comparable data sets must contain the same variables of interest and must possess values that can be converted to a common unit of measurement. Comparability is normally a qualitative parameter that is dependent upon other data quality elements. For example, if the detection limits for a target analyte were significantly different for two different methods, the two methods would not be comparable. By using standard sampling and analytical procedures, and carefully assessing laboratory capabilities, datasets will be comparable.

3.3.7 Sensitivity

Sensitivity refers to the minimum magnitude at which analytical methods can resolve quantitative differences among sample concentrations. If the minimum magnitude for a particular analytical method is sufficiently below an action level or risk screening criterion, then the method sensitivity is deemed sufficient to fully evaluate the dataset with respect to the desired reference values. Frequently, risk-based screening levels fall below the sensitivity of even the most sensitive analytical methods. In such cases, it is necessary to review the qualifications of several laboratories, both from the standpoint of sensitivity as well as other DQIs, to select the best laboratory for the project.

The MDL is a theoretical limit determined through an MDL study in which the concentration of a spiked solution is tested at least seven times and the concentration of method blanks is tested at least seven times. The standard deviation of the recovered concentrations is computed and multiplied by the t-distribution value to arrive at the MDL. The higher of the two MDLs is then used as the MDL for the analyte and test method. The project quantitation limit (PQL), sometimes referred to as the reporting limit (RL), is a quantifiable value and usually the lowest concentration standard used in the calibration curve. In practice, to allow for matrix interferences variability in instrument control, a RL of three to eight times the MDL is typically selected.

Analytical sensitivity is readily evaluated by comparing method RLs and/or MDLs to risk-based screening values, such as ROD Table 17 COC cleanup levels. The results of this analysis are presented in Tables 2a through 2e of this QAPP, which demonstrate the suitability of the selected methods to meet the project requirements within the limits of technical practicability. The methods selected are the most current and sensitive methods available, however, the RLs and/or MDLs for the following analytes may not meet the ROD cleanup levels:

- dioxin/furans in surface water (2,3,7,8-TCDD eq)
- arsenic in surface water, porewater, and fish tissue
- 2,3,7,8-TCDD, 1,2,3,7,8-PeCDD, 2,3,4,7,8-PeCDF, and pentachlorophenol in fish tissue

Both the PQLs and the MDLs will be recorded in the project database; however, analytical results will be reported to the MDLs consistent with previous RI studies to meet the majority of the project reporting requirements.

3.4 Special Training / Certifications

Health and safety training will include the following:

- Initial training of Site workers in 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER), per 29 Code of Federal Regulation (CFR) 1910.120, with supervisor training for the field manager and annual 8-hour refresher training thereafter for all field staff
- Project Field Coordinators will have United States Occupational Safety and Health Administration (OSHA) 10 (or 30) hour Hazard Awareness Training for Construction or Maritime Related Industries
- Annual training in cardiopulmonary resuscitation (CPR)
- Triennial first aid training
- Baseline and annual medical monitoring

All sampling personnel will have completed the 40-hour HAZWOPER training course and 8-hour refresher courses, as necessary. The 40-hour course meets the OSHA regulation 29 CFR 1910.120(e)(3). Documentation of course completion will be required, and copies will be maintained in personnel files. All subcontractors performing work during the PDI will be required to conduct all activities in accordance with applicable health and safety regulations and site-specific requirements. A copy of the project HASP will be provided to each subcontractor. However, subcontractors will be responsible for the health and safety of their personnel while working at the Site. Each day before work commences, a tailgate health and safety meeting will be conducted by the field coordinators with participation by the full contractor field team.

All sampling activities conducted during the PDI will be performed by individuals with training and experience in the specific sampling and monitoring techniques. Individuals collecting samples will be trained, as necessary, on the specific requirements provided in the field SOPs.

3.5 Documentation and Records

Documentation involves generating, maintaining, and controlling field data, laboratory analytical data, field logs, reports, and any other data relevant to the project. Bound field logbooks, loose-leaf coring logs, or automated field data entry records generated with personal data assistants (PDAs) are examples of documents. This project will have dedicated field logbooks, forms, and databases that will not be used for other projects. Entries will be dated, and the time of entry will be recorded. Sample collection data as well as visual observations will be documented on forms or PDAs or, when forms are not available or applicable, in the field logbook. To the extent possible, field data will be recorded on field forms or PDAs and not repeated in the field notebook. Any sample collection equipment, field analytical equipment, and equipment used to make physical measurements will be identified in the field documentation. Calculations, results, equipment usage, maintenance, and repair and calibration data for field sampling, analytical, and physical measurement equipment will also be recorded in field documentation. Once completed, the field forms, field databases, and field logbook will become part of the project file.

Office data management will involve establishing and maintaining a project file. The project file will include the following:

- PDI planning documents, such as this QAPP
- FSPs and schedules
- SOPs (for both the field and laboratory)
- Field sampling logs
- Field screening data
- QA auditing and inspection reports
- Laboratory analytical data
- Calculations
- Drawings and figures
- Reports
- External and internal correspondence
- Notes/minutes of meetings and phone conversations
- Contract/purchase orders
- Change orders

- Bid evaluations

All project-related information will be routed to the PDI Project Manager who will be responsible for distributing the information to appropriate personnel. The official project files will be maintained in the Seattle, Washington, offices of AECOM and Geosyntec. Project documentation will be archived for a minimum of 10 years after completion of the remedial action, as required by the ASAOC.

4. DATA GENERATION AND ACQUISITION

4.1 Sample Design

Below are overviews of the sampling designs for the various components of the PDI. Complete sampling designs and rationales are described in the PDI Work Plan (Geosyntec 2017) and individual FSPs. A total of seven FSPs have been developed for the PDI study (Appendix C). These include FSPs for bathymetry, surface sediment sampling, subsurface sediment coring, fish tissue sampling, surface water and sediment trap sampling, fish tracking, and porewater sampling.

4.1.1 Bathymetry Survey

The bathymetry survey is designed to produce an up-to-date bathymetric survey of the Site with a high level of detail and accuracy. Multi-beam sonar will be used to collect high-resolution data throughout the Site, supplemented with single-beam data in difficult access areas, with a survey goal of 80 to 100% coverage of the riverbed, as some areas will be difficult to cover (e.g., under docks, around ships, inside oil booms, etc.).

4.1.2 Surface Sediment Sampling

Three kinds of surface sediment data will be collected: stratified random samples within a grid system, targeted non-random samples located in the SMA areas, and co-located samples to correspond with sediment core samples also placed in SMA areas. The stratified random sample design is based on a geostatistical analysis approach to maintain or improve upon the level of variability in the SWACs generated using 2004 data and in most areas and assessment segments, and to enable the design to statistically detect differences ($\alpha = 0.05$) between 2004 SWACs and current SWAC estimates with an approximate 80% level of statistical power. Additional samples may be added to the current scope of work, with the purpose of re-occupying old 2004 surface sediment stations (or other period more than 10 years old). The targeted samples placed in SMA areas are designed to further refine the SMA footprints (along with the subsurface data) and inform the decision tree described in the ROD.

4.1.3 Subsurface Sediment Coring

Subsurface sediment coring is designed to refine the vertical and horizontal extent of contamination. Ninety subsurface core locations are planned in targeted areas within or along the boundaries of SMAs that have limited spatial coverage both vertically and horizontally. A distance of 250 to 300 feet was used as a general guide for spacing to the next nearest coring location. Target core depths range from 6 feet below mudline (bml) for shallow, nearshore cores, up to 20 feet bml for deep cores, with 3 to 8 samples collected per core assuming 2-foot sample intervals.

4.1.4 Sediment Trap Sampling

The sediment trap sampling is designed to provide information on the incoming sediment load to the Site. Four sediment traps, two at RM 11.8 and two at RM 16.2, will be deployed over three flow conditions (summer low-flow, winter high-flow, and storm flood-influenced conditions) to collect fine-grained, more mobile suspended sediment and higher TOC material that is more likely to move downstream and be deposited at the Site.

4.1.5 Surface Water Sampling

The objective of surface water sampling is to develop baseline river conditions with synoptic data (sediment, fish tissue, surface water), evaluate surface water current conditions and changes, and provide 2018 data to refine the CSM for remedial design purposes. Surface water will be collected from seven transect locations as cross-section composite samples over three flow conditions (summer low-flow, winter high-flow, and storm flood-induced conditions) that coincide with the sediment trap sampling events.

One composited sample will be collected per transect (similar to the RI/FS data use approach). The objective of the composite sample design is equal volume across the cross-sectional area of the segment. A total of 21 samples will be collected using PP (low-volume) and high-volume XAD samplers, consistent with the RI/FS.

4.1.6 Fish Tissue Sampling

The fish tissue sampling design will split the Site into four segments and will target collecting 20 to 30 SMB from each segment. Twenty SMB samples will also be targeted for collection from the Downtown Reach and 20 SMB will be targeted from the Upriver Reach. The objectives of the fish tissue sampling study include characterization of current levels of fish tissue COCs in resident fish tissue, characterization of upriver concentrations in resident fish tissue, an update of statistically based evaluations of PCB differences and changes in fish tissue, and an update and evaluation of Site conditions to refine the CSM for all pathways consistent with the ROD.

4.1.7 Fish Tracking Study

The fish tracking study will be conducted throughout the Site using an array of acoustic receivers. The receivers will be placed at 34 locations, and 40 SMB will be tagged and monitored for a period of 1 year. Equipment will be periodically checked for performance and data downloaded at 3-month, 6-month, and 12-month intervals. The design will capture fine-scale temporal and spatial movement of SMB that can be used to understand SMB movement in the study area.

4.1.8 Porewater Sampling

Porewater samplers (peepers) will be deployed, in triplicate, in the sediment bed in areas that are representative of background arsenic and manganese concentrations. Eight sampling locations

will be placed in upstream areas or other relevant areas from within the Site that meet target conditions (outside of SMAs, high TOC, high percent fines, low redox, near wetlands, etc.). Peepers will be co-located with surface sediment sampling locations and sediment will be pre-screened for arsenic and manganese. Porewater data will be used to assist in the development of background metals, porewater concentrations of arsenic and manganese, and to further inform remedial action objectives.

4.2 Sample Methods

The task-specific FSPs for each media type contain complete descriptions of the sample collection and handling methods. The types and numbers of samples that will be collected, the rationale for collection, and the analyses that will be performed are discussed in the FSPs. The sections below provide a general description of the sampling methods.

4.2.1 Sample Nomenclature Scheme

Sample containers will be labeled with an identification number that uniquely identifies the sample. The sample nomenclature number will be logged in the field logbook or applicable sampling form as prescribed in the task-specific FSPs, along with the following information about the sampling event:

- Sampling personnel
- Date and time of collection
- Field sample location and depth (as appropriate)
- Type of sampling (composite or grab)
- Method of sampling
- Sampling matrix or source
- Intended analyses

The sample nomenclature design includes up to five components. Component 1 is the PDI study. Component 2 is the matrix type (sediment, water, tissue). Component 3 is the unique station code. Component 4, if needed, provides more detail about a sample such as core sample depth, monitoring round, or low-flow sample event. Component 5 is for the field duplicate designation. Table 4 further describes the sample nomenclature design for all media and the QA/QC samples.

4.2.1.1 Surface Sediment Sample Nomenclature

The sample nomenclature for surface sediment samples will consist of up to five components: a three-letter project identification code, followed by a sample matrix code, a sample station code, a monitoring round code (for baseline monitoring sites), and a QC code (if appropriate). Examples of the nomenclature scheme are as follows:

- PDI-SG-B001-BL1 = Pre-design investigation, surface sediment grab, from baseline monitoring station #1, baseline monitoring round #1.
- PDI-SG-S110 = Pre-design investigation, surface sediment grab, sediment management area station #110.
- PDI-SG-B001-BL1-D = Pre-design investigation, surface sediment grab, baseline monitoring station #1, baseline monitoring round #1, field duplicate sample.
- Samples collected for MS or MSD purposes will have the same sample identification as the original sample and will be indicated on the same line on the Chain-of-Custody Record as the original sample with a comma and then -MS, -MSD next to it. Alternatively -MS, -MSD may be entered in the comment section or line on the Chain-of-Custody Record where the original sample ID is listed. Either way, the sample will be considered a single sample and will not be considered three discrete samples.

Other relevant field information about these samples (e.g., sample penetration depth, confirmed coordinates, water depth, mudline elevation, and visual observations) will be recorded in the field notebooks and included in the project database. The DQMP (AECOM and Geosyntec 2018a) provides detailed description of database management and data compilation activities.

4.2.1.2 Subsurface Sediment Sample Nomenclature

The sample nomenclature for subsurface sediment core samples will consist of up to five components: a three-letter project identification code, followed by a sample matrix code, a sample station code, a sample depth interval, and a QC code (if appropriate). Examples of the nomenclature scheme are as follows:

- PDI-SC-S010-2to4 = Pre-design investigation, sediment core, sediment management area station #10, depth interval 2 to 4 feet
- PDI-SC-S010-2to4-D = Pre-design investigation, sediment core, sediment management area station #10, depth interval 2 to 4 feet, field duplicate sample

Other relevant field information about these core samples (e.g., sample depth, percent core recovery, drive depth, total sample volume, and visual observations) will be recorded in field notebooks and included in the project database.

The DQMP (AECOM and Geosyntec 2018a) provides detailed description of database management and data compilation activities.

4.2.1.3 Surface Water Sample Nomenclature

The sample nomenclature for the surface water samples will consist of up to five components: a three-letter project identification code, a sample matrix code, a transect location code, a sampling date, and a QC code (if appropriate). Examples of the nomenclature scheme are as follows:

- PDI-WS-T07-1807 = Pre-design investigation, water (surface water), transect seven, July 2018
- PDI-WS-T07-1807-D = Pre-design investigation, surface water, transect seven, July 2018, field duplicate sample.
- For ethylbenzene, the transect number will be followed by "E," N," or "W" to indicate location along the transect where E = east, N = navigation channel, and W = west.
- Samples collected for MS or MSD purposes will have the same sample identification as the original sample and will be indicated on the same line on the Chain-of-Custody Record as the original sample with a comma and then -MS, -MSD next to it. Alternatively -MS, -MSD may be entered in the comment section or line on the Chain-of-Custody Record where the original sample ID is listed. Either way, the sample will be considered a single sample and will not be considered three discrete samples.

The sample identifications will not be different for the specific fractions of surface water (i.e., whole water, filtered water, particulate phase, or XAD-2 adsorbed dissolved phase). Rather, the matrix field within the database will be used to identify the specific fraction. For example, the nomenclature would use "XAD" to represent the dissolved phase of the organic constituents collected using the PR2900 or "F" for field-filtered samples collected using the PP. See the DQMP (AECOM and Geosyntec 2018a) for details.

4.2.1.4 Sediment Trap Sample Nomenclature

The sample nomenclature for the sediment trap samples will consist of up to five components: a three-letter project identification code, a sample matrix code, a sample station code, a sampling date, and a QC code (if appropriate). Examples of the nomenclature scheme are as follows:

- PDI-ST-T07A-1803 = Pre-design investigation, sediment trap, transect seven station A, March 2018
- PDI-ST-T07B-1803-D = Pre-design investigation, sediment trap, transect seven station B, March 2018, field duplicate sample

4.2.1.5 Fish Tissue Sample Nomenclature

The sample nomenclature for the fish tissue samples will consist of three components: a three-letter project identification code, a sample matrix code, and sample number. An example of the nomenclature scheme is as follows:

- PDI-TF-SMB005- = Pre-design investigation, fish tissue, smallmouth bass sample #5

4.2.1.6 Porewater Sample Nomenclature

The sample nomenclature for the porewater samples will consist of three components: a three-letter project identification code, a sample matrix code, and sample station number. Examples of the nomenclature scheme are as follows:

- PDI-WP-B001 = Pre-design investigation, water (porewater) sample co-located with baseline surface sediment station # 1
- PDI-WP-S042 = Pre-design investigation, porewater sample, co-located with SMA surface sediment station # 42

The porewater stations are co-located with existing surface sediment grab stations, and the sediment station location numbers will be used. If the porewater sampling station is placed in a new area (and sediment is not already being collected for another purpose), then a unique station identification will be applied starting sequentially after the SMA samples (e.g., PDI-PW-S190).

4.2.1.7 Fish Tracking Nomenclature

The nomenclature for the fish tracking will consist of three components: a three-letter project identification code, a sample code, and a receiver station number (for acoustic receivers) or an acoustic tag number (for tagged fish). Examples of the nomenclature scheme are as follows:

- PDI-AR-A032 = Pre-design investigation, acoustic receiver, from receiver station 32
- PDI-AT-SMBT40 = Pre-design investigation, acoustic tagged fish, SMB tagged with tag #40

Tagged fish that die may be saved for fish tissue sampling and will be identified using the following nomenclature: a three-letter project identification code, a tagged fish sample matrix code, and the acoustic tag number. An example of the nomenclature scheme is as follows:

- PDI-TF-SMBT32 = Pre-design investigation, fish tissue, SMB tagged with tag #32

4.2.1.8 Blanks Nomenclature

The sample nomenclature for the blank samples will consist of five components: a three-letter project identification code, a QC code for the type of blank, an equipment code (if applicable), a sampling date, and a sampling time (if two or more pieces of equipment are sampled the same day or if two or more trip blanks are submitted on the same day). Examples of the nomenclature scheme are as follows:

- PDI-RB-SC-180612-1430 = Pre-design investigation, rinsate blank of a sediment core tube, collected June 12, 2018 at 2:30 p.m.

- PDI-TB-180515-0830 = Pre-design investigation, trip blank, collected May 15, 2018 at 8:30 a.m.

Below is the list of the equipment codes for equipment that will require rinsate blanks:

- VV = Van Veen sampler
- SC = sediment core tube
- SS = spoons and bowls
- PP = peristaltic pump (and carboys)
- XD = XAD sampler
- XF = XAD filter
- ST = sediment trap
- PW = porewater sampler

No rinsate blanks will be needed for fish sampling tools, because all fish processing will be conducted at the analytical laboratories.

4.2.2 Collection Methods

The sample collection methods, location control, field equipment, and decontamination procedures to be used are described in detail in the FSPs for each media type and in the SOPs for each collection method.

4.2.3 Field Generated Waste and Waste Disposal

Excess water or sediment remaining after sample processing will be returned to the vicinity of the collection Site. Any water or sediment spilled on the deck of the sampling vessel will be washed into the surface waters at the collection Site before proceeding to the next station. Further details on the management of investigation-derived waste (IDW) are provided as SOPs in the surface sediment, surface water/sediment trap, subsurface sediment core, and porewater FSPs.

Per the EPA-approved Round 1 FSP (Integral Consulting [Integral] 2004), all disposable materials used in sample processing, such as paper towels and disposable coveralls and gloves, will be placed in heavyweight garbage bags or other appropriate containers. Disposable supplies will be removed from the Site by sampling personnel and placed in a normal refuse container for disposal at a solid waste landfill. Phosphate-free, detergent-bearing liquid wastes from decontamination of the sampling equipment will be washed overboard or disposed into the sanitary sewer system.

4.3 Sample Handling

4.3.1 Hold Times

The first step in proper sample handling and custody is observance of analytical holding times, which can vary from 7 days to 1 year depending upon the media and analytical method(s) selected for the samples. Knowledge of required holding times will have a direct impact on the scheduling of sample collection, packing, and shipping activities. The sample containers, volumes, preservations, and holding times applicable to each analytical method are shown in Table 5 of this QAPP.

4.3.2 Sample Custody

Sample collection and sample custody procedures are designed so that field custody of samples is maintained and documented. These procedures provide identification and documentation of the sampling event and the sample chain-of-custody from shipment of sample bottle ware and pre-cleaned sampling supplies, through sample collection, to receipt of the samples by the laboratory. When used in conjunction with the laboratory's custody procedures and documentation, these data establish full legal custody and allow complete tracking of a sample from preparation and receipt of sample bottle ware to sample collection, preservation, and shipping through laboratory receipt, sample analysis, and data validation. The chain-of-custody is defined as the sequence of persons who have the item in custody. Field custody procedures, sample packing, and shipping are described below. The persons responsible for sample custody, and a brief description of their duties, are as follows:

- **Laboratory Sample Custodian or Commercial Supplier:** Verifies that the bottle ware is certified clean; arranges for bottle ware shipment to field sampling personnel.
- **Field Staff:** Receive sample bottle ware from laboratory, inspect bottle ware for physical integrity; retain shipping invoice or packing list from shipping courier as documentation of transfer of bottle ware; collect and preserve samples; retain bottle ware and samples under custody until sample shipment; relinquish samples to shipping courier or to laboratory representative.
- **Laboratory Project Manager (LPM):** Verifies reported laboratory analyses to the sample Chain-of-Custody Record; assures that chain-of-custody documentation is incorporated into the project file.

A sample or other physical evidence is in custody if it is or was:

- In the field investigator's, transferee's, or laboratory technician's actual possession.
- In the field investigator's, transferee's, or laboratory technician's view after being in his/her physical possession.

- In the field investigator's, transferee's, or laboratory technician's physical possession and then he/she secured it to prevent tampering.
- Placed in a designated secure area.

4.3.3 Chain-of-Custody Record

The field Chain-of-Custody Record is used to record the custody of samples or other physical evidence collected and maintained. This form will not be used to document the collection of split or duplicate samples. The Chain-of-Custody Record also serves as a sample logging mechanism for the analytical laboratories' sample custodian.

The following information must be supplied in the indicated spaces in detail to complete the field Chain-of-Custody Record:

- Project-specific information, including the project number and project name.
- The signature of the sampler and/or the sampling team leader in the designated signature block.
- The sampling location identification number, date, and time of sample collection, grab or composite sample designation, and sample preservation type must be included on each line (each line should contain only those samples collected at a specific location).
- The total number of sample containers must be listed in the indicated space for each sample, and the total number of individual containers must also be listed for each type of analysis.
- The field investigator and subsequent transferee(s) must document the transfer of the samples listed on the Chain-of-Custody Record in the spaces provided at the bottom of the form. Both the person relinquishing the samples and the person receiving them must sign the form and provide the date and time that this occurred in the proper space on the form. Usually, the last person receiving the samples or evidence should be a laboratory sample custodian.
- The remarks column at the bottom of the form is used to record air bill numbers or registered or certified mail serial numbers.

The Chain-of-Custody Record is a serialized document; once it is completed, it becomes an accountable document and must be maintained in the project file. The suitability of any other form for chain-of-custody should be evaluated based on its inclusion of the above information in a legible format. Examples of Chain-of-Custody Records for each laboratory described in this document are provided as Appendix B.

4.3.4 Sample Packing and Shipping

Samples are packed for shipping in waterproof ice chests and coolers. Depending upon container type, the sample containers may be individually sealed in Ziploc® or other similar plastic bags prior to packing them in the cooler with bubble wrap or Styrofoam packing. Wet ice will be double-bagged in plastic bags (to inhibit cross contamination of samples by melt water) and placed with the samples in the cooler to maintain the samples at a temperature of 0 to less than 6 degrees Celsius (°C) during shipping. Tissue samples will be frozen upon collection and shipped to the designated laboratories on dry ice. Specific shipping instructions for fish samples shipped on dry ice will be followed per information provided by the specific carrier and described in the Fish Tissue FSP. Samples being shipped to SGS AXYS in Sidney, British Columbia, Canada will also include a commercial invoice form provided by SGS AXYS with the supply order. The commercial invoice forms will include language provided by SGS AXYS that Canada Customs will need to clear the shipment, and SGS AXYS will be listed as the consignee and the importer of record on the commercial invoice forms. To ensure holding times and proper storage requirements are met, Friday shipments to Canada will be avoided if possible.

The Chain-of-Custody Record that identifies the samples is signed as "relinquished" by the principal sampler or responsible party. This Chain-of-Custody Record is sealed in a waterproof plastic bag and is placed inside the cooler, typically by taping the bag to the inside lid of the cooler.

Following packing, the cooler lid is sealed with packing tape. Two custody seals are signed, dated, and affixed from the cooler lid to the cooler body on two adjacent sides, and are also covered with clear tape. This ensures that tampering with the cooler contents will be immediately evident.

The sample coolers will be shipped by courier to the laboratory in accordance with laboratory schedule requirements. A copy of the shipping invoice is retained by the field manager and becomes part of the sample custody documentation.

4.4 Laboratory Procedures

The analytical laboratories named in this QAPP have established programs of sample custody that are designed to ensure that each sample is accounted for at all times. The objectives of these sample custody programs include the following:

- Unique identification of the samples, as appropriate for the data required
- Analysis of the correct samples and traceability to the appropriate record
- Preservation of sample characteristics
- Protection of samples from loss or damage

- Documentation of any sample alteration (e.g., filtration, preservation)
- Establishing a record of sample integrity for legal purposes

The SOPs for sample custody protocol are maintained by the laboratories and adhered to by laboratory personnel. The sample custody SOPs are in the laboratories' SOP libraries and/or QA manuals.

Tagged fish that are submitted for fish tissue chemistry will be clearly identified when submitted to the laboratory using a note on the sample bag and chain-of-custody record indicating "tagged fish." Before fish processing, the laboratory will remove the internal acoustic tag and external identification tag, record the tag IDs, and archive the tags in a sealed bag labeled with the fish sample ID.

4.4.1 Intra-Laboratory and Sub Laboratory Sample Transfer

The laboratory project manager will ensure that a sample-tracking record is maintained that follows each sample through all stages of laboratory processing. The sample-tracking record must contain, at a minimum, the names of individuals responsible for performing the analysis; the dates of sample extraction, preparation, and analysis; and the type of analysis being performed.

Any sample, homogenate, or sample extract that will need further analysis that is not performed by the initial contracted laboratory and that requires inter- or intra-laboratory transfer will be subject to all specifications described in the previous section. Sample matrices and analyses per specific laboratory, as shown in Tables 2a through 2e, will not be subcontracted to outside laboratories or transferred to other laboratories within the specific laboratory organization without consultation with the PDI Project Manager, the PDI Project Coordinator, and the EPA.

4.4.2 Archived Samples

All excess sediment and tissue samples submitted to the analytical laboratory will be archived at less than -10 °C and all excess water samples submitted to the analytical laboratory will be stored at 0 to 6 °C. The extracts for water samples will be archived at less than -10 °C. The laboratories will maintain chain-of-custody documentation and proper storage conditions for the entire time that the samples are in their possession. All laboratories for this project will store the excess samples for up to 12 months following completion of data validation. The laboratories will not dispose of the samples for this project until they are authorized to do so by the Project QA/QC Manager and/or EPA.

4.5 Analytical Methods

Liquid and solid samples will be extracted, prepared, and analyzed for organic and inorganic parameters by the methods specified in EPA's Test Methods for Evaluating Solid Waste,

Physical/Chemical Methods (SW-846) and additional EPA methods under the Clean Water Act (40 CFR 136) as noted in Tables 2a through 2e. Sample analysis methods will follow the laboratory SOPs and the referenced methods. The QC limits for these analyses are shown in Tables 2a through 2e. A list of referenced Laboratory SOPs for these analyses are provided in Appendix A. Analytical methods are generally consistent with EPA-approved QAPPs from the RI (Striplin Environmental Associates [Striplin] 2002, Integral 2004), EPA guidance on collecting and manipulating sediment data (EPA 2014), and Puget Sound Estuary Program (PSEP) protocols (PSEP 1996).

4.6 Quality Control

A QC system is a set of internal procedures used by the field team and laboratory for assuring that the data output of a measurement system meets prescribed criteria for data quality. A well-designed internal QC program must be capable of controlling and measuring the quality of the data in terms of precision and accuracy. Precision reflects the influence of the inherent variability in any measurement system, and accuracy reflects the degree to which the measured value represents the actual or "true" value for a given parameter, and includes elements of both bias and precision.

This section addresses QC procedures associated with field sampling and analytical efforts. Included are general QC considerations as well as specific QC checks that provide ongoing control and assessment of data quality in terms of precision and accuracy. Table 6 summarizes the requirements for the collection of QC samples in the field.

4.6.1 Field Quality Control

Field QC samples are collected in the field and used to evaluate the validity of the field sampling effort. Field QC samples are collected for laboratory analysis to check sampling and analytical precision, accuracy, and representativeness. The following section discusses the types and purpose of field QC samples that will be collected for this project. Table 6 provides a summary of the types and frequency of collection of field QC samples:

- **Field Duplicates:** Field duplicates are additional samples collected at a sampling location from the bowl or container of field-composite material and then split into two unique samples to enable statistical analysis of the resulting data. Two sets of samples from a single source are prepared, labeled with unique sample numbers, and submitted to the laboratory. One field duplicate will be prepared for every 20 environmental samples collected for each matrix type except fish tissue and high-volume surface water samples. Field replicates (unique samples processed from co-located stations in the field) are not planned for this PDI study because most of the field samples are composites.
- **Equipment Blanks:** Field equipment blanks will be used to assess the introduction of chemical contaminants during sampling and field processing activities and to help determine if decontamination procedures are effective at removing contaminated material

from non-dedicated sampling equipment. Field equipment blanks will consist of rinsate blanks collected by pouring anywhere from 3 to 6 liters of de-ionized water over or through decontaminated sampling equipment and collected in the appropriate sample containers (1-liter amber glass). Equipment surfaces exposed during actual sampling will be rinsed. These samples will be analyzed along with the field samples. No rinsate blanks will be collected from disposable field equipment. Field equipment rinsate blanks will be generated for all chemical parameter groups, with one equipment blank being collected for every 20 analytical samples and submitted for analysis to the laboratory for the same constituents targeted in that day's sampling. The task-specific FSPs provide more detail on the procedures for generating equipment blanks. For surface water sampling, in particular, three equipment blanks will be collected per sampling event: deionized (DI) water run through XAD tubing, column cartridge and equipment to collect a water sample, DI water run through the XAD cartridge to collect a "particulate" phase blank, and DI water run through the PP equipment. A filter blank of the 0.45-micron filter run in-line with the PP tubing for dissolved metals is not necessary because those filters come certified from the laboratories. Rinsate blanks for the high-volume sampling equipment (PR2900) are further described in the surface water and sediment trap sampling FSP and XAD sampling SOP.

- **Trip Blanks:** Field trip blanks will be used to determine if VOCs are introduced to samples during holding, shipping, or storage prior to analysis. Trip blank samples are prepared in the laboratory by filling a clean sampling container with reagent-grade DI water. The sample is then taken to the Site and handled with the other project samples and then submitted for analysis. One trip blank sample will be included in each container used to transport VOC samples to and from the laboratory. Trip blank samples will be analyzed for VOCs by EPA Method 8260C only. Laboratory results of trip blank samples will be analyzed to assess potential contamination associated with sample handling and shipping.

The results of the analyses of these QC sample types will be used as independent, external checks on laboratory and field contamination as well as the precision of analyses.

4.6.2 Analytical Laboratory Quality Control

The analytical laboratories QC procedures will be consistent with the requirements of the analytical methods and the laboratories SOPs (Appendix A). The LPMs will oversee the activities of all analytical chemistry support staff employed on this project. Oversight will be achieved through on-site audits and reviews of analytical facilities prior to and during analysis of project samples (see Section 5 for further details). Types and frequencies of analytical QC samples are shown in Table 6.

Analytical laboratory QC samples are used to evaluate PARCCS parameters for the analytical results (Table 7). Analytical methods specify routine procedures that are required to evaluate

whether data are within proper QC limits. Additional internal QC includes collection and analysis of field and laboratory QC samples, as described in the sections that follow.

4.6.2.1 Method Blanks

Method blanks are used to check for laboratory contamination and instrument bias. A method (or preparation) blank is prepared at the frequency specified by the referenced method, typically one per preparation batch (a preparation batch is defined as a group of samples prepared together within a 24-hour time frame, not to exceed 20 samples). The purpose of the method blank is to ensure that contaminants are not introduced by the bottle ware, reagents, standards, personnel, or the sample preparation environment.

4.6.2.2 Matrix Spikes and Matrix Spike Duplicates

MS/MSD duplicate pairs provide information to assess precision and accuracy. The MS is a second, extra aliquot of an environmental sample to which known concentrations of target analytes have been added. The MS is carried through the entire analytical procedure, and the recovery of the analytes is calculated. Results are expressed as %R. The MS is used to evaluate the effect of the sample matrix on the accuracy of the analysis. The MSD is a third, extra aliquot of an environmental sample that is also spiked with the same known concentrations of analytes used for the MS. The two spiked aliquots are processed separately, and the results are compared to determine the effects of the matrix on the precision and accuracy of the analysis. Results are expressed as RPD and %R.

One MS/MSD set will be analyzed for every 20 investigative samples as applicable to the method. The MS/MSD will be site-specific and field personnel will therefore be responsible for collecting additional sample volumes (three times the normal volume) to account for the MS/MSD samples.

4.6.2.3 Laboratory Control Sample

LCS are used to monitor the laboratory's day-to-day performance of routine analytical methods independent of matrix effects and are prepared at a frequency of one per preparation batch. LCS are fortified with spike standard solutions containing target parameters of interest. The recovery of these standards is quantitatively measured during analysis, and historical records are maintained on the percent recovery for each sample.

4.6.2.4 Surrogate Spikes

Surrogate spike analyses provide information on a laboratory’s ability to recover the analytes of interest. The surrogate spike is carried through the entire analytical procedure, and the recoveries of the surrogate spikes are calculated. Results are expressed as percent recovery for each sample. Surrogates are added to samples based on the specifications of the individual analytical method.

4.6.2.5 Certified Reference Material

Each laboratory will analyze certified reference materials (CRM) per analysis per matrix, if available, at a frequency of at least once at the beginning of each project task that has an analytical component. Otherwise, analysis of CRMs will be per the requirements of the analytical method and laboratory QA program as applicable. The CRM results will be assessed against the acceptance criteria provided by the CRM vendor.

4.7 Instrument/Equipment Quality Control

4.7.1 Laboratory Instrument/Equipment Quality Control

Analytical instrument testing, inspection, maintenance, setup, and calibration will be conducted in accordance with the QC requirements identified in each laboratory's SOPs. In addition, each of the specified analytical methods provides protocols for proper instrument calibration, setup, and critical operating parameters.

Preventive maintenance in the laboratory will be the responsibility of the laboratory personnel and analysts. At a minimum, the preventative maintenance schedules contained in the EPA methods and laboratory SOPs and in the equipment manufacturer's instructions will be followed. This maintenance includes routine care and cleaning of instruments, and inspection and monitoring of the carrier gases, reagents, solvents, reference materials, and glassware used in analysis. All maintenance of instruments and procedures will be documented in maintenance log/record books. Each of the laboratories has SOPs for preventive maintenance that are contained in their individual QA manuals.

4.7.2 Field Equipment Quality Control

Field equipment requiring calibration, maintenance, inspection, and decontamination will be conducted in accordance with the project-specific FSPs, SOPs, and manufacturers' instructions.

4.8 Inspection/Acceptance of Supplies and Consumables

Sample container requirements are shown in Table 5. Other supplies include, but are not limited to, DI water, chemicals for decontamination, sample collection equipment, and personal protective equipment. All will be obtained from reputable suppliers with appropriate documentation or certification. Supplies will be inspected to confirm that they meet use requirements, and certification records will be kept in project files.

4.9 Non-Direct Measurements

Existing chemical and biological data from previous investigations in the lower Willamette River were compiled from historical databases and technical reports. All data were reviewed for QA prior to entry in the project database. The historical data, results of the QA review, and

acceptance criteria for use are described in the PDI Work Plan (Geosyntec 2017). The historical data meeting QA requirements were one of several elements considered in developing the PDI Work Plan.

4.10 Data Management

Documentation and data management are critical steps in maintaining quality during the PDI activities. Documentation and data management begin with the development of appropriate field forms prior to field mobilization, continue with appropriate recordkeeping in the field and adequate analytical documentation and reporting, and conclude with thorough records management and database population after the work has been completed. Detailed information regarding database management is provided in the project DQMP (AECOM and Geosyntec 2018a).

4.10.1 Field Logbooks and Forms

Field visits and sample collection programs are documented using a combination of field logbooks and specific field log forms.

A logbook will be in use for all visits to the Site, ranging from brief Site walks to major, multi-week characterization programs. If the work is short in duration (e.g., less than 1 day) and irregular or *ad hoc* in nature (i.e., a task that is not captured by a standard field form), then all the work will be documented in the logbook. Conversely, if the Site visit is longer in duration and more repetitive (e.g., a major sediment or surface water sampling event), corresponding field forms will be used for documentation of each sample, whereas the logbook will be used to document a summary of the day's activities and non-repetitive tasks, including the following:

- Time of arrival and departure from the Site, including lunch breaks
- Names of field team members
- Time of arrival and departure of subcontractors
- The nature of the daily health and safety tailgate meeting
- Instrument calibration
- Supply deliveries
- Weather
- Interaction with agency or client personnel
- Incident occurrence and management
- Any other irregular or *ad hoc* activities

As such, the logbook(s) will provide a comprehensive overview of all Site activities throughout the PDI. The level of detail of the documentation within each logbook entry will depend upon the duration of an individual visit and the applicability of field forms to the tasks performed.

4.10.2 Electronic Data Management

Data management for the PDI is governed by EPA Region 10 specifications. These specifications indicate a standardized database schema for electronic data reporting to the consultant, entry into the Site database, and delivery to EPA Region 10 with data reports. Data management requirements are also discussed in the DQMP (AECOM and Geosyntec 2018a).

5. DATA QUALITY ASSESSMENT

5.1 Assessments and Response Actions

The Project QA/QC Manager or their designee may conduct both performance and systems audits of field and laboratory activities, as necessary. This section discusses the types of audits, including system audits of the field and laboratory prior to project startup and ongoing field and laboratory performance audits over the course of project activities.

5.1.1 Systems Audit

A systems audit consists of the evaluation of key components of the measurement systems to determine their proper selection and use. This audit includes a careful evaluation of both field and laboratory QC procedures. When required by EPA or an alternative regulatory authority, systems audits are performed prior to or shortly after systems are operational.

5.1.1.1 Field Systems Audits

The field systems audit is an on-site audit that focuses on data collection systems, using this QAPP as a reference. Specific activities vary with the scope of the audit, but can include a review of the following:

- Sample collection activities
- Equipment calibration techniques and records
- Decontamination and equipment cleaning
- Background and training of personnel
- Sample containers and preservation techniques
- Chain-of-custody verification of sample IDs against collection records and sample container IDs

5.1.1.2 Laboratory Systems Audit

The laboratory systems audit is a review of laboratory operations to verify that the laboratory has the necessary facilities, equipment, staff, and procedures in place to generate acceptable data.

Specific activities vary with the scope of the audit, but can include a review of the following:

- Equipment suitability and maintenance/repair
- Background and training of personnel
- Laboratory control charts and support systems
- QA samples, including performance evaluation samples

- Chain-of-custody procedures
- Data logs, data transfer, data reduction, and validation

5.1.2 Performance Audits

After systems are operational and generating data, EPA may request that a performance audit be conducted to determine the accuracy of the total measurement system(s) or component parts thereof.

5.1.2.1 Laboratory Performance Audits

The project laboratories participate in a variety of federal and state programs that subject laboratories to stringent performance audits on a regular basis. QA policies and procedures currently in place at the laboratories, and actions that will be included in sampling activities to ensure QA conformance, include the following:

- Both intra-laboratory and inter-laboratory check samples
- Periodic (at least annual) audits conducted by the corporate QA office
- Laboratory control samples prepared and/or analyzed as applicable to the method(s) at a frequency equal to at least 5% of the total number of samples analyzed

Laboratory performance will be monitored by the Project QA/QC Manager. If necessary, or at the request of the EPA RPM, the Project QA/QC Manager will conduct an on-site audit of field operations or any of these laboratories at a frequency of no more than once per year per laboratory or once per major sampling event.

5.1.2.2 Field Performance Audits

Performance audits of field screening and sampling activities will be conducted by the PDI Project Manager and/or the Project QA/QC Manager to assess the performance and adequacy of sample collection procedures and will include the following:

- Observing sample collection activities
- Reviewing field notebooks
- Reviewing the chain-of-custody documents prior to shipping
- Inspecting sample containers being shipped
- Reviewing laboratory sample receipt forms

5.1.3 Corrective Action for Measurement Systems

When a problem situation arises regarding any significant impediment to the progress of the PDI, corrective action will be implemented to identify the problem and its source. Appropriate documentation of this action will be recorded in the project file.

Personnel responsible for the initiation and approval of a corrective action will be the laboratory QA manager (for a corrective action at the laboratory) and the Project QA/QC Manager (for corrective actions identified during field activities and/or during the data validation effort). The PDI Project Manager will be responsible for the approval of corrective action measures.

5.1.3.1 Laboratory Corrective Action and Response

When the analysis of any sample indicates the analytical system may be out of control, the laboratory will stop analysis until the source of the problem is identified and corrected. The laboratory manager is also notified, and the corrective action is approved and implemented. This corrective action may include, but is not limited to, the following:

- Removal of an instrument from service
- Isolation and correction of the source of the problem
- Reanalysis of the failing QC sample

To minimize the chances for an out-of-control situation to occur, the laboratory manager will be provided feedback on performance evaluations in a timely manner by analysts, group supervisors, and the laboratory QA manager.

5.1.3.2 Field Measurement Corrective Action and Response

Technical staff and project personnel will be responsible for reporting suspected technical or QA nonconformances or suspected deficiencies of any activity or issued document by reporting the situation to the field manager. This supervisor will be responsible for assessing the suspected problems in consultation with the Project QA/QC Manager and for making a decision based on the potential for the situation to impact the quality of the data. If it is determined that the situation indicates a reportable nonconformance requiring corrective action, a nonconformance report will be initiated by the field manager.

The field manager will be responsible for ensuring that corrective action for nonconformances is initiated by:

- Evaluating reported nonconformances
- Controlling additional work on nonconforming items
- Determining the disposition or action to be taken

- Maintaining a log of nonconformances
- Reviewing nonconformance reports and corrective actions taken
- Ensuring nonconformance reports are included in the final Site documentation in project files

If appropriate, the field manager will ensure that no additional work that is dependent on the nonconforming activity is performed until the corrective actions are completed.

Corrective actions for field measurements may include the following:

- Repeating measurements to check the error
- Checking for proper adjustments for ambient conditions such as temperature
- Checking the batteries
- Recalibrating
- Checking the calibration
- Replacing the instrument measuring devices
- Stopping work (if necessary)

The field manager or his/her designee is responsible for Site activities. In this role, the field manager at times is required to adjust the Site programs to accommodate site-specific needs. When it becomes necessary to modify a program, the responsible person notifies the field manager of the anticipated change and implements the necessary changes after obtaining the approval of the field manager.

Corrective actions will be implemented and documented in the field logbook. No staff member will initiate a corrective action without prior communication of findings through the field manager.

5.2 Quality Assurance Reporting Procedures

This section presents the QA reporting procedures that will be implemented for this project.

5.2.1 Reporting Responsibility and Recordkeeping

Comprehensive records will be maintained by the Pre-RD AOC Group to provide evidence of QA activities.

These records will include the following documentation:

- Results of performance and systems audits

- Data validation summary reports
- Significant QA problems and proposed corrective actions
- Changes to this QAPP

The proper maintenance of QA records is essential to provide support in any evidentiary proceedings. The original QA records will be kept in the Project QA/QC Manager's records.

Access to working files will be restricted to project personnel. Upon termination of an individual task or work assignment, working files will be processed for storage as QA.

5.2.2 Monthly Progress Reports

Descriptions of completed tasks will be forwarded to the EPA RPM as part of the monthly progress report for the Site.

5.2.3 Audit Reports

Should audits be requested by the EPA, the corresponding audit reports will be distributed to the following project personnel, as appropriate:

- EPA, PDI Project Manager, and PDI Project Coordinator
- Project Field Coordinator
- Laboratory QA/QC Manager

6. DATA VALIDATION AND USABILITY

This section describes the stages of data quality assessment after data have been received. It addresses data reduction, review, verification, and validation. It also discusses the procedures for evaluating the usability of data with respect to the DQOs set forth in Section 3.

6.1 Data Reduction

Raw analytical data generated in the laboratory are collected on printouts from the instruments and associated data system or are manually recorded in bound notebooks. Analysts review data as they are generated to determine that the instruments are performing within specifications. This review includes calibration checks, surrogate recoveries, blank checks, retention time reproducibility, and other QC checks as specified in the SOPs and applicable to the method. If any problems are noted during the analytical run, corrective action is taken and documented.

6.2 Data Review

Data review is an initial and relatively non-technical step of data assessment that primarily addresses issues of completeness and data handling integrity. In data review, the reviewer will ensure that the necessary reporting components have been included in laboratory reports, such as necessary fields (e.g., collection/analysis dates, units) as well as the presence of (but not implications of) QA/QC data components (e.g., LCS records, surrogate results).

6.3 Data Verification and Validation

Data verification is a more technical process than data review in that the core technical aspects of data quality (e.g., precision, accuracy) are evaluated through a review of the results of QA/QC measures, such as LCS and surrogates.

Following interpretation and data reduction by an analyst, data are transferred to the laboratory sample management system either by direct data upload from the analytical data system or manually. The data are reviewed by the group leader or another analyst and marked on the sample management system as being verified. The person performing the verification reviews the data, including QC information, prior to verifying the data. If data package deliverables have been requested, the laboratory will complete the appropriate forms summarizing the QC information and transfer copies of the raw data (e.g., instrument printouts, spectra, chromatograms) to the Data Packages Group. This group will combine the information from the various analytical groups and the analytical reports from the laboratory sample management system into one package. This package is reviewed by the LPM for conformance with SOPs and to ensure that project QC goals have been met. Any analytical problems are discussed in the case narrative, which is also included with the data package deliverables.

Following data verification by the laboratory, data validation will be conducted.

A full validation as described for EPA Stage 4 validation (review of raw data and calculation checks) will be conducted on 10% of the data per analytical test and per matrix where instrument outputs are generated as part of the analysis (e.g., HRMS, GC, ICPMS, etc.). For those analyses where instrument outputs are not generally part of the procedure but where data are recorded for purposes of calculation or data reduction to a final result (e.g., total solids, grain size), 10% of the data per analytical test and per matrix will be validated as described under EPA Stage 3 by the project data validation team. EPA Stage 2A data validation (review of summary forms presented for applicable method QA/QC parameters) will be conducted on 90% of the laboratory data by the project data validation team. The project data validation team is considered independent since the members of the team are not affiliated with the analytical laboratories, the sampling effort, or to the data user (EPA 2002b). If during the EPA Stage 2A data validation, systematic data quality issues are identified with the analytical data, the laboratory will be contacted, and the data will be validated at an EPA Stage 4 level until the data quality issues are resolved.

Validation may be done on hard-copy data with the assistance of an automated validation screening program performed electronically, if applicable and/or available. Data will be evaluated based on the method requirements, work plan requirements, and current laboratory criteria at the time samples were submitted to the laboratory. If there are QC results outside of criteria range or method requirements, the affected data may be qualified based on the potential effect of the out of compliance item on the data quality. Qualifiers will be assigned using professional and technical judgement of qualified validation personnel and guidance for assigning data qualifiers outlined in the EPA documents National Functional Guidelines for Organic Superfund Methods Data Review (EPA 2017c), January 2017; National Functional Guidelines for Inorganic Superfund Methods Data Review (EPA 2017d), January 2017; and National Functional Guidelines for High Resolution Superfund Methods Data Review (EPA 2016c). Region 10 EPA validation guidance may also be utilized if a validation element is not covered in National Functional Guidelines and is available in the regional guidance. After data validation and database management, data interpretation will follow the methods outlined in Table 8.

6.3.1 Data Validation and Usability Determination

While data verification is a technical process in which the data's adherence to core PARCCS elements is evaluated, it still does not answer the final question of the usability of the data and the implications of any departures from data expectations. The data validation process is designed to answer these questions through: 1) the assignment of data qualifiers based on the data verification results; and 2) a case-by-case review of data quality issues with respect to QAPP objectives to render a final assessment of data usability.

The final step of data evaluation entails a comparison of data quality performance with the QAPP-specific DQOs. Section 3.2 of this QAPP discusses the PDI objectives and Table 3 outlines the required data inputs and associated required quality metrics references. Validation of

the analytical data is the process of determining that the data support the task-specific DQOs. Validation is performed by the independent validator as well as the project team, as data usability is also determined once put into context of the entire data set. Where summing of analytical results is required (e.g., total PAHs), the process referenced in EPA's 12/12/2017 data summation rules document, with clarifications noted in AECOM's 8/31/18 memorandum to Davis Zhen, will be followed.

6.4 Data Evaluation Roles and Responsibilities

The components of data evaluation will be performed by the entities noted in the following list:

- Data reduction will be performed by the analytical laboratory.
- Data review will be performed both by the laboratory and by the data validator.
- Data verification will be performed both by the laboratory and by the data validator.
- Data validation and usability determination will be performed by the data validator and the project team.

6.5 Data Reporting

Laboratory reports will contain an EPA Level 2 Data Package and an EPA Level 4 Data Package.

6.5.1 EPA Level 2 Data Package

- Case Narrative: Description of sample types, tests performed, any problems encountered, corrective actions taken, and general comments are given.
- Analytical Data: Data are reported by sample or by test. Pertinent information (such as dates sampled, received, prepared, or extracted) is included on each results page. The PQL and MDL for each analyte are also provided. In addition to a hard-copy report or PDF copy of the report, laboratories will provide an electronic data deliverable (EDD) in a text format corresponding to each analytical report. The EDD generated by the laboratories will comply with the PDI requirements described in the DQMP.
- Laboratory Performance QC Information: The results of the LCS and surrogate recoveries (as applicable) analyzed with the data set are listed, together with the control limits. Also, the analytical results for method blanks generated during analysis of organic and inorganic parameters are reported.
- Laboratory Duplicate Data: Laboratory duplicate results together with RPD control limits are reported.
- Matrix-Specific QC Information: The results of any field sample duplicates, MSs, and MSDs that are requested, along with the specific laboratory acceptance criteria, are reported.

- Methodology: The reference for the applied analytical method (or methods) is cited.
- Email Communications: Email communications between the laboratory and consultant team that provide additional instructions or corrections to the laboratory are included.
- Chain-of-Custody: Chain-of-custody documentation and sample receiving documentation are included.

6.5.2 EPA Level 4 Data Package

An EPA Level 4 Data Package includes all the elements listed above for the EPA Level 2 package, but also includes the following:

- All the pertinent standards information and traceability and standard logbook information for individual standard solutions
- All the pertinent calibration data and continuing calibration data, including tune information
- All the raw data chromatograms and instrument printouts for the sample results and calibration data
- Internal standard area and retention time summaries
- Ion abundance ratio summaries for high resolution mass spectroscopy analyses
- All the pertinent sample preparation information
- Preparation batch and analytical batch associations
- Before and after manual integration chromatograms
- Run logs for all analyses
- Any correspondence that occurred between the laboratory and the client regarding sample issues

7. REFERENCES

AECOM (AECOM Technical Services) and Geosyntec (Geosyntec Consultants, Inc.). 2018a. Data Quality Management Plan Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling. Portland Harbor Superfund Site. 22 February.

AECOM and Geosyntec. 2018b. Health and Safety Plan. Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling. Portland Harbor Superfund Site. 13 March.

EPA (United States Environmental Protection Agency). 2001. EPA Requirements of Quality Assurance Project Plans (EPA QA/R-5). March. EPA/240/B-01/003.

EPA. 2002a. EPA Guidance for Quality Assurance Project Plans (EPA QA/G-5). December. EPA/240/R-02/009.

EPA. 2002b. EPA Guidance on Environmental Data Verification and Data Validation (EPA QA/G-8). November. EPA/240/4-02/004.

EPA. 2005. Uniform Federal Policy for Quality Assurance Project Plans Part 1 UFP-QAPP Manual, Intergovernmental Data Quality Task Force, Version 1. March. EPA-505-B-04-900A.

EPA. 2006. EPA Guidance on Systematic Planning Using the Data Quality Objectives Process (EPA QA/G-4). February. EPA/240/B-06/001.

EPA. 2014. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846), Third Edition, Update V.

EPA. 2016a. Portland Harbor RI/FS, Final Remedial Investigation Report, Portland Oregon. United States Environmental Protection Agency Region 10, Seattle, Washington. 8 February.

EPA. 2016b. Portland Harbor RI/FS, Final Feasibility Study, Portland Oregon. United States Environmental Protection Agency Region 10, Seattle, Washington. June.

EPA. 2016c. National Functional Guidelines for High Resolution Superfund Methods Data Review (OLEM 9200.3-115). EPA-542-B-16-001. April 2016.

EPA. 2017a. Record of Decision Portland Harbor Superfund Site, Portland Oregon. United States Environmental Protection Agency Region 10, Seattle, Washington. January.

EPA. 2017b. Administrative Settlement Agreement and Order on Consent and Statement of Work for Pre-Remedial Design Investigation and Baseline Sampling. Agreement between EPA

Region 10, Seattle, Washington and the Pre-Remedial Design Group. CERCLA Docket No. 10-2018-0236. 19 December.

EPA. 2017c. National Functional Guidelines for Organic Superfund Methods Data Review (SOM02.4). January. EPA-540-R-2017-002.

EPA. 2017d. National Functional Guidelines for Inorganic Superfund Methods Data Review (OLEM 9355.0-135). EPA-540-R-2017-001. January.

Geosyntec. 2017. Final Work Plan. Portland Harbor Pre-Remedial Design Investigation Studies, Portland Harbor Superfund Site, Portland, Oregon. Prepared for the Pre-RD AOC Group for submittal to EPA Region 10 (attached to the final Statement of Work). 19 December.

Integral (Integral Consulting). 2004. Round 2 Round 2 Quality Assurance Project Plan Final Report, Prepared for the Lower Willamette Group (LWG) for submittal and approval by EPA Region 10. 24 June.

PSEP (Puget Sound Estuary Program). 1996. Puget Sound Estuary Program: Recommended Protocols for Measuring Selected Environmental Variables in Puget Sound. Final Report. TC-3991-04. Prepared for U.S. Environmental Protection Agency, Region 10 and Puget Sound Estuary Program, Seattle, Washington. Tetra Tech and HRA, Inc., Bellevue, Washington.

Striplin (Striplin Environmental Associates). 2002. Portland Harbor RI/FS Round 1 Quality Assurance Project Plan Final Report, Prepared for the Lower Willamette Group. 22 November.

TABLES

Table 1. PDI Project Personnel Contact Information

Key Role	Name	Telephone Numbers	Email Address	Mailing Address
Pre-RD AOC Group				
PDI Project Coordinator	Ken Tyrrell	281-224-2793	ken.tyrrell@aecom.com	1111 Third Ave. Suite 1600 Seattle, WA 98101
US Environmental Protection Agency				
RPM	Davis Zhen	206-553-7660	zhen.davis@epa.gov	EPA Region 10 1200 Sixth Ave. Seattle, WA 98101
AECOM Technical Services				
PDI Project Manager	Jenny Pretare	206-438-2175	jennifer.pretare@aecom.com	1111 Third Ave. Suite 1600 Seattle, WA 98101
Project QA/QC Manager	Amy Dahl	206-438-2261	amy.dahl@aecom.com	
Project Technical Lead	Betsy Ruffle	978-621-2546	betsy.ruffle@aecom.com	250 Apollo Drive Chelmsford, MA 01884
Field Coordinator	Nicky Moody	503-478-2765	nicky.moody@aecom.com	111 SW Columbia Ave. Suite 1500 Portland, OR 97201
Project Data Management	Mike Surowiec	206-257-9416	mike.surowiec@aecom.com	1111 Third Ave. Suite 1600 Seattle, WA 98101
Project Data Management	Cary Kindberg	206-438-2700	cary.kindberg@aecom.com	
Chemistry	Karen Mixon	206-438-2234	karen.mixon@aecom.com	
Health & Safety	Fred Merrill	206-719-1105	fred.merrill@aecom.com	
Geosyntec Consultants, Inc.				
Project Technical Lead	Anne Fitzpatrick	206-496-1461	afitzpatrick@geosyntec.com	520 Pike Street Suite 1375 Seattle, WA 98101
Field Coordinator	Keith Kroeger	971-271-5901	kkroeger@geosyntec.com	621 SW Morrison Street Suite 600 Portland, OR 97205
Chemistry	Julia Klens Caprio	865-291-4696	jklenscaprio@geosyntec.com	180A Marketplace Blvd. Knoxville, TN 37922
AECOM Sampling Processing Facility				
Field Coordinator	Keith Kroeger	971-271-5901	kkroeger@geosyntec.com	1115 SE Caruthers Street Portland, OR 97214
Field Coordinator	Nicky Moody	503-478-2765	nicky.moody@aecom.com	
Project Field Team	Alison Clements	971-271-5920	aclements@geosyntec.com	
Field Team	Erin Dunbar	971-271-5916	edunbar@geosyntec.com	

Key Role	Name	Telephone Numbers	Email Address	Mailing Address
ALS Global				
PM	Howard Holmes	360-577-7222	howard.holmes@alsglobal.com	1317 S. 13th Ave. Kelso, WA 98626
Ballard Marine				
PM	Robert Stanton	360-695-5163	robert.stanton@ballardmc.com	727 S. 27th Street Washougal, WA 98671
David Evans & Associates				
PM	Jon Dasler	360-314-3200	jld@deainc.com	2100 SW River Parkway Portland, OR 97201
Gravity Marine				
Project Manager	Shawn Hinz	425-281-1471	shinz@gravitycon.com	32617 SE 44th Street Fall City ,WA 98024
HTI-Vemco				
PM	TBD	206-633-3383	TBD	711 NE Northlake Way Seattle WA 98105
Global Diving and Salvage				
PM	Spencer McGinnis	425-923-4693	spencer.mcginnis@gdiving.com	3840 W Marginal Way SW Seattle, WA 98106
SGS/AXYS Laboratory				
PM	Sean Campbell	250-655-5834	sean.campbell@sgs.com	2045 W. Mills Road Sidney, BC Canada V8L 5X2
TestAmerica Laboratory, Seattle				
PM	Elaine Walker	253-248-4972	Elaine.Walker@testamericainc.com	5755 E.8th Street Tacoma, WA 98424
TestAmerica Laboratory, Sacramento				
PM	TBD	916-373-5600	TBD	880 Riverside Parkway West Sacramento, CA 95605
TestAmerica Laboratory, Knoxville				
PM	TBD	865-291-3000	TBD	5815 Middlebrook Pike Knoxville, TN 37921

Notes:
This list will be updated throughout the project and distributed to all parties working on the project at time of update.

Acronyms:
EPA = U.S. Environmental Protection Agency
PM = project manager
Pre-RD AOC Group = Pre-Remedial Design Agreement and Order on Consent Group
QA/QC = quality assurance/quality control
RPM = remedial project manager
TBD = to be determined

Table 2a. Cleanup Levels and Analytical Quantitation Limits for Chemicals of Potential Concern in Targeted SMA Sediment Samples (Surface and Subsurface)

PARCCS:	Comparability			Sensitivity[1]					Accuracy and Precision[1]							
Parameter	CAS Number	Laboratory	Method	ROD Cleanup Levels[2]	Project Quantitation Limits[3]	Achievable Laboratory MDLs[3]	Laboratory EDLs[3]	Units	MS/MSD				LCS/LCSD			
									Percent Recovery (%)			*RPD (%)*	*Percent Recovery (%)*			*RPD (%)*
Surface Sediment																
Chlorinated Pesticides [5]																
DDx	--	ALS Kelso	EPA GC/MS/MS 1699M	6.1	0.1	--	NA	µg/kg	--	--	--	--	--	--	--	--
DDD[4]	--	ALS Kelso	EPA GC/MS/MS 1699M	114	0.1	0.06	NA	µg/kg	10	--	190	30	74	--	117	30
DDE[4]	--	ALS Kelso	EPA GC/MS/MS 1699M	226	0.1	0.07	NA	µg/kg	43	--	155	30	54	--	145	30
DDT[4]	--	ALS Kelso	EPA GC/MS/MS 1699M	246	0.1	0.09	NA	µg/kg	24	--	183	30	78	--	116	30
Dioxins/Furans [5]																
Dioxins/Furans (2,3,7,8-TCDD eq)	--	TA Sacramento	EPA 1613B	NA	NA	NA	NA	NA	--	--	--	--	--	--	--	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1746-01-6	TA Sacramento	EPA 1613B	0.20	1.0	0.15	0.028	pg/g	--	--	--	--	67	--	158	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	40321-76-4	TA Sacramento	EPA 1613B	0.20	5.0	0.300	0.030	pg/g	--	--	--	--	70	--	142	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	39227-28-6	TA Sacramento	EPA 1613B	NA	5.0	0.71	0.025	pg/g	--	--	--	--	70	--	164	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	57653-85-7	TA Sacramento	EPA 1613B	NA	5.0	0.58	0.025	pg/g	--	--	--	--	76	--	134	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	19408-74-3	TA Sacramento	EPA 1613B	NA	5.0	0.58	0.022	pg/g	--	--	--	--	64	--	162	--
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	35822-46-9	TA Sacramento	EPA 1613B	NA	5.0	0.46	0.038	pg/g	--	--	--	--	70	--	140	--
1,2,3,4,5,6,7,8-Octachlorodibenzo-p-dioxin (OCDD)	3268-87-9	TA Sacramento	EPA 1613B	NA	10.0	1.5	0.053	pg/g	--	--	--	--	78	--	144	--
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	51207-31-9	TA Sacramento	EPA 1613B	0.407	1.0	0.11	0.015	pg/g	--	--	--	--	75	--	158	--
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	57117-41-6	TA Sacramento	EPA 1613B	NA	5.0	0.27	0.018	pg/g	--	--	--	--	80	--	134	--
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	57117-31-4	TA Sacramento	EPA 1613B	0.30	5.0	0.29	0.019	pg/g	--	--	--	--	68	--	160	--
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	70648-26-9	TA Sacramento	EPA 1613B	0.40	5.0	0.3	0.023	pg/g	--	--	--	--	72	--	134	--
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	57117-44-9	TA Sacramento	EPA 1613B	NA	5.0	0.38	0.021	pg/g	--	--	--	--	84	--	130	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	72918-21-9	TA Sacramento	EPA 1613B	NA	5.0	0.43	0.017	pg/g	--	--	--	--	78	--	130	--
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	60851-34-5	TA Sacramento	EPA 1613B	NA	5.0	0.3	0.017	pg/g	--	--	--	--	70	--	156	--
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	67562-39-4	TA Sacramento	EPA 1613B	NA	5.0	0.38	0.043	pg/g	--	--	--	--	82	--	122	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	55673-89-7	TA Sacramento	EPA 1613B	NA	5.0	0.65	0.059	pg/g	--	--	--	--	78	--	138	--
1,2,3,4,5,6,7,8-Octachlorodibenzofuran (OCDF)	39001-02-0	TA Sacramento	EPA 1613B	NA	10.0	1.2	0.032	pg/g	--	--	--	--	63	--	170	--
Grain Size																
Clay	STL00587	TA Seattle	ASTM D7928 and D6913	NA	0.010	NA	NA	%	--	--	--	--	--	--	--	--
Coarse Sand	STL00583	TA Seattle	ASTM D7928 and D6913	NA	0.010	NA	NA	%	--	--	--	--	--	--	--	--
Fine Sand	STL00585	TA Seattle	ASTM D7928 and D6913	NA	0.010	NA	NA	%	--	--	--	--	--	--	--	--
Gravel	STL00581	TA Seattle	ASTM D7928 and D6913	NA	0.010	NA	NA	%	--	--	--	--	--	--	--	--
Medium Sand	STL00584	TA Seattle	ASTM D7928 and D6913	NA	0.010	NA	NA	%	--	--	--	--	--	--	--	--
Silt	STL00586	TA Seattle	ASTM D7928 and D6913	NA	0.010	NA	NA	%	--	--	--	--	--	--	--	--
PAHs [5]																
PAHs	NA	ALS Kelso	EPA 8270D-SIM	23000	NA	NA	NA	µg/kg	--	--	--	--	--	--	--	--
cPAHs (BaP equivalent)	NA	ALS Kelso	EPA 8270D-SIM	12	NA	NA	NA	µg/kg	--	--	--	--	--	--	--	--
Acenaphthene	83-32-9	ALS Kelso	EPA 8270D-SIM	NA	0.5	0.032	NA	µg/kg	51	--	82	40	70	--	130	40
Acenaphthylene	208-96-8	ALS Kelso	EPA 8270D-SIM	NA	0.5	0.029	NA	µg/kg	51	--	80	40	70	--	130	40
Anthracene	120-12-7	ALS Kelso	EPA 8270D-SIM	NA	0.5	0.026	NA	µg/kg	56	--	87	40	70	--	130	40
Benzo(a)anthracene	56-55-3	ALS Kelso	EPA 8270D-SIM	NA	0.5	0.033	NA	µg/kg	65	--	97	40	70	--	130	40
Benzo(a)pyrene	50-32-8	ALS Kelso	EPA 8270D-SIM	NA	0.5	0.036	NA	µg/kg	64	--	103	40	70	--	130	40
Benzo(b)fluoranthene	205-99-2	ALS Kelso	EPA 8270D-SIM	NA	0.5	0.057	NA	µg/kg	63	--	99	40	70	--	130	40
Benzo(g,h,i)perylene	191-24-2	ALS Kelso	EPA 8270D-SIM	NA	0.5	0.059	NA	µg/kg	56	--	101	40	70	--	130	40
Benzo(k)fluoranthene	207-08-9	ALS Kelso	EPA 8270D-SIM	NA	0.5	0.045	NA	µg/kg	62	--	99	40	70	--	130	40
Chrysene	218-01-9	ALS Kelso	EPA 8270D-SIM	NA	0.5	0.027	NA	µg/kg	63	--	100	40	70	--	130	40
Dibenz(a,h)anthracene	53-70-3	ALS Kelso	EPA 8270D-SIM	NA	0.5	0.058	NA	µg/kg	56	--	104	40	70	--	130	40
Fluoranthene	206-44-0	ALS Kelso	EPA 8270D-SIM	NA	0.5	0.032	NA	µg/kg	45	--	96	40	70	--	130	40
Fluorene	86-73-7	ALS Kelso	EPA 8270D-SIM	NA	0.5	0.039	NA	µg/kg	52	--	83	40	70	--	130	40
Indeno(1,2,3-cd)pyrene	193-39-5	ALS Kelso	EPA 8270D-SIM	NA	0.5	0.064	NA	µg/kg	61	--	105	40	70	--	130	40
2-Methylnaphthalene	91-57-6	ALS Kelso	EPA 8270D-SIM	NA	0.5	0.047	NA	µg/kg	52	--	85	40	70	--	130	40
Naphthalene	91-20-3	ALS Kelso	EPA 8270D-SIM	NA	0.5	0.089	NA	µg/kg	48	--	77	40	70	--	130	40
Phenanthrene	85-01-8	ALS Kelso	EPA 8270D-SIM	NA	0.5	0.033	NA	µg/kg	48	--	85	40	70	--	130	40
Pyrene	129-00-0	ALS Kelso	EPA 8270D-SIM	NA	0.5	0.032	NA	µg/kg	59	--	98	40	70	--	130	40
PAHs	NA	TA Seattle	EPA 8270D-SIM	23000	--	--	NA	µg/kg	--	--	--	--	--	--	--	--
cPAHs (BaP equivalent)	NA	TA Seattle	EPA 8270D-SIM	12	--	--	NA	µg/kg	--	--	--	--	--	--	--	--

Table 2a. Cleanup Levels and Analytical Quantitation Limits for Chemicals of Potential Concern in Targeted SMA Sediment Samples (Surface and Subsurface)

PARCCS:	Comparability			Sensitivity[1]					Accuracy and Precision[1]							
									MS/MSD				LCS/LCSD			
Parameter	CAS Number	Laboratory	Method	ROD Cleanup Levels[2]	Project Quantitation Limits[3]	Achievable Laboratory MDLs[3]	Laboratory EDLs[3]	Units	*Percent Recovery (%)*			*RPD (%)*	*Percent Recovery (%)*			*RPD (%)*
Acenaphthene	83-32-9	TA Seattle	EPA 8270D-SIM	NA	1	0.12	NA	µg/kg	68	--	120	12	68	--	120	12
Acenaphthylene	208-96-8	TA Seattle	EPA 8270D-SIM	NA	1	0.1	NA	µg/kg	68	--	120	12	68	--	120	12
Anthracene	120-12-7	TA Seattle	EPA 8270D-SIM	NA	1	0.12	NA	µg/kg	73	--	125	12	73	--	125	12
Benzo(a)anthracene	56-55-3	TA Seattle	EPA 8270D-SIM	NA	1	0.152	NA	µg/kg	66	--	120	14	66	--	120	14
Benzo(a)pyrene	50-32-8	TA Seattle	EPA 8270D-SIM	NA	1	0.08	NA	µg/kg	72	--	124	12	72	--	124	12
Benzo(b)fluoranthene	205-99-2	TA Seattle	EPA 8270D-SIM	NA	1	0.118	NA	µg/kg	63	--	121	10	63	--	121	10
Benzo(g,h,i)perylene	191-24-2	TA Seattle	EPA 8270D-SIM	NA	1	0.1	NA	µg/kg	63	--	120	14	63	--	120	14
Benzo(k)fluoranthene	207-08-9	TA Seattle	EPA 8270D-SIM	NA	1	0.12	NA	µg/kg	63	--	123	15	63	--	123	15
Chrysene	218-01-9	TA Seattle	EPA 8270D-SIM	NA	1	0.3	NA	µg/kg	69	--	120	10	69	--	120	10
Dibenz(a,h)anthracene	53-70-3	TA Seattle	EPA 8270D-SIM	NA	1	0.144	NA	µg/kg	70	--	125	13	70	--	125	13
Fluoranthene	206-44-0	TA Seattle	EPA 8270D-SIM	NA	1	0.28	NA	µg/kg	74	--	125	13	74	--	125	13
Fluorene	86-73-7	TA Seattle	EPA 8270D-SIM	NA	1	0.1	NA	µg/kg	73	--	120	13	73	--	120	13
Indeno(1,2,3-cd)pyrene	193-39-5	TA Seattle	EPA 8270D-SIM	NA	1	0.12	NA	µg/kg	65	--	121	15	65	--	121	15
2-Methylnaphthalene	91-57-6	TA Seattle	EPA 8270D-SIM	NA	1	0.09	NA	µg/kg	68	--	120	12	68	--	120	12
Naphthalene	91-20-3	TA Seattle	EPA 8270D-SIM	NA	1	0.16	NA	µg/kg	70	--	120	12	70	--	120	12
Phenanthrene	85-01-8	TA Seattle	EPA 8270D-SIM	NA	1	0.138	NA	µg/kg	73	--	120	11	73	--	120	11
Pyrene	129-00-0	TA Seattle	EPA 8270D-SIM	NA	1	0.194	NA	µg/kg	70	--	120	12	70	--	120	12
PCB Congeners (surface grabs only)[5, 6]																
Total PCBs	--	TA Knoxville	EPA 1668A	9	NA	NA	NA	ng/g	--	--	--	--	--	--	--	--
PCB 1	2051-60-7	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	50	--	150	50	50	--	150	50
PCB 2	2051-61-8	TA Knoxville	EPA 1668A	NA	0.010	0.0023	--	ng/g	--	--	--	--	--	--	--	--
PCB 3	2051-62-9	TA Knoxville	EPA 1668A	NA	0.010	0.0021	--	ng/g	50	--	150	50	50	--	150	50
PCB 4	13029-08-8	TA Knoxville	EPA 1668A	NA	0.020	0.0035	--	ng/g	50	--	150	50	50	--	150	50
PCB 5	16605-91-7	TA Knoxville	EPA 1668A	NA	0.010	0.0026	--	ng/g	--	--	--	--	--	--	--	--
PCB 6	25569-80-6	TA Knoxville	EPA 1668A	NA	0.010	0.0022	--	ng/g	--	--	--	--	--	--	--	--
PCB 7	33284-50-3	TA Knoxville	EPA 1668A	NA	0.010	0.0038	--	ng/g	--	--	--	--	--	--	--	--
PCB 8	34883-43-7	TA Knoxville	EPA 1668A	NA	0.020	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 9	34883-39-1	TA Knoxville	EPA 1668A	NA	0.010	0.0037	--	ng/g	--	--	--	--	--	--	--	--
PCB 10	33146-45-1	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 11	2050-67-1	TA Knoxville	EPA 1668A	NA	0.020	0.0090	--	ng/g	--	--	--	--	--	--	--	--
PCB 12	2974-92-7	TA Knoxville	EPA 1668A	NA	0.020	0.012	--	ng/g	--	--	--	--	--	--	--	--
PCB 13	2974-90-5	TA Knoxville	EPA 1668A	NA	0.020	0.012	--	ng/g	--	--	--	--	--	--	--	--
PCB 14	34883-41-5	TA Knoxville	EPA 1668A	NA	0.010	0.0035	--	ng/g	--	--	--	--	--	--	--	--
PCB 15	2050-68-2	TA Knoxville	EPA 1668A	NA	0.010	0.0048	--	ng/g	50	--	150	50	50	--	150	50
PCB 16	38444-78-9	TA Knoxville	EPA 1668A	NA	0.010	0.0072	--	ng/g	--	--	--	--	--	--	--	--
PCB 17	37680-66-3	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 18	37680-65-2	TA Knoxville	EPA 1668A	NA	0.020	0.014	--	ng/g	--	--	--	--	--	--	--	--
PCB 19	38444-73-4	TA Knoxville	EPA 1668A	NA	0.010	0.0021	--	ng/g	50	--	150	50	50	--	150	50
PCB 20	38444-84-7	TA Knoxville	EPA 1668A	NA	0.020	0.0056	--	ng/g	--	--	--	--	--	--	--	--
PCB 21	55702-46-0	TA Knoxville	EPA 1668A	NA	0.020	0.0066	--	ng/g	--	--	--	--	--	--	--	--
PCB 22	38444-85-8	TA Knoxville	EPA 1668A	NA	0.010	0.0023	--	ng/g	--	--	--	--	--	--	--	--
PCB 23	55720-44-0	TA Knoxville	EPA 1668A	NA	0.010	0.0021	--	ng/g	--	--	--	--	--	--	--	--
PCB 24	55702-45-9	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 25	55712-37-3	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 26	38444-81-4	TA Knoxville	EPA 1668A	NA	0.020	0.0046	--	ng/g	--	--	--	--	--	--	--	--
PCB 27	38444-76-7	TA Knoxville	EPA 1668A	NA	0.010	0.0021	--	ng/g	--	--	--	--	--	--	--	--
PCB 28	7012-37-5	TA Knoxville	EPA 1668A	NA	0.020	0.0056	--	ng/g	--	--	--	--	--	--	--	--
PCB 29	15862-07-4	TA Knoxville	EPA 1668A	NA	0.020	0.0046	--	ng/g	--	--	--	--	--	--	--	--
PCB 30	35693-92-6	TA Knoxville	EPA 1668A	NA	0.020	0.014	--	ng/g	--	--	--	--	--	--	--	--
PCB 31	16606-02-3	TA Knoxville	EPA 1668A	NA	0.020	0.0022	--	ng/g	--	--	--	--	--	--	--	--
PCB 32	38444-77-8	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 33	38444-86-9	TA Knoxville	EPA 1668A	NA	0.020	0.0066	--	ng/g	--	--	--	--	--	--	--	--
PCB 34	37680-68-5	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 35	37680-69-6	TA Knoxville	EPA 1668A	NA	0.010	0.0027	--	ng/g	--	--	--	--	--	--	--	--
PCB 36	38444-87-0	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--

Table 2a. Cleanup Levels and Analytical Quantitation Limits for Chemicals of Potential Concern in Targeted SMA Sediment Samples (Surface and Subsurface)

PARCCS:	Comparability			Sensitivity[1]					Accuracy and Precision[1]							
									MS/MSD				LCS/LCSD			
Parameter	CAS Number	Laboratory	Method	ROD Cleanup Levels[2]	Project Quantitation Limits[3]	Achievable Laboratory MDLs[3]	Laboratory EDLs[3]	Units	*Percent Recovery (%)*			*RPD (%)*	*Percent Recovery (%)*			*RPD (%)*
PCB 37	38444-90-5	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	50	--	150	50	50	--	150	50
PCB 38	53555-66-1	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 39	38444-88-1	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 40	38444-93-8	TA Knoxville	EPA 1668A	NA	0.030	0.013	--	ng/g	--	--	--	--	--	--	--	--
PCB 41	52663-59-9	TA Knoxville	EPA 1668A	NA	0.030	0.013	--	ng/g	--	--	--	--	--	--	--	--
PCB 42	36559-22-5	TA Knoxville	EPA 1668A	NA	0.010	0.0033	--	ng/g	--	--	--	--	--	--	--	--
PCB 43	70362-46-8	TA Knoxville	EPA 1668A	NA	0.020	0.0048	--	ng/g	--	--	--	--	--	--	--	--
PCB 44	41464-39-5	TA Knoxville	EPA 1668A	NA	0.030	0.015	--	ng/g	--	--	--	--	--	--	--	--
PCB 45	70362-45-7	TA Knoxville	EPA 1668A	NA	0.020	0.010	--	ng/g	--	--	--	--	--	--	--	--
PCB 46	41464-47-5	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 47	2437-79-8	TA Knoxville	EPA 1668A	NA	0.030	0.015	--	ng/g	--	--	--	--	--	--	--	--
PCB 48	70362-47-9	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 49	41464-40-8	TA Knoxville	EPA 1668A	NA	0.020	0.0054	--	ng/g	--	--	--	--	--	--	--	--
PCB 50	62796-65-0	TA Knoxville	EPA 1668A	NA	0.020	0.0060	--	ng/g	--	--	--	--	--	--	--	--
PCB 51	68194-04-7	TA Knoxville	EPA 1668A	NA	0.020	0.010	--	ng/g	--	--	--	--	--	--	--	--
PCB 52	35693-99-3	TA Knoxville	EPA 1668A	NA	0.010	0.0029	--	ng/g	--	--	--	--	--	--	--	--
PCB 53	41464-41-9	TA Knoxville	EPA 1668A	NA	0.020	0.0060	--	ng/g	--	--	--	--	--	--	--	--
PCB 54	15968-05-5	TA Knoxville	EPA 1668A	NA	0.010	0.0023	--	ng/g	50	--	150	50	50	--	150	50
PCB 55	74338-24-2	TA Knoxville	EPA 1668A	NA	0.010	0.0026	--	ng/g	--	--	--	--	--	--	--	--
PCB 56	41464-43-1	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 57	70424-67-8	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 58	41464-49-7	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 59	74472-33-6	TA Knoxville	EPA 1668A	NA	0.030	0.016	--	ng/g	--	--	--	--	--	--	--	--
PCB 60	33025-41-1	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 61	33284-53-6	TA Knoxville	EPA 1668A	NA	0.040	0.011	--	ng/g	--	--	--	--	--	--	--	--
PCB 62	54230-22-7	TA Knoxville	EPA 1668A	NA	0.030	0.016	--	ng/g	--	--	--	--	--	--	--	--
PCB 63	74472-34-7	TA Knoxville	EPA 1668A	NA	0.010	0.0027	--	ng/g	--	--	--	--	--	--	--	--
PCB 64	52663-58-8	TA Knoxville	EPA 1668A	NA	0.010	0.0027	--	ng/g	--	--	--	--	--	--	--	--
PCB 65	33284-54-7	TA Knoxville	EPA 1668A	NA	0.030	0.015	--	ng/g	--	--	--	--	--	--	--	--
PCB 66	32598-10-0	TA Knoxville	EPA 1668A	NA	0.010	0.0024	--	ng/g	--	--	--	--	--	--	--	--
PCB 67	73575-53-8	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 68	73575-52-7	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 69	60233-24-1	TA Knoxville	EPA 1668A	NA	0.020	0.0054	--	ng/g	--	--	--	--	--	--	--	--
PCB 70	32598-11-1	TA Knoxville	EPA 1668A	NA	0.040	0.011	--	ng/g	--	--	--	--	--	--	--	--
PCB 71	41464-46-4	TA Knoxville	EPA 1668A	NA	0.030	0.013	--	ng/g	--	--	--	--	--	--	--	--
PCB 72	41464-42-0	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 73	74338-23-1	TA Knoxville	EPA 1668A	NA	0.020	0.0048	--	ng/g	--	--	--	--	--	--	--	--
PCB 74	32690-93-0	TA Knoxville	EPA 1668A	NA	0.040	0.011	--	ng/g	--	--	--	--	--	--	--	--
PCB 75	32598-12-2	TA Knoxville	EPA 1668A	NA	0.030	0.016	--	ng/g	--	--	--	--	--	--	--	--
PCB 76	70362-48-0	TA Knoxville	EPA 1668A	NA	0.040	0.011	--	ng/g	--	--	--	--	--	--	--	--
PCB 77	32598-13-3	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	50	--	150	50	50	--	150	50
PCB 78	70362-49-1	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 79	41464-48-6	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 80	33284-52-5	TA Knoxville	EPA 1668A	NA	0.010	0.0022	--	ng/g	--	--	--	--	--	--	--	--
PCB 81	70362-50-4	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	50	--	150	50	50	--	150	50
PCB 82	52663-62-4	TA Knoxville	EPA 1668A	NA	0.010	0.0029	--	ng/g	--	--	--	--	--	--	--	--
PCB 83	60145-20-2	TA Knoxville	EPA 1668A	NA	0.020	0.0054	--	ng/g	--	--	--	--	--	--	--	--
PCB 84	52663-60-2	TA Knoxville	EPA 1668A	NA	0.010	0.0042	--	ng/g	--	--	--	--	--	--	--	--
PCB 85	65510-45-4	TA Knoxville	EPA 1668A	NA	0.030	0.012	--	ng/g	--	--	--	--	--	--	--	--
PCB 86	55312-69-1	TA Knoxville	EPA 1668A	NA	0.060	0.046	--	ng/g	--	--	--	--	--	--	--	--
PCB 87	38380-02-8	TA Knoxville	EPA 1668A	NA	0.060	0.046	--	ng/g	--	--	--	--	--	--	--	--
PCB 88	55215-17-3	TA Knoxville	EPA 1668A	NA	0.020	0.0064	--	ng/g	--	--	--	--	--	--	--	--
PCB 89	73575-57-2	TA Knoxville	EPA 1668A	NA	0.010	0.0030	--	ng/g	--	--	--	--	--	--	--	--
PCB 90	68194-07-0	TA Knoxville	EPA 1668A	NA	0.030	0.014	--	ng/g	--	--	--	--	--	--	--	--
PCB 91	68194-05-8	TA Knoxville	EPA 1668A	NA	0.020	0.0064	--	ng/g	--	--	--	--	--	--	--	--

Table 2a. Cleanup Levels and Analytical Quantitation Limits for Chemicals of Potential Concern in Targeted SMA Sediment Samples (Surface and Subsurface)

PARCCS:	Comparability			Sensitivity[1]					Accuracy and Precision[1]							
									MS/MSD				LCS/LCSD			
Parameter	CAS Number	Laboratory	Method	ROD Cleanup Levels[2]	Project Quantitation Limits[3]	Achievable Laboratory MDLs[3]	Laboratory EDLs[3]	Units	*Percent Recovery (%)*			*RPD (%)*	*Percent Recovery (%)*			*RPD (%)*
PCB 92	52663-61-3	TA Knoxville	EPA 1668A	NA	0.010	0.0028	--	ng/g	--	--	--	--	--	--	--	--
PCB 93	73575-56-1	TA Knoxville	EPA 1668A	NA	0.020	0.0070	--	ng/g	--	--	--	--	--	--	--	--
PCB 94	73575-55-0	TA Knoxville	EPA 1668A	NA	0.010	0.0035	--	ng/g	--	--	--	--	--	--	--	--
PCB 95	38379-99-6	TA Knoxville	EPA 1668A	NA	0.010	0.0042	--	ng/g	--	--	--	--	--	--	--	--
PCB 96	73575-54-9	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 97	41464-51-1	TA Knoxville	EPA 1668A	NA	0.060	0.046	--	ng/g	--	--	--	--	--	--	--	--
PCB 98	60233-25-2	TA Knoxville	EPA 1668A	NA	0.020	0.0064	--	ng/g	--	--	--	--	--	--	--	--
PCB 99	38380-01-7	TA Knoxville	EPA 1668A	NA	0.020	0.0054	--	ng/g	--	--	--	--	--	--	--	--
PCB 100	39485-83-1	TA Knoxville	EPA 1668A	NA	0.020	0.0070	--	ng/g	--	--	--	--	--	--	--	--
PCB 101	37680-73-2	TA Knoxville	EPA 1668A	NA	0.030	0.014	--	ng/g	--	--	--	--	--	--	--	--
PCB 102	68194-06-9	TA Knoxville	EPA 1668A	NA	0.020	0.0064	--	ng/g	--	--	--	--	--	--	--	--
PCB 103	60145-21-3	TA Knoxville	EPA 1668A	NA	0.010	0.0031	--	ng/g	--	--	--	--	--	--	--	--
PCB 104	56558-16-8	TA Knoxville	EPA 1668A	NA	0.010	0.0021	--	ng/g	50	--	150	50	50	--	150	50
PCB 105	32598-14-4	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	50	--	150	50	50	--	150	50
PCB 106	70424-69-0	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 107	70424-68-9	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 108	70362-41-3	TA Knoxville	EPA 1668A	NA	0.020	0.0040	--	ng/g	--	--	--	--	--	--	--	--
PCB 109	74472-35-8	TA Knoxville	EPA 1668A	NA	0.060	0.046	--	ng/g	--	--	--	--	--	--	--	--
PCB 110	38380-03-9	TA Knoxville	EPA 1668A	NA	0.020	0.0068	--	ng/g	--	--	--	--	--	--	--	--
PCB 111	39635-32-0	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 112	74472-36-9	TA Knoxville	EPA 1668A	NA	0.010	0.0036	--	ng/g	--	--	--	--	--	--	--	--
PCB 113	68194-10-5	TA Knoxville	EPA 1668A	NA	0.030	0.014	--	ng/g	--	--	--	--	--	--	--	--
PCB 114	74472-37-0	TA Knoxville	EPA 1668A	NA	0.010	0.0025	--	ng/g	50	--	150	50	50	--	150	50
PCB 115	74472-38-1	TA Knoxville	EPA 1668A	NA	0.020	0.0068	--	ng/g	--	--	--	--	--	--	--	--
PCB 116	18259-05-7	TA Knoxville	EPA 1668A	NA	0.030	0.012	--	ng/g	--	--	--	--	--	--	--	--
PCB 117	68194-11-6	TA Knoxville	EPA 1668A	NA	0.030	0.012	--	ng/g	--	--	--	--	--	--	--	--
PCB 118	31508-00-6	TA Knoxville	EPA 1668A	NA	0.010	0.0022	--	ng/g	50	--	150	50	50	--	150	50
PCB 119	56558-17-9	TA Knoxville	EPA 1668A	NA	0.060	0.046	--	ng/g	--	--	--	--	--	--	--	--
PCB 120	68194-12-7	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 121	56558-18-0	TA Knoxville	EPA 1668A	NA	0.010	0.0023	--	ng/g	--	--	--	--	--	--	--	--
PCB 122	76842-07-4	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 123	65510-44-3	TA Knoxville	EPA 1668A	NA	0.010	0.0024	--	ng/g	50	--	150	50	50	--	150	50
PCB 124	70424-70-3	TA Knoxville	EPA 1668A	NA	0.020	0.0040	--	ng/g	--	--	--	--	--	--	--	--
PCB 125	74472-39-2	TA Knoxville	EPA 1668A	NA	0.060	0.046	--	ng/g	--	--	--	--	--	--	--	--
PCB 126	57465-28-8	TA Knoxville	EPA 1668A	NA	0.010	0.0027	--	ng/g	50	--	150	50	50	--	150	50
PCB 127	39635-33-1	TA Knoxville	EPA 1668A	NA	0.010	0.0023	--	ng/g	--	--	--	--	--	--	--	--
PCB 128	38380-07-3	TA Knoxville	EPA 1668A	NA	0.020	0.010	--	ng/g	--	--	--	--	--	--	--	--
PCB 129	55215-18-4	TA Knoxville	EPA 1668A	NA	0.040	0.023	--	ng/g	--	--	--	--	--	--	--	--
PCB 130	52663-66-8	TA Knoxville	EPA 1668A	NA	0.010	0.0023	--	ng/g	--	--	--	--	--	--	--	--
PCB 131	61798-70-7	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 132	38380-05-1	TA Knoxville	EPA 1668A	NA	0.010	0.0024	--	ng/g	--	--	--	--	--	--	--	--
PCB 133	35694-04-3	TA Knoxville	EPA 1668A	NA	0.010	0.0030	--	ng/g	--	--	--	--	--	--	--	--
PCB 134	52704-70-8	TA Knoxville	EPA 1668A	NA	0.020	0.0086	--	ng/g	--	--	--	--	--	--	--	--
PCB 135	52744-13-5	TA Knoxville	EPA 1668A	NA	0.020	0.0074	--	ng/g	--	--	--	--	--	--	--	--
PCB 136	38411-22-2	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 137	35694-06-5	TA Knoxville	EPA 1668A	NA	0.010	0.0036	--	ng/g	--	--	--	--	--	--	--	--
PCB 138	35065-28-2	TA Knoxville	EPA 1668A	NA	0.040	0.023	--	ng/g	--	--	--	--	--	--	--	--
PCB 139	56030-56-9	TA Knoxville	EPA 1668A	NA	0.020	0.0060	--	ng/g	--	--	--	--	--	--	--	--
PCB 140	59291-64-4	TA Knoxville	EPA 1668A	NA	0.020	0.0060	--	ng/g	--	--	--	--	--	--	--	--
PCB 141	52712-04-6	TA Knoxville	EPA 1668A	NA	0.010	0.0035	--	ng/g	--	--	--	--	--	--	--	--
PCB 142	41411-61-4	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 143	68194-15-0	TA Knoxville	EPA 1668A	NA	0.020	0.0086	--	ng/g	--	--	--	--	--	--	--	--
PCB 144	68194-14-9	TA Knoxville	EPA 1668A	NA	0.010	0.0034	--	ng/g	--	--	--	--	--	--	--	--
PCB 145	74472-40-5	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 146	51908-16-8	TA Knoxville	EPA 1668A	NA	0.010	0.0040	--	ng/g	--	--	--	--	--	--	--	--

Table 2a. Cleanup Levels and Analytical Quantitation Limits for Chemicals of Potential Concern in Targeted SMA Sediment Samples (Surface and Subsurface)

PARCCS:	Comparability			Sensitivity[1]					Accuracy and Precision[1]							
									MS/MSD				LCS/LCSD			
Parameter	CAS Number	Laboratory	Method	ROD Cleanup Levels[2]	Project Quantitation Limits[3]	Achievable Laboratory MDLs[3]	Laboratory EDLs[3]	Units	*Percent Recovery (%)*			*RPD (%)*	*Percent Recovery (%)*			*RPD (%)*
PCB 147	68194-13-8	TA Knoxville	EPA 1668A	NA	0.020	0.0048	--	ng/g	--	--	--	--	--	--	--	--
PCB 148	74472-41-6	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 149	38380-04-0	TA Knoxville	EPA 1668A	NA	0.020	0.0048	--	ng/g	--	--	--	--	--	--	--	--
PCB 150	68194-08-1	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 151	52663-63-5	TA Knoxville	EPA 1668A	NA	0.020	0.0074	--	ng/g	--	--	--	--	--	--	--	--
PCB 152	68194-09-2	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 153	35065-27-1	TA Knoxville	EPA 1668A	NA	0.020	0.0036	--	ng/g	--	--	--	--	--	--	--	--
PCB 154	60145-22-4	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 155	33979-03-2	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	50	--	150	50	50	--	150	50
PCB 156	38380-08-4	TA Knoxville	EPA 1668A	NA	0.020	0.0048	--	ng/g	50	--	150	50	50	--	150	50
PCB 157	69782-90-7	TA Knoxville	EPA 1668A	NA	0.020	0.0048	--	ng/g	50	--	150	50	50	--	150	50
PCB 158	74472-42-7	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 159	39635-35-3	TA Knoxville	EPA 1668A	NA	0.010	0.0022	--	ng/g	--	--	--	--	--	--	--	--
PCB 160	41411-62-5	TA Knoxville	EPA 1668A	NA	0.040	0.0230	--	ng/g	--	--	--	--	--	--	--	--
PCB 161	74472-43-8	TA Knoxville	EPA 1668A	NA	0.010	0.0028	--	ng/g	--	--	--	--	--	--	--	--
PCB 162	39635-34-2	TA Knoxville	EPA 1668A	NA	0.010	0.0022	--	ng/g	--	--	--	--	--	--	--	--
PCB 163	74472-44-9	TA Knoxville	EPA 1668A	NA	0.040	0.023	--	ng/g	--	--	--	--	--	--	--	--
PCB 164	74472-45-0	TA Knoxville	EPA 1668A	NA	0.010	0.0036	--	ng/g	--	--	--	--	--	--	--	--
PCB 165	74472-46-1	TA Knoxville	EPA 1668A	NA	0.010	0.0024	--	ng/g	--	--	--	--	--	--	--	--
PCB 166	41411-63-6	TA Knoxville	EPA 1668A	NA	0.020	0.010	--	ng/g	--	--	--	--	--	--	--	--
PCB 167	52663-72-6	TA Knoxville	EPA 1668A	NA	0.010	0.0025	--	ng/g	50	--	150	50	50	--	150	50
PCB 168	59291-65-5	TA Knoxville	EPA 1668A	NA	0.020	0.0036	--	ng/g	--	--	--	--	--	--	--	--
PCB 169	32774-16-6	TA Knoxville	EPA 1668A	NA	0.010	0.0023	--	ng/g	50	--	150	50	50	--	150	50
PCB 170	35065-30-6	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 171	52663-71-5	TA Knoxville	EPA 1668A	NA	0.020	0.0086	--	ng/g	--	--	--	--	--	--	--	--
PCB 172	52663-74-8	TA Knoxville	EPA 1668A	NA	0.010	0.0030	--	ng/g	--	--	--	--	--	--	--	--
PCB 173	68194-16-1	TA Knoxville	EPA 1668A	NA	0.020	0.0086	--	ng/g	--	--	--	--	--	--	--	--
PCB 174	38411-25-5	TA Knoxville	EPA 1668A	NA	0.010	0.0029	--	ng/g	--	--	--	--	--	--	--	--
PCB 175	40186-70-7	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 176	52663-65-7	TA Knoxville	EPA 1668A	NA	0.010	0.0021	--	ng/g	--	--	--	--	--	--	--	--
PCB 177	52663-70-4	TA Knoxville	EPA 1668A	NA	0.010	0.0021	--	ng/g	--	--	--	--	--	--	--	--
PCB 178	52663-67-9	TA Knoxville	EPA 1668A	NA	0.010	0.0024	--	ng/g	--	--	--	--	--	--	--	--
PCB 179	52663-64-6	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 180	35065-29-3	TA Knoxville	EPA 1668A	NA	0.020	0.0074	--	ng/g	--	--	--	--	--	--	--	--
PCB 181	74472-47-2	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 182	60145-23-5	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 183	52663-69-1	TA Knoxville	EPA 1668A	NA	0.020	0.0052	--	ng/g	--	--	--	--	--	--	--	--
PCB 184	74472-48-3	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 185	52712-05-7	TA Knoxville	EPA 1668A	NA	0.020	0.0052	--	ng/g	--	--	--	--	--	--	--	--
PCB 186	74472-49-4	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 187	52663-68-0	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 188	74487-85-7	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	50	--	150	50	50	--	150	50
PCB 189	39635-31-9	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	50	--	150	50	50	--	150	50
PCB 190	41411-64-7	TA Knoxville	EPA 1668A	NA	0.010	0.0026	--	ng/g	--	--	--	--	--	--	--	--
PCB 191	74472-50-7	TA Knoxville	EPA 1668A	NA	0.010	0.0024	--	ng/g	--	--	--	--	--	--	--	--
PCB 192	74472-51-8	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 193	69782-91-8	TA Knoxville	EPA 1668A	NA	0.020	0.0074	--	ng/g	--	--	--	--	--	--	--	--
PCB 194	35694-08-7	TA Knoxville	EPA 1668A	NA	0.010	0.0026	--	ng/g	--	--	--	--	--	--	--	--
PCB 195	52663-78-2	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 196	42740-50-1	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 197	33091-17-7	TA Knoxville	EPA 1668A	NA	0.010	0.0029	--	ng/g	--	--	--	--	--	--	--	--
PCB 198	68194-17-2	TA Knoxville	EPA 1668A	NA	0.020	0.0074	--	ng/g	--	--	--	--	--	--	--	--
PCB 199	52663-75-9	TA Knoxville	EPA 1668A	NA	0.020	0.0074	--	ng/g	--	--	--	--	--	--	--	--
PCB 200	52663-73-7	TA Knoxville	EPA 1668A	NA	0.010	0.0029	--	ng/g	--	--	--	--	--	--	--	--
PCB 201	40186-71-8	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--

Table 2a. Cleanup Levels and Analytical Quantitation Limits for Chemicals of Potential Concern in Targeted SMA Sediment Samples (Surface and Subsurface)

PARCCS:	Comparability			Sensitivity[1]					Accuracy and Precision[1]							
									MS/MSD				LCS/LCSD			
Parameter	CAS Number	Laboratory	Method	ROD Cleanup Levels[2]	Project Quantitation Limits[3]	Achievable Laboratory MDLs[3]	Laboratory EDLs[3]	Units	*Percent Recovery (%)*			*RPD (%)*	*Percent Recovery (%)*			*RPD (%)*
PCB 202	2136-99-4	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	50	--	150	50	50	--	150	50
PCB 203	52663-76-0	TA Knoxville	EPA 1668A	NA	0.010	0.0025	--	ng/g	--	--	--	--	--	--	--	--
PCB 204	74472-52-9	TA Knoxville	EPA 1668A	NA	0.010	0.0026	--	ng/g	--	--	--	--	--	--	--	--
PCB 205	74472-53-0	TA Knoxville	EPA 1668A	NA	0.010	0.0021	--	ng/g	50	--	150	50	50	--	150	50
PCB 206	40186-72-9	TA Knoxville	EPA 1668A	NA	0.010	0.0029	--	ng/g	50	--	150	50	50	--	150	50
PCB 207	52663-79-3	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 208	52663-77-1	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	50	--	150	50	50	--	150	50
PCB 209	2051-24-3	TA Knoxville	EPA 1668A	NA	0.010	0.0021	--	ng/g	50	--	150	50	50	--	150	50
Conventionals																
Total Organic Carbon[5]	7440-44-0	TA Seattle	EPA 9060	NA	2000	44.4	NA	mg/kg	68	--	149	32	68	--	149	32
Total Solids	NA	ALS Kelso/TA	EPA 160.3M/ASTM D-2216	NA	NA	NA	NA	%	--	--	--	20	--	--	--	20
Subsurface Sediment																
Chlorinated Pesticides[5]																
DDx	--	ALS Burlington	EPA HR-GC/MS 1699	6.1	--	--	NA	µg/kg	--	--	--	--	--	--	--	--
DDD[4]	--	ALS Burlington	EPA HR-GC/MS 1699	114	--	0.07	0.019	µg/kg	--	--	--	--	42	--	120	30
DDE[4]	--	ALS Burlington	EPA HR-GC/MS 1699	226	--	0.032	0.025	µg/kg	--	--	--	--	50	--	120	30
DDT[4]	--	ALS Burlington	EPA HR-GC/MS 1699	246	--	0.085	0.042	µg/kg	--	--	--	--	50	--	120	30
Dioxins/Furans[5]																
Dioxins/Furans (2,3,7,8 TCDD eq)	--	TA Sacramento	EPA 1613B	NA	NA	NA	NA	NA	--	--	--	--	--	--	--	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1746-01-6	TA Sacramento	EPA 1613B	0.20	1.0	0.15	0.028	pg/g	--	--	--	--	67	--	158	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	40321-76-4	TA Sacramento	EPA 1613B	0.20	5.0	0.300	0.030	pg/g	--	--	--	--	70	--	142	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	39227-28-6	TA Sacramento	EPA 1613B	NA	5.0	0.71	0.025	pg/g	--	--	--	--	70	--	164	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	57653-85-7	TA Sacramento	EPA 1613B	NA	5.0	0.58	0.025	pg/g	--	--	--	--	76	--	134	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	19408-74-3	TA Sacramento	EPA 1613B	NA	5.0	0.58	0.022	pg/g	--	--	--	--	64	--	162	--
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	35822-46-9	TA Sacramento	EPA 1613B	NA	5.0	0.46	0.038	pg/g	--	--	--	--	70	--	140	--
1,2,3,4,5,6,7,8-Octachlorodibenzo-p-dioxin (OCDD)	3268-87-9	TA Sacramento	EPA 1613B	NA	10.0	1.5	0.053	pg/g	--	--	--	--	78	--	144	--
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	51207-31-9	TA Sacramento	EPA 1613B	0.407	1.0	0.11	0.015	pg/g	--	--	--	--	75	--	158	--
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	57117-41-6	TA Sacramento	EPA 1613B	NA	5.0	0.27	0.018	pg/g	--	--	--	--	80	--	134	--
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	57117-31-4	TA Sacramento	EPA 1613B	0.30	5.0	0.29	0.019	pg/g	--	--	--	--	68	--	160	--
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	70648-26-9	TA Sacramento	EPA 1613B	0.40	5.0	0.3	0.023	pg/g	--	--	--	--	72	--	134	--
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	57117-44-9	TA Sacramento	EPA 1613B	NA	5.0	0.38	0.021	pg/g	--	--	--	--	84	--	130	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	72918-21-9	TA Sacramento	EPA 1613B	NA	5.0	0.43	0.017	pg/g	--	--	--	--	78	--	130	--
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	60851-34-5	TA Sacramento	EPA 1613B	NA	5.0	0.3	0.017	pg/g	--	--	--	--	70	--	156	--
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	67562-39-4	TA Sacramento	EPA 1613B	NA	5.0	0.38	0.043	pg/g	--	--	--	--	82	--	122	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	55673-89-7	TA Sacramento	EPA 1613B	NA	5.0	0.65	0.059	pg/g	--	--	--	--	78	--	138	--
1,2,3,4,5,6,7,8-Octachlorodibenzofuran (OCDF)	39001-02-0	TA Sacramento	EPA 1613B	NA	10.0	1.2	0.032	pg/g	--	--	--	--	63	--	170	--
Grain Size																
Clay	STL00587	TA Seattle	ASTM D7928 and D6913	NA	0.010	NA	NA	%	--	--	--	--	--	--	--	--
Coarse Sand	STL00583	TA Seattle	ASTM D7928 and D6913	NA	0.010	NA	NA	%	--	--	--	--	--	--	--	--
Fine Sand	STL00585	TA Seattle	ASTM D7928 and D6913	NA	0.010	NA	NA	%	--	--	--	--	--	--	--	--
Gravel	STL00581	TA Seattle	ASTM D7928 and D6913	NA	0.010	NA	NA	%	--	--	--	--	--	--	--	--
Medium Sand	STL00584	TA Seattle	ASTM D7928 and D6913	NA	0.010	NA	NA	%	--	--	--	--	--	--	--	--
Silt	STL00586	TA Seattle	ASTM D7928 and D6913	NA	0.010	NA	NA	%	--	--	--	--	--	--	--	--
Atterberg Limits																
Atterberg Limits	--	TA Burlington	ASTM D4318	NA	--	NA	NA	%	--	--	--	--	--	--	--	--
PAHs[5]																
PAHs	--	TA Seattle	EPA 8270D-SIM	23000	NA	NA	NA	µg/kg	--	--	--	--	--	--	--	--
cPAHs (BaP equivalent)	--	TA Seattle	EPA 8270D-SIM	12	NA	NA	NA	µg/kg	--	--	--	--	--	--	--	--
Acenaphthene	83-32-9	TA Seattle	EPA 8270D-SIM	NA	1	0.12	NA	µg/kg	68	--	120	12	68	--	120	12
Acenaphthylene	208-96-8	TA Seattle	EPA 8270D-SIM	NA	1	0.1	NA	µg/kg	68	--	120	12	68	--	120	12
Anthracene	120-12-7	TA Seattle	EPA 8270D-SIM	NA	1	0.12	NA	µg/kg	73	--	125	12	73	--	125	12
Benzo(a)anthracene	56-55-3	TA Seattle	EPA 8270D-SIM	NA	1	0.152	NA	µg/kg	66	--	120	14	66	--	120	14
Benzo(a)pyrene	50-32-8	TA Seattle	EPA 8270D-SIM	NA	1	0.08	NA	µg/kg	72	--	124	12	72	--	124	12
Benzo(b)fluoranthene	205-99-2	TA Seattle	EPA 8270D-SIM	NA	1	0.118	NA	µg/kg	63	--	121	10	63	--	121	10
Benzo(g,h,i)perylene	191-24-2	TA Seattle	EPA 8270D-SIM	NA	1	0.1	NA	µg/kg	63	--	120	14	63	--	120	14

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PARCCS:	Comparability			Sensitivity[1]					Accuracy and Precision[1]							
									MS/MSD				LCS/LCSD			
Parameter	CAS Number	Laboratory	Method	ROD Cleanup Levels[2]	Project Quantitation Limits[3]	Achievable Laboratory MDLs[3]	Laboratory EDLs[3]	Units	*Percent Recovery (%)*			*RPD (%)*	*Percent Recovery (%)*			*RPD (%)*
Benzo(k)fluoranthene	207-08-9	TA Seattle	EPA 8270D-SIM	NA	1	0.12	NA	µg/kg	63	--	123	15	63	--	123	15
Chrysene	218-01-9	TA Seattle	EPA 8270D-SIM	NA	1	0.3	NA	µg/kg	69	--	120	10	69	--	120	10
Dibenz(a,h)anthracene	53-70-3	TA Seattle	EPA 8270D-SIM	NA	1	0.144	NA	µg/kg	70	--	125	13	70	--	125	13
Fluoranthene	206-44-0	TA Seattle	EPA 8270D-SIM	NA	1	0.28	NA	µg/kg	74	--	125	13	74	--	125	13
Fluorene	86-73-7	TA Seattle	EPA 8270D-SIM	NA	1	0.1	NA	µg/kg	73	--	120	13	73	--	120	13
Indeno(1,2,3-cd)pyrene	193-39-5	TA Seattle	EPA 8270D-SIM	NA	1	0.12	NA	µg/kg	65	--	121	15	65	--	121	15
2-Methylnaphthalene	91-57-6	TA Seattle	EPA 8270D-SIM	NA	1	0.09	NA	µg/kg	68	--	120	12	68	--	120	12
Naphthalene	91-20-3	TA Seattle	EPA 8270D-SIM	NA	1	0.16	NA	µg/kg	70	--	120	12	70	--	120	12
Phenanthrene	85-01-8	TA Seattle	EPA 8270D-SIM	NA	1	0.138	NA	µg/kg	73	--	120	11	73	--	120	11
Pyrene	129-00-0	TA Seattle	EPA 8270D-SIM	NA	1	0.194	NA	µg/kg	70	--	120	12	70	--	120	12
PCB Aroclors[5]																
Total PCBs	--	TA Seattle	EPA 8082A LL	9	--	--		µg/kg	--	--	--	--	--	--	--	--
PCB-1016	12674-11-2	TA Seattle	EPA 8082A LL	NA	1.0	0.050	NA	µg/kg	69	--	126	17	69	--	126	17
PCB-1221	11104-28-2	TA Seattle	EPA 8082A LL	NA	1.1	0.34	NA	µg/kg	--	--	--	--	--	--	--	--
PCB-1232	11141-16-5	TA Seattle	EPA 8082A LL	NA	1.1	0.22	NA	µg/kg	--	--	--	--	--	--	--	--
PCB-1242	53469-21-9	TA Seattle	EPA 8082A LL	NA	1.0	0.21	NA	µg/kg	--	--	--	--	--	--	--	--
PCB-1248	12672-29-6	TA Seattle	EPA 8082A LL	NA	1.1	0.16	NA	µg/kg	--	--	--	--	--	--	--	--
PCB-1254	11097-69-1	TA Seattle	EPA 8082A LL	NA	1.0	0.090	NA	µg/kg	--	--	--	--	--	--	--	--
PCB-1260	11096-82-5	TA Seattle	EPA 8082A LL	NA	1.0	0.13	NA	µg/kg	68	--	136	21	68	--	136	21
Conventionals																
Total Organic Carbon[5]	7440-44-0	TA Seattle	EPA 9060	NA	2000	44.4	NA	mg/kg	68	--	149	32	68	--	149	32
Total Solids	NA	ALS Kelso/TA	EPA 160.3M/ASTM D-2216	NA	NA	NA	NA	%	--	--	--	20	--	--	--	20

Notes:

[1] Accuracy and precision values, as well as PQLs, MDLs, and EDLs were provided by the laboratory. These are presented for informational purposes only. Data review/validation will be based on the most current precision and accuracy limits in effect at the time of analysis.

[2] From Table 17 of the ROD.

[3] Project quantitation limits, MDLs, and EDLs are reported on a dry weight basis.

[4] The laboratory will analyze for both the 2,4 and 4,4 DDD, DDE and DDT isomers.

[5] Chlorinated Pesticides by EPA 1699 modified (GC/MS/MS), PAHs by EPA 8270D-SIM, PCB Aroclors by EPA 8082A, and Total Organic Carbon (EPA 9060) will be reported to the laboratory MDL. Detections between the MDL and the PQL will be reported as estimated results using a "J" qualifier. The laboratory will provide both MDLs and PQLs in their reports and EDDs.

Chlorinated Pesticides by EPA Method 1699 (HR-GCMS), Dioxins/Furans by EPA 1613B and PCB congeners by EPA 1668A will be reported to the sample EDL. Detections between the EDL and the PQL will be reported as estimated results using a "J" qualifier. The laboratory will provide both EDLs and PQLs in their reports and EDDs.

[6] MS/MSD analysis was removed from PCB congener analysis documented in change request 06 approved by EPA on 6/15/2018. Samples prepared after 6/15/2018 do not include MS/MSD results.

Abbreviations:

-- = not provided
ASTM = American Society for Testing and Materials
BaP = benzo(a)pyrene
CAS = Chemical Abstract Service
cPAH = carcinogenic polycyclic aromatic hydrocarbon
DDx = dichlorodiphenyltrichloroethane and its derivatives
EDD = Electronic Data Deliverable
EDL = Estimated detection limit
EPA = Environmental Protection Agency
LCS = Laboratory Control Sample
LCSD = Laboratory Control Sample Duplicate
MDL = Method Detection Limit
mg/kg = milligrams per kilogram
MS = Matrix Spike
MSD = Matrix Spike Duplicate
NA = not applicable
ng/g = nanograms per gram
PAH = polycyclic aromatic hydrocarbons
PARCCS = Precision, Accuracy, Representativeness, Completeness, Comparability, and Sensitivity
PCB = polychlorinated biphenyl
pg/g = picograms per gram
PQL = Project Quantitation Limit
RI = remedial investigation
ROD = Record of Decision
RPD = Relative Percent Difference
SIM = Selective Ion Monitoring
SMA = sediment management area
TA = TestAmerica
TOC = total organic carbon
µg/kg = micrograms per kilogram

Table 2b. Cleanup Levels and Analytical Quantitation Limits for Chemicals of Potential Concern in Stratified Random Surface Sediment and Suspended Sediment Samples

PARCCS:	Comparability			Sensitivity[1]					Accuracy and Precision[1]							
Parameter	CAS Number	Laboratory	Method	ROD Cleanup Levels[2]	Project Quantitation Limits[3]	Achievable Laboratory MDLs[3]	Laboratory EDLs[3]	Units	MS/MSD				LCS/LCSD			
									Percent Recovery (%)			*RPD (%)*	*Percent Recovery (%)*			*RPD (%)*
Atterberg Limits																
Atterberg Limits	--	TA Burlington	ASTM D4318	NA	--	NA	NA	%	--	--	--	--	--	--	--	--
Semi Volatile Organic Compounds (SVOCs)[4]																
bis-(2-ethylhexyl) phthalate (BEHP)	117-81-7	ALS Kelso	EPA 8270D-LL	135	100	8.9	NA	µg/kg	23	--	123	40	39	--	113	40
bis-(2-ethylhexyl) phthalate (BEHP)	117-81-7	TA Seattle	EPA 8270D-LL	135	30	6.8	NA	µg/kg	59	--	123	13	59	--	123	13
Chlorinated Pesticides[4]																
Aldrin	309-00-2	ALS Kelso	EPA GC/MS/MS 1699M	2	0.1	0.079	NA	µg/kg	52	--	151	30	74	--	122	30
Chlordanes	57-74-9	ALS Kelso	EPA GC/MS/MS 1699M	1.4	--	--	NA	µg/kg	--	--	--	--	--	--	--	--
Chlordane, oxy-	27304-13-8	ALS Kelso	EPA GC/MS/MS 1699M	NA	0.2	0.13	NA	µg/kg	53	--	144	40	59	--	141	30
Chlordane, gamma (trans)	5103-74-2	ALS Kelso	EPA GC/MS/MS 1699M	NA	0.2	0.064	NA	µg/kg	31	--	158	40	76	--	128	30
Chlordane, alpha (cis)	5103-71-9	ALS Kelso	EPA GC/MS/MS 1699M	NA	0.2	0.062	NA	µg/kg	31	--	156	40	74	--	130	30
Nonachlor, trans-	39765-80-5	ALS Kelso	EPA GC/MS/MS 1699M	NA	0.2	0.058	NA	µg/kg	35	--	153	40	76	--	124	30
Nonachlor, cis-	5103-73-1	ALS Kelso	EPA GC/MS/MS 1699M	NA	0.1	0.097	NA	µg/kg	27	--	144	40	69	--	134	30
DDx	--	ALS Kelso	EPA GC/MS/MS 1699M	6.1	0.1	-	NA	µg/kg	--	--	--	--	--	--	--	--
DDD[5]	--	ALS Kelso	EPA GC/MS/MS 1699M	114	0.1	0.06	NA	µg/kg	10	--	190	30	74	--	117	30
DDE[5]	--	ALS Kelso	EPA GC/MS/MS 1699M	226	0.1	0.07	NA	µg/kg	43	--	155	30	54	--	145	30
DDT[5]	--	ALS Kelso	EPA GC/MS/MS 1699M	246	0.1	0.09	NA	µg/kg	24	--	183	30	78	--	116	30
Dieldrin	60-57-1	ALS Kelso	EPA GC/MS/MS 1699M	0.07	0.2	0.01	NA	µg/kg	28	--	150	30	62	--	131	30
Lindane	58-89-9	ALS Kelso	EPA GC/MS/MS 1699M	5	0.1	0.031	NA	µg/kg	64	--	135	30	79	--	116	30
Dioxins/Furans[4]																
Dioxins/Furans (2,3,7,8 TCDD eq)	--	TA Sacramento	EPA 1613B	NA	NA	NA	NA	NA	--	--	--	--	--	--	--	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1746-01-6	TA Sacramento	EPA 1613B	0.20	1	0.15	0.028	pg/g	--	--	--	--	67	--	158	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	40321-76-4	TA Sacramento	EPA 1613B	0.20	5	0.300	0.030	pg/g	--	--	--	--	70	--	142	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	39227-28-6	TA Sacramento	EPA 1613B	NA	5	0.71	0.025	pg/g	--	--	--	--	70	--	164	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	57653-85-7	TA Sacramento	EPA 1613B	NA	5	0.58	0.025	pg/g	--	--	--	--	76	--	134	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	19408-74-3	TA Sacramento	EPA 1613B	NA	5	0.58	0.022	pg/g	--	--	--	--	64	--	162	--
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	35822-46-9	TA Sacramento	EPA 1613B	NA	5	0.46	0.038	pg/g	--	--	--	--	70	--	140	--
1,2,3,4,5,6,7,8-Octachlorodibenzo-p-dioxin (OCDD)	3268-87-9	TA Sacramento	EPA 1613B	NA	10	1.5	0.053	pg/g	--	--	--	--	78	--	144	--
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	51207-31-9	TA Sacramento	EPA 1613B	0.407	1	0.11	0.015	pg/g	--	--	--	--	75	--	158	--
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	57117-41-6	TA Sacramento	EPA 1613B	NA	5	0.27	0.018	pg/g	--	--	--	--	80	--	134	--
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	57117-31-4	TA Sacramento	EPA 1613B	0.30	5	0.29	0.019	pg/g	--	--	--	--	68	--	160	--
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	70648-26-9	TA Sacramento	EPA 1613B	0.40	5	0.3	0.023	pg/g	--	--	--	--	72	--	134	--
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	57117-44-9	TA Sacramento	EPA 1613B	NA	5	0.38	0.021	pg/g	--	--	--	--	84	--	130	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	72918-21-9	TA Sacramento	EPA 1613B	NA	5	0.43	0.017	pg/g	--	--	--	--	78	--	130	--
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	60851-34-5	TA Sacramento	EPA 1613B	NA	5	0.3	0.017	pg/g	--	--	--	--	70	--	156	--
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	67562-39-4	TA Sacramento	EPA 1613B	NA	5	0.38	0.043	pg/g	--	--	--	--	82	--	122	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	55673-89-7	TA Sacramento	EPA 1613B	NA	5	0.65	0.059	pg/g	--	--	--	--	78	--	138	--
1,2,3,4,5,6,7,8-Octachlorodibenzofuran (OCDF)	39001-02-0	TA Sacramento	EPA 1613B	NA	10	1.2	0.032	pg/g	--	--	--	--	63	--	170	--
Grain Size																
Clay	STL00587	TA Seattle	ASTM D7928 and D6913	NA	0.010	NA	NA	%	--	--	--	--	--	--	--	--
Coarse Sand	STL00583	TA Seattle	ASTM D7928 and D6913	NA	0.010	NA	NA	%	--	--	--	--	--	--	--	--
Fine Sand	STL00585	TA Seattle	ASTM D7928 and D6913	NA	0.010	NA	NA	%	--	--	--	--	--	--	--	--
Gravel	STL00581	TA Seattle	ASTM D7928 and D6913	NA	0.010	NA	NA	%	--	--	--	--	--	--	--	--
Medium Sand	STL00584	TA Seattle	ASTM D7928 and D6913	NA	0.010	NA	NA	%	--	--	--	--	--	--	--	--
Silt	STL00586	TA Seattle	ASTM D7928 and D6913	NA	0.010	NA	NA	%	--	--	--	--	--	--	--	--

Table 2b. Cleanup Levels and Analytical Quantitation Limits for Chemicals of Potential Concern in Stratified Random Surface Sediment and Suspended Sediment Samples

PARCCS:	Comparability			Sensitivity[1]					Accuracy and Precision[1]							
Parameter	CAS Number	Laboratory	Method	ROD Cleanup Levels[2]	Project Quantitation Limits[3]	Achievable Laboratory MDLs[3]	Laboratory EDLs[3]	Units	MS/MSD				LCS/LCSD			
									Percent Recovery (%)			*RPD (%)*	*Percent Recovery (%)*			*RPD (%)*
Metals [4]																
Arsenic	7440-38-2	TA Seattle	EPA 6020B	3	0.50	0.10	NA	mg/kg	80	--	120	20	80	--	120	20
Cadmium	7440-43-9	TA Seattle	EPA 6020B	0.51	0.40	0.077	NA	mg/kg	80	--	120	20	80	--	120	20
Copper	7440-50-8	TA Seattle	EPA 6020B	359	1.0	0.22	NA	mg/kg	80	--	120	20	80	--	120	20
Lead	7439-92-1	TA Seattle	EPA 6020B	196	0.50	0.048	NA	mg/kg	80	--	120	20	80	--	120	20
Zinc	7440-66-6	TA Seattle	EPA 6020B	459	5.0	1.61	NA	mg/kg	80	--	120	20	80	--	120	20
Mercury	7439-97-6	TA Seattle	EPA 7471A	0.085	0.030	0.0090	NA	mg/kg	80	--	120	20	80	--	120	20
PAHs [4]																
PAHs	NA	ALS Kelso	EPA 8270D-SIM	23000	NA	NA	NA	µg/kg	--	--	--	--	--	--	--	--
cPAHs (BaP equivalent)	NA	ALS Kelso	EPA 8270D-SIM	12	NA	NA	NA	µg/kg	--	--	--	--	--	--	--	--
Acenaphthene	83-32-9	ALS Kelso	EPA 8270D-SIM	NA	0.5	0.032	NA	µg/kg	51	--	82	40	70	--	130	40
Acenaphthylene	208-96-8	ALS Kelso	EPA 8270D-SIM	NA	0.5	0.029	NA	µg/kg	51	--	80	40	70	--	130	40
Anthracene	120-12-7	ALS Kelso	EPA 8270D-SIM	NA	0.5	0.026	NA	µg/kg	56	--	87	40	70	--	130	40
Benzo(a)anthracene	56-55-3	ALS Kelso	EPA 8270D-SIM	NA	0.5	0.033	NA	µg/kg	65	--	97	40	70	--	130	40
Benzo(a)pyrene	50-32-8	ALS Kelso	EPA 8270D-SIM	NA	0.5	0.036	NA	µg/kg	64	--	103	40	70	--	130	40
Benzo(b)fluoranthene	205-99-2	ALS Kelso	EPA 8270D-SIM	NA	0.5	0.057	NA	µg/kg	63	--	99	40	70	--	130	40
Benzo(g,h,i)perylene	191-24-2	ALS Kelso	EPA 8270D-SIM	NA	0.5	0.059	NA	µg/kg	56	--	101	40	70	--	130	40
Benzo(k)fluoranthene	207-08-9	ALS Kelso	EPA 8270D-SIM	NA	0.5	0.045	NA	µg/kg	62	--	99	40	70	--	130	40
Chrysene	218-01-9	ALS Kelso	EPA 8270D-SIM	NA	0.5	0.027	NA	µg/kg	63	--	100	40	70	--	130	40
Dibenz(a,h)anthracene	53-70-3	ALS Kelso	EPA 8270D-SIM	NA	0.5	0.058	NA	µg/kg	56	--	104	40	70	--	130	40
Fluoranthene	206-44-0	ALS Kelso	EPA 8270D-SIM	NA	0.5	0.032	NA	µg/kg	45	--	96	40	70	--	130	40
Fluorene	86-73-7	ALS Kelso	EPA 8270D-SIM	NA	0.5	0.039	NA	µg/kg	52	--	83	40	70	--	130	40
Indeno(1,2,3-cd)pyrene	193-39-5	ALS Kelso	EPA 8270D-SIM	NA	0.5	0.064	NA	µg/kg	61	--	105	40	70	--	130	40
2-Methylnaphthalene	91-57-6	ALS Kelso	EPA 8270D-SIM	NA	0.5	0.047	NA	µg/kg	52	--	85	40	70	--	130	40
Naphthalene	91-20-3	ALS Kelso	EPA 8270D-SIM	NA	0.5	0.089	NA	µg/kg	48	--	77	40	70	--	130	40
Phenanthrene	85-01-8	ALS Kelso	EPA 8270D-SIM	NA	0.5	0.033	NA	µg/kg	48	--	85	40	70	--	130	40
Pyrene	129-00-0	ALS Kelso	EPA 8270D-SIM	NA	0.5	0.032	NA	µg/kg	59	--	98	40	70	--	130	40
PAHs	NA	TA Seattle	EPA 8270D-SIM	23000	--	--	NA	µg/kg	--	--	--	--	--	--	--	--
cPAHs (BaP equivalent)	NA	TA Seattle	EPA 8270D-SIM	12	--	--	NA	µg/kg	--	--	--	--	--	--	--	--
Acenaphthene	83-32-9	TA Seattle	EPA 8270D-SIM	NA	1	0.12	NA	µg/kg	68	--	120	12	68	--	120	12
Acenaphthylene	208-96-8	TA Seattle	EPA 8270D-SIM	NA	1	0.1	NA	µg/kg	68	--	120	12	68	--	120	12
Anthracene	120-12-7	TA Seattle	EPA 8270D-SIM	NA	1	0.12	NA	µg/kg	73	--	125	12	73	--	125	12
Benzo(a)anthracene	56-55-3	TA Seattle	EPA 8270D-SIM	NA	1	0.152	NA	µg/kg	66	--	120	14	66	--	120	14
Benzo(a)pyrene	50-32-8	TA Seattle	EPA 8270D-SIM	NA	1	0.08	NA	µg/kg	72	--	124	12	72	--	124	12
Benzo(b)fluoranthene	205-99-2	TA Seattle	EPA 8270D-SIM	NA	1	0.118	NA	µg/kg	63	--	121	10	63	--	121	10
Benzo(g,h,i)perylene	191-24-2	TA Seattle	EPA 8270D-SIM	NA	1	0.1	NA	µg/kg	63	--	120	14	63	--	120	14
Benzo(k)fluoranthene	207-08-9	TA Seattle	EPA 8270D-SIM	NA	1	0.12	NA	µg/kg	63	--	123	15	63	--	123	15
Chrysene	218-01-9	TA Seattle	EPA 8270D-SIM	NA	1	0.3	NA	µg/kg	69	--	120	10	69	--	120	10
Dibenz(a,h)anthracene	53-70-3	TA Seattle	EPA 8270D-SIM	NA	1	0.144	NA	µg/kg	70	--	125	13	70	--	125	13
Fluoranthene	206-44-0	TA Seattle	EPA 8270D-SIM	NA	1	0.28	NA	µg/kg	74	--	125	13	74	--	125	13
Fluorene	86-73-7	TA Seattle	EPA 8270D-SIM	NA	1	0.1	NA	µg/kg	73	--	120	13	73	--	120	13
Indeno(1,2,3-cd)pyrene	193-39-5	TA Seattle	EPA 8270D-SIM	NA	1	0.12	NA	µg/kg	65	--	121	15	65	--	121	15
2-Methylnaphthalene	91-57-6	TA Seattle	EPA 8270D-SIM	NA	1	0.09	NA	µg/kg	68	--	120	12	68	--	120	12
Naphthalene	91-20-3	TA Seattle	EPA 8270D-SIM	NA	1	0.16	NA	µg/kg	70	--	120	12	70	--	120	12
Phenanthrene	85-01-8	TA Seattle	EPA 8270D-SIM	NA	1	0.138	NA	µg/kg	73	--	120	11	73	--	120	11
Pyrene	129-00-0	TA Seattle	EPA 8270D-SIM	NA	1	0.194	NA	µg/kg	70	--	120	12	70	--	120	12

Table 2b. Cleanup Levels and Analytical Quantitation Limits for Chemicals of Potential Concern in Stratified Random Surface Sediment and Suspended Sediment Samples

PARCCS:	Comparability			Sensitivity[1]					Accuracy and Precision[1]							
Parameter	CAS Number	Laboratory	Method	ROD Cleanup Levels[2]	Project Quantitation Limits[3]	Achievable Laboratory MDLs[3]	Laboratory EDLs[3]	Units	MS/MSD				LCS/LCSD			
									Percent Recovery (%)			*RPD (%)*	*Percent Recovery (%)*			*RPD (%)*
PCB Congeners [4, 6]																
Total PCBs	--	TA Knoxville	EPA 1668A	9	NA	NA	NA	ng/g	--	--	--	--	--	--	--	--
PCB 1	2051-60-7	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	50	--	150	50	50	--	150	50
PCB 2	2051-61-8	TA Knoxville	EPA 1668A	NA	0.010	0.0023	--	ng/g	--	--	--	--	--	--	--	--
PCB 3	2051-62-9	TA Knoxville	EPA 1668A	NA	0.010	0.0021	--	ng/g	50	--	150	50	50	--	150	50
PCB 4	13029-08-8	TA Knoxville	EPA 1668A	NA	0.020	0.0035	--	ng/g	50	--	150	50	50	--	150	50
PCB 5	16605-91-7	TA Knoxville	EPA 1668A	NA	0.010	0.0026	--	ng/g	--	--	--	--	--	--	--	--
PCB 6	25569-80-6	TA Knoxville	EPA 1668A	NA	0.010	0.0022	--	ng/g	--	--	--	--	--	--	--	--
PCB 7	33284-50-3	TA Knoxville	EPA 1668A	NA	0.010	0.0038	--	ng/g	--	--	--	--	--	--	--	--
PCB 8	34883-43-7	TA Knoxville	EPA 1668A	NA	0.020	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 9	34883-39-1	TA Knoxville	EPA 1668A	NA	0.010	0.0037	--	ng/g	--	--	--	--	--	--	--	--
PCB 10	33146-45-1	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 11	2050-67-1	TA Knoxville	EPA 1668A	NA	0.020	0.0090	--	ng/g	--	--	--	--	--	--	--	--
PCB 12	2974-92-7	TA Knoxville	EPA 1668A	NA	0.020	0.012	--	ng/g	--	--	--	--	--	--	--	--
PCB 13	2974-90-5	TA Knoxville	EPA 1668A	NA	0.020	0.012	--	ng/g	--	--	--	--	--	--	--	--
PCB 14	34883-41-5	TA Knoxville	EPA 1668A	NA	0.010	0.0035	--	ng/g	--	--	--	--	--	--	--	--
PCB 15	2050-68-2	TA Knoxville	EPA 1668A	NA	0.010	0.0048	--	ng/g	50	--	150	50	50	--	150	50
PCB 16	38444-78-9	TA Knoxville	EPA 1668A	NA	0.010	0.0072	--	ng/g	--	--	--	--	--	--	--	--
PCB 17	37680-66-3	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 18	37680-65-2	TA Knoxville	EPA 1668A	NA	0.020	0.014	--	ng/g	--	--	--	--	--	--	--	--
PCB 19	38444-73-4	TA Knoxville	EPA 1668A	NA	0.010	0.0021	--	ng/g	50	--	150	50	50	--	150	50
PCB 20	38444-84-7	TA Knoxville	EPA 1668A	NA	0.020	0.0056	--	ng/g	--	--	--	--	--	--	--	--
PCB 21	55702-46-0	TA Knoxville	EPA 1668A	NA	0.020	0.0066	--	ng/g	--	--	--	--	--	--	--	--
PCB 22	38444-85-8	TA Knoxville	EPA 1668A	NA	0.010	0.0023	--	ng/g	--	--	--	--	--	--	--	--
PCB 23	55720-44-0	TA Knoxville	EPA 1668A	NA	0.010	0.0021	--	ng/g	--	--	--	--	--	--	--	--
PCB 24	55702-45-9	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 25	55712-37-3	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 26	38444-81-4	TA Knoxville	EPA 1668A	NA	0.020	0.0046	--	ng/g	--	--	--	--	--	--	--	--
PCB 27	38444-76-7	TA Knoxville	EPA 1668A	NA	0.010	0.0021	--	ng/g	--	--	--	--	--	--	--	--
PCB 28	7012-37-5	TA Knoxville	EPA 1668A	NA	0.020	0.0056	--	ng/g	--	--	--	--	--	--	--	--
PCB 29	15862-07-4	TA Knoxville	EPA 1668A	NA	0.020	0.0046	--	ng/g	--	--	--	--	--	--	--	--
PCB 30	35693-92-6	TA Knoxville	EPA 1668A	NA	0.020	0.014	--	ng/g	--	--	--	--	--	--	--	--
PCB 31	16606-02-3	TA Knoxville	EPA 1668A	NA	0.020	0.0022	--	ng/g	--	--	--	--	--	--	--	--
PCB 32	38444-77-8	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 33	38444-86-9	TA Knoxville	EPA 1668A	NA	0.020	0.0066	--	ng/g	--	--	--	--	--	--	--	--
PCB 34	37680-68-5	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 35	37680-69-6	TA Knoxville	EPA 1668A	NA	0.010	0.0027	--	ng/g	--	--	--	--	--	--	--	--
PCB 36	38444-87-0	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 37	38444-90-5	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	50	--	150	50	50	--	150	50
PCB 38	53555-66-1	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 39	38444-88-1	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 40	38444-93-8	TA Knoxville	EPA 1668A	NA	0.030	0.013	--	ng/g	--	--	--	--	--	--	--	--
PCB 41	52663-59-9	TA Knoxville	EPA 1668A	NA	0.030	0.013	--	ng/g	--	--	--	--	--	--	--	--
PCB 42	36559-22-5	TA Knoxville	EPA 1668A	NA	0.010	0.0033	--	ng/g	--	--	--	--	--	--	--	--
PCB 43	70362-46-8	TA Knoxville	EPA 1668A	NA	0.020	0.0048	--	ng/g	--	--	--	--	--	--	--	--
PCB 44	41464-39-5	TA Knoxville	EPA 1668A	NA	0.030	0.015	--	ng/g	--	--	--	--	--	--	--	--
PCB 45	70362-45-7	TA Knoxville	EPA 1668A	NA	0.020	0.010	--	ng/g	--	--	--	--	--	--	--	--
PCB 46	41464-47-5	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 47	2437-79-8	TA Knoxville	EPA 1668A	NA	0.030	0.015	--	ng/g	--	--	--	--	--	--	--	--
PCB 48	70362-47-9	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--

Table 2b. Cleanup Levels and Analytical Quantitation Limits for Chemicals of Potential Concern in Stratified Random Surface Sediment and Suspended Sediment Samples

PARCCS:	Comparability			Sensitivity[1]					Accuracy and Precision[1]							
Parameter	CAS Number	Laboratory	Method	ROD Cleanup Levels[2]	Project Quantitation Limits[3]	Achievable Laboratory MDLs[3]	Laboratory EDLs[3]	Units	MS/MSD				LCS/LCSD			
									Percent Recovery (%)			*RPD (%)*	*Percent Recovery (%)*			*RPD (%)*
PCB 49	41464-40-8	TA Knoxville	EPA 1668A	NA	0.020	0.0054	--	ng/g	--	--	--	--	--	--	--	--
PCB 50	62796-65-0	TA Knoxville	EPA 1668A	NA	0.020	0.0060	--	ng/g	--	--	--	--	--	--	--	--
PCB 51	68194-04-7	TA Knoxville	EPA 1668A	NA	0.020	0.010	--	ng/g	--	--	--	--	--	--	--	--
PCB 52	35693-99-3	TA Knoxville	EPA 1668A	NA	0.010	0.0029	--	ng/g	--	--	--	--	--	--	--	--
PCB 53	41464-41-9	TA Knoxville	EPA 1668A	NA	0.020	0.0060	--	ng/g	--	--	--	--	--	--	--	--
PCB 54	15968-05-5	TA Knoxville	EPA 1668A	NA	0.010	0.0023	--	ng/g	50	--	150	50	50	--	150	50
PCB 55	74338-24-2	TA Knoxville	EPA 1668A	NA	0.010	0.0026	--	ng/g	--	--	--	--	--	--	--	--
PCB 56	41464-43-1	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 57	70424-67-8	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 58	41464-49-7	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 59	74472-33-6	TA Knoxville	EPA 1668A	NA	0.030	0.016	--	ng/g	--	--	--	--	--	--	--	--
PCB 60	33025-41-1	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 61	33284-53-6	TA Knoxville	EPA 1668A	NA	0.040	0.011	--	ng/g	--	--	--	--	--	--	--	--
PCB 62	54230-22-7	TA Knoxville	EPA 1668A	NA	0.030	0.016	--	ng/g	--	--	--	--	--	--	--	--
PCB 63	74472-34-7	TA Knoxville	EPA 1668A	NA	0.010	0.0027	--	ng/g	--	--	--	--	--	--	--	--
PCB 64	52663-58-8	TA Knoxville	EPA 1668A	NA	0.010	0.0027	--	ng/g	--	--	--	--	--	--	--	--
PCB 65	33284-54-7	TA Knoxville	EPA 1668A	NA	0.030	0.015	--	ng/g	--	--	--	--	--	--	--	--
PCB 66	32598-10-0	TA Knoxville	EPA 1668A	NA	0.010	0.0024	--	ng/g	--	--	--	--	--	--	--	--
PCB 67	73575-53-8	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 68	73575-52-7	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 69	60233-24-1	TA Knoxville	EPA 1668A	NA	0.020	0.0054	--	ng/g	--	--	--	--	--	--	--	--
PCB 70	32598-11-1	TA Knoxville	EPA 1668A	NA	0.040	0.011	--	ng/g	--	--	--	--	--	--	--	--
PCB 71	41464-46-4	TA Knoxville	EPA 1668A	NA	0.030	0.013	--	ng/g	--	--	--	--	--	--	--	--
PCB 72	41464-42-0	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 73	74338-23-1	TA Knoxville	EPA 1668A	NA	0.020	0.0048	--	ng/g	--	--	--	--	--	--	--	--
PCB 74	32690-93-0	TA Knoxville	EPA 1668A	NA	0.040	0.011	--	ng/g	--	--	--	--	--	--	--	--
PCB 75	32598-12-2	TA Knoxville	EPA 1668A	NA	0.030	0.016	--	ng/g	--	--	--	--	--	--	--	--
PCB 76	70362-48-0	TA Knoxville	EPA 1668A	NA	0.040	0.011	--	ng/g	--	--	--	--	--	--	--	--
PCB 77	32598-13-3	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	50	--	150	50	50	--	150	50
PCB 78	70362-49-1	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 79	41464-48-6	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 80	33284-52-5	TA Knoxville	EPA 1668A	NA	0.010	0.0022	--	ng/g	--	--	--	--	--	--	--	--
PCB 81	70362-50-4	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	50	--	150	50	50	--	150	50
PCB 82	52663-62-4	TA Knoxville	EPA 1668A	NA	0.010	0.0029	--	ng/g	--	--	--	--	--	--	--	--
PCB 83	60145-20-2	TA Knoxville	EPA 1668A	NA	0.020	0.0054	--	ng/g	--	--	--	--	--	--	--	--
PCB 84	52663-60-2	TA Knoxville	EPA 1668A	NA	0.010	0.0042	--	ng/g	--	--	--	--	--	--	--	--
PCB 85	65510-45-4	TA Knoxville	EPA 1668A	NA	0.030	0.012	--	ng/g	--	--	--	--	--	--	--	--
PCB 86	55312-69-1	TA Knoxville	EPA 1668A	NA	0.060	0.046	--	ng/g	--	--	--	--	--	--	--	--
PCB 87	38380-02-8	TA Knoxville	EPA 1668A	NA	0.060	0.046	--	ng/g	--	--	--	--	--	--	--	--
PCB 88	55215-17-3	TA Knoxville	EPA 1668A	NA	0.020	0.0064	--	ng/g	--	--	--	--	--	--	--	--
PCB 89	73575-57-2	TA Knoxville	EPA 1668A	NA	0.010	0.0030	--	ng/g	--	--	--	--	--	--	--	--
PCB 90	68194-07-0	TA Knoxville	EPA 1668A	NA	0.030	0.014	--	ng/g	--	--	--	--	--	--	--	--
PCB 91	68194-05-8	TA Knoxville	EPA 1668A	NA	0.020	0.0064	--	ng/g	--	--	--	--	--	--	--	--
PCB 92	52663-61-3	TA Knoxville	EPA 1668A	NA	0.010	0.0028	--	ng/g	--	--	--	--	--	--	--	--
PCB 93	73575-56-1	TA Knoxville	EPA 1668A	NA	0.020	0.0070	--	ng/g	--	--	--	--	--	--	--	--
PCB 94	73575-55-0	TA Knoxville	EPA 1668A	NA	0.010	0.0035	--	ng/g	--	--	--	--	--	--	--	--
PCB 95	38379-99-6	TA Knoxville	EPA 1668A	NA	0.010	0.0042	--	ng/g	--	--	--	--	--	--	--	--
PCB 96	73575-54-9	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 97	41464-51-1	TA Knoxville	EPA 1668A	NA	0.060	0.046	--	ng/g	--	--	--	--	--	--	--	--
PCB 98	60233-25-2	TA Knoxville	EPA 1668A	NA	0.020	0.0064	--	ng/g	--	--	--	--	--	--	--	--

Table 2b. Cleanup Levels and Analytical Quantitation Limits for Chemicals of Potential Concern in Stratified Random Surface Sediment and Suspended Sediment Samples

PARCCS:	Comparability			Sensitivity[1]					Accuracy and Precision[1]							
Parameter	CAS Number	Laboratory	Method	ROD Cleanup Levels[2]	Project Quantitation Limits[3]	Achievable Laboratory MDLs[3]	Laboratory EDLs[3]	Units	MS/MSD				LCS/LCSD			
									Percent Recovery (%)			*RPD (%)*	*Percent Recovery (%)*			*RPD (%)*
PCB 99	38380-01-7	TA Knoxville	EPA 1668A	NA	0.020	0.0054	--	ng/g	--	--	--	--	--	--	--	--
PCB 100	39485-83-1	TA Knoxville	EPA 1668A	NA	0.020	0.0070	--	ng/g	--	--	--	--	--	--	--	--
PCB 101	37680-73-2	TA Knoxville	EPA 1668A	NA	0.030	0.014	--	ng/g	--	--	--	--	--	--	--	--
PCB 102	68194-06-9	TA Knoxville	EPA 1668A	NA	0.020	0.0064	--	ng/g	--	--	--	--	--	--	--	--
PCB 103	60145-21-3	TA Knoxville	EPA 1668A	NA	0.010	0.0031	--	ng/g	--	--	--	--	--	--	--	--
PCB 104	56558-16-8	TA Knoxville	EPA 1668A	NA	0.010	0.0021	--	ng/g	50	--	150	50	50	--	150	50
PCB 105	32598-14-4	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	50	--	150	50	50	--	150	50
PCB 106	70424-69-0	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 107	70424-68-9	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 108	70362-41-3	TA Knoxville	EPA 1668A	NA	0.020	0.0040	--	ng/g	--	--	--	--	--	--	--	--
PCB 109	74472-35-8	TA Knoxville	EPA 1668A	NA	0.060	0.046	--	ng/g	--	--	--	--	--	--	--	--
PCB 110	38380-03-9	TA Knoxville	EPA 1668A	NA	0.020	0.007	--	ng/g	--	--	--	--	--	--	--	--
PCB 111	39635-32-0	TA Knoxville	EPA 1668A	NA	0.010	0.002	--	ng/g	--	--	--	--	--	--	--	--
PCB 112	74472-36-9	TA Knoxville	EPA 1668A	NA	0.010	0.004	--	ng/g	--	--	--	--	--	--	--	--
PCB 113	68194-10-5	TA Knoxville	EPA 1668A	NA	0.030	0.014	--	ng/g	--	--	--	--	--	--	--	--
PCB 114	74472-37-0	TA Knoxville	EPA 1668A	NA	0.010	0.003	--	ng/g	50	--	150	50	50	--	150	50
PCB 115	74472-38-1	TA Knoxville	EPA 1668A	NA	0.020	0.007	--	ng/g	--	--	--	--	--	--	--	--
PCB 116	18259-05-7	TA Knoxville	EPA 1668A	NA	0.030	0.012	--	ng/g	--	--	--	--	--	--	--	--
PCB 117	68194-11-6	TA Knoxville	EPA 1668A	NA	0.030	0.012	--	ng/g	--	--	--	--	--	--	--	--
PCB 118	31508-00-6	TA Knoxville	EPA 1668A	NA	0.010	0.0022	--	ng/g	50	--	150	50	50	--	150	50
PCB 119	56558-17-9	TA Knoxville	EPA 1668A	NA	0.060	0.046	--	ng/g	--	--	--	--	--	--	--	--
PCB 120	68194-12-7	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 121	56558-18-0	TA Knoxville	EPA 1668A	NA	0.010	0.0023	--	ng/g	--	--	--	--	--	--	--	--
PCB 122	76842-07-4	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 123	65510-44-3	TA Knoxville	EPA 1668A	NA	0.010	0.0024	--	ng/g	50	--	150	50	50	--	150	50
PCB 124	70424-70-3	TA Knoxville	EPA 1668A	NA	0.020	0.0040	--	ng/g	--	--	--	--	--	--	--	--
PCB 125	74472-39-2	TA Knoxville	EPA 1668A	NA	0.060	0.046	--	ng/g	--	--	--	--	--	--	--	--
PCB 126	57465-28-8	TA Knoxville	EPA 1668A	NA	0.010	0.0027	--	ng/g	50	--	150	50	50	--	150	50
PCB 127	39635-33-1	TA Knoxville	EPA 1668A	NA	0.010	0.0023	--	ng/g	--	--	--	--	--	--	--	--
PCB 128	38380-07-3	TA Knoxville	EPA 1668A	NA	0.020	0.010	--	ng/g	--	--	--	--	--	--	--	--
PCB 129	55215-18-4	TA Knoxville	EPA 1668A	NA	0.040	0.023	--	ng/g	--	--	--	--	--	--	--	--
PCB 130	52663-66-8	TA Knoxville	EPA 1668A	NA	0.010	0.0023	--	ng/g	--	--	--	--	--	--	--	--
PCB 131	61798-70-7	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 132	38380-05-1	TA Knoxville	EPA 1668A	NA	0.010	0.0024	--	ng/g	--	--	--	--	--	--	--	--
PCB 133	35694-04-3	TA Knoxville	EPA 1668A	NA	0.010	0.0030	--	ng/g	--	--	--	--	--	--	--	--
PCB 134	52704-70-8	TA Knoxville	EPA 1668A	NA	0.020	0.0086	--	ng/g	--	--	--	--	--	--	--	--
PCB 135	52744-13-5	TA Knoxville	EPA 1668A	NA	0.020	0.0074	--	ng/g	--	--	--	--	--	--	--	--
PCB 136	38411-22-2	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 137	35694-06-5	TA Knoxville	EPA 1668A	NA	0.010	0.0036	--	ng/g	--	--	--	--	--	--	--	--
PCB 138	35065-28-2	TA Knoxville	EPA 1668A	NA	0.040	0.023	--	ng/g	--	--	--	--	--	--	--	--
PCB 139	56030-56-9	TA Knoxville	EPA 1668A	NA	0.020	0.0060	--	ng/g	--	--	--	--	--	--	--	--
PCB 140	59291-64-4	TA Knoxville	EPA 1668A	NA	0.020	0.0060	--	ng/g	--	--	--	--	--	--	--	--
PCB 141	52712-04-6	TA Knoxville	EPA 1668A	NA	0.010	0.0035	--	ng/g	--	--	--	--	--	--	--	--
PCB 142	41411-61-4	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 143	68194-15-0	TA Knoxville	EPA 1668A	NA	0.020	0.0086	--	ng/g	--	--	--	--	--	--	--	--
PCB 144	68194-14-9	TA Knoxville	EPA 1668A	NA	0.010	0.0034	--	ng/g	--	--	--	--	--	--	--	--
PCB 145	74472-40-5	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 146	51908-16-8	TA Knoxville	EPA 1668A	NA	0.010	0.0040	--	ng/g	--	--	--	--	--	--	--	--
PCB 147	68194-13-8	TA Knoxville	EPA 1668A	NA	0.020	0.0048	--	ng/g	--	--	--	--	--	--	--	--
PCB 148	74472-41-6	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--

Table 2b. Cleanup Levels and Analytical Quantitation Limits for Chemicals of Potential Concern in Stratified Random Surface Sediment and Suspended Sediment Samples

PARCCS:	Comparability			Sensitivity[1]					Accuracy and Precision[1]							
Parameter	CAS Number	Laboratory	Method	ROD Cleanup Levels[2]	Project Quantitation Limits[3]	Achievable Laboratory MDLs[3]	Laboratory EDLs[3]	Units	MS/MSD				LCS/LCSD			
									Percent Recovery (%)			*RPD (%)*	*Percent Recovery (%)*			*RPD (%)*
PCB 149	38380-04-0	TA Knoxville	EPA 1668A	NA	0.020	0.0048	--	ng/g	--	--	--	--	--	--	--	--
PCB 150	68194-08-1	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 151	52663-63-5	TA Knoxville	EPA 1668A	NA	0.020	0.0074	--	ng/g	--	--	--	--	--	--	--	--
PCB 152	68194-09-2	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 153	35065-27-1	TA Knoxville	EPA 1668A	NA	0.020	0.0036	--	ng/g	--	--	--	--	--	--	--	--
PCB 154	60145-22-4	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 155	33979-03-2	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	50	--	150	50	50	--	150	50
PCB 156	38380-08-4	TA Knoxville	EPA 1668A	NA	0.020	0.0048	--	ng/g	50	--	150	50	50	--	150	50
PCB 157	69782-90-7	TA Knoxville	EPA 1668A	NA	0.020	0.0048	--	ng/g	50	--	150	50	50	--	150	50
PCB 158	74472-42-7	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 159	39635-35-3	TA Knoxville	EPA 1668A	NA	0.010	0.0022	--	ng/g	--	--	--	--	--	--	--	--
PCB 160	41411-62-5	TA Knoxville	EPA 1668A	NA	0.040	0.023	--	ng/g	--	--	--	--	--	--	--	--
PCB 161	74472-43-8	TA Knoxville	EPA 1668A	NA	0.010	0.0028	--	ng/g	--	--	--	--	--	--	--	--
PCB 162	39635-34-2	TA Knoxville	EPA 1668A	NA	0.010	0.0022	--	ng/g	--	--	--	--	--	--	--	--
PCB 163	74472-44-9	TA Knoxville	EPA 1668A	NA	0.040	0.023	--	ng/g	--	--	--	--	--	--	--	--
PCB 164	74472-45-0	TA Knoxville	EPA 1668A	NA	0.010	0.0036	--	ng/g	--	--	--	--	--	--	--	--
PCB 165	74472-46-1	TA Knoxville	EPA 1668A	NA	0.010	0.0024	--	ng/g	--	--	--	--	--	--	--	--
PCB 166	41411-63-6	TA Knoxville	EPA 1668A	NA	0.020	0.010	--	ng/g	--	--	--	--	--	--	--	--
PCB 167	52663-72-6	TA Knoxville	EPA 1668A	NA	0.010	0.0025	--	ng/g	50	--	150	50	50	--	150	50
PCB 168	59291-65-5	TA Knoxville	EPA 1668A	NA	0.020	0.0036	--	ng/g	--	--	--	--	--	--	--	--
PCB 169	32774-16-6	TA Knoxville	EPA 1668A	NA	0.010	0.0023	--	ng/g	50	--	150	50	50	--	150	50
PCB 170	35065-30-6	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 171	52663-71-5	TA Knoxville	EPA 1668A	NA	0.020	0.0086	--	ng/g	--	--	--	--	--	--	--	--
PCB 172	52663-74-8	TA Knoxville	EPA 1668A	NA	0.010	0.0030	--	ng/g	--	--	--	--	--	--	--	--
PCB 173	68194-16-1	TA Knoxville	EPA 1668A	NA	0.020	0.0086	--	ng/g	--	--	--	--	--	--	--	--
PCB 174	38411-25-5	TA Knoxville	EPA 1668A	NA	0.010	0.0029	--	ng/g	--	--	--	--	--	--	--	--
PCB 175	40186-70-7	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 176	52663-65-7	TA Knoxville	EPA 1668A	NA	0.010	0.0021	--	ng/g	--	--	--	--	--	--	--	--
PCB 177	52663-70-4	TA Knoxville	EPA 1668A	NA	0.010	0.0021	--	ng/g	--	--	--	--	--	--	--	--
PCB 178	52663-67-9	TA Knoxville	EPA 1668A	NA	0.010	0.0024	--	ng/g	--	--	--	--	--	--	--	--
PCB 179	52663-64-6	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 180	35065-29-3	TA Knoxville	EPA 1668A	NA	0.020	0.0074	--	ng/g	--	--	--	--	--	--	--	--
PCB 181	74472-47-2	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 182	60145-23-5	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 183	52663-69-1	TA Knoxville	EPA 1668A	NA	0.020	0.0052	--	ng/g	--	--	--	--	--	--	--	--
PCB 184	74472-48-3	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 185	52712-05-7	TA Knoxville	EPA 1668A	NA	0.020	0.0052	--	ng/g	--	--	--	--	--	--	--	--
PCB 186	74472-49-4	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 187	52663-68-0	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 188	74487-85-7	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	50	--	150	50	50	--	150	50
PCB 189	39635-31-9	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	50	--	150	50	50	--	150	50
PCB 190	41411-64-7	TA Knoxville	EPA 1668A	NA	0.010	0.0026	--	ng/g	--	--	--	--	--	--	--	--
PCB 191	74472-50-7	TA Knoxville	EPA 1668A	NA	0.010	0.0024	--	ng/g	--	--	--	--	--	--	--	--
PCB 192	74472-51-8	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 193	69782-91-8	TA Knoxville	EPA 1668A	NA	0.020	0.0074	--	ng/g	--	--	--	--	--	--	--	--
PCB 194	35694-08-7	TA Knoxville	EPA 1668A	NA	0.010	0.0026	--	ng/g	--	--	--	--	--	--	--	--
PCB 195	52663-78-2	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 196	42740-50-1	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 197	33091-17-7	TA Knoxville	EPA 1668A	NA	0.010	0.0029	--	ng/g	--	--	--	--	--	--	--	--
PCB 198	68194-17-2	TA Knoxville	EPA 1668A	NA	0.020	0.0074	--	ng/g	--	--	--	--	--	--	--	--

Table 2b. Cleanup Levels and Analytical Quantitation Limits for Chemicals of Potential Concern in Stratified Random Surface Sediment and Suspended Sediment Samples

PARCCS:	Comparability			Sensitivity[1]					Accuracy and Precision[1]							
Parameter	CAS Number	Laboratory	Method	ROD Cleanup Levels[2]	Project Quantitation Limits[3]	Achievable Laboratory MDLs[3]	Laboratory EDLs[3]	Units	MS/MSD				LCS/LCSD			
									Percent Recovery (%)			*RPD (%)*	*Percent Recovery (%)*			*RPD (%)*
PCB 199	52663-75-9	TA Knoxville	EPA 1668A	NA	0.020	0.0074	--	ng/g	--	--	--	--	--	--	--	--
PCB 200	52663-73-7	TA Knoxville	EPA 1668A	NA	0.010	0.0029	--	ng/g	--	--	--	--	--	--	--	--
PCB 201	40186-71-8	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 202	2136-99-4	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	50	--	150	50	50	--	150	50
PCB 203	52663-76-0	TA Knoxville	EPA 1668A	NA	0.010	0.0025	--	ng/g	--	--	--	--	--	--	--	--
PCB 204	74472-52-9	TA Knoxville	EPA 1668A	NA	0.010	0.0026	--	ng/g	--	--	--	--	--	--	--	--
PCB 205	74472-53-0	TA Knoxville	EPA 1668A	NA	0.010	0.0021	--	ng/g	50	--	150	50	50	--	150	50
PCB 206	40186-72-9	TA Knoxville	EPA 1668A	NA	0.010	0.0029	--	ng/g	50	--	150	50	50	--	150	50
PCB 207	52663-79-3	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	--	--	--	--	--	--	--	--
PCB 208	52663-77-1	TA Knoxville	EPA 1668A	NA	0.010	0.0020	--	ng/g	50	--	150	50	50	--	150	50
PCB 209	2051-24-3	TA Knoxville	EPA 1668A	NA	0.010	0.0021	--	ng/g	50	--	150	50	50	--	150	50
TPH-Diesel[4]																
Diesel Range Organics (C10-C24)	STL00143	TA Seattle	Ecology NWTPH-Dx	91	50	12.3	NA	mg/kg	70	--	125	16	70	--	125	16
Extended Range Organics (>C24-C36)	STL00293	TA Seattle	Ecology NWTPH-Dx	91	50	9.0	NA	mg/kg	70	--	119	16	70	--	119	16
Other[4]																
Tributyltin (bulk sediment)	NA	ALS Kelso	Krone et al	3080	1	0.43	NA	µg/kg	10	--	115	40	10	--	122	40
Tributyltin (bulk sediment)	NA	TA Seattle	Krone et al	3080	15	3.91	NA	µg/kg	14	--	150	20	14	--	150	20
Total Organic Carbon	7440-44-0	TA Seattle	EPA 9060	NA	2000	44.4	NA	mg/kg	68	--	149	32	68	--	149	32
Total Solids	NA	ALS Kelso/TA	EPA 160.3M/ASTM D-2216	NA	NA	NA	NA	%	--	--	--	20	--	--	--	20

Notes:

[1] Accuracy and precision values, as well as PQLs, MDLs, and EDLs were provided by the laboratory. These are presented for informational purposes only. Data review/validation will be based on the most current precision and accuracy limits in effect at the time of analysis.

[2] From Table 17 of the ROD.

[3] Project quantitation limits, MDLs, and EDLs are reported on a dry weight basis.

[4] Chlorinated Pesticides by EPA 1699 modified (GC/MS/MS), PAHs by EPA 8270D-SIM, BEHP by EPA 8270D-LL, TPH-Diesel by Ecology 1997, tributyltin by Krone, et al., Total Organic Carbon (EPA 9060), and metals by EPA 6020B/7471A will be reported to the laboratory MDL. Detections between the MDL and the PQL will be reported as estimated results using a "J" qualifier. The laboratory will provide both MDLs and PQLs in their reports and EDDs.
Dioxins/Furans by EPA 1613B and PCB congeners by EPA 1668A will be reported to the sample EDL. Detections between the EDL and the PQL will be reported as estimated results using a "J" qualifier. The laboratory will provide both EDLs and PQLs in their reports and EDDs.

[5] The laboratory will analyze for both the 2,4 and 4,4 DDD, DDE and DDT isomers.

[8] MS/MSD analysis was removed from PCB congener analysis documented in change request 06 approved by EPA on 6/15/2018. Samples prepared after 6/15/2018 do not include MS/MSD results.

Abbreviations:

-- = not provided
ASTM = American Society for Testing and Materials
BaP = benzo(a)pyrene
BEHP = Bis(2-ethylhexyl) phthalate
CAS = Chemical Abstract Service
cPAH = carcinogenic polycyclic aromatic hydrocarbons
DDx = dichlorodiphenyltrichloroethane and its derivatives
EDD = Electronic Data Deliverable
EDL = Estimated detection limit
EPA = Environmental Protection Agency
LCS = Laboratory Control Sample
LCSD = Laboratory Control Sample Duplicate
MDL = Method Detection Limit
mg/kg = milligrams per kilogram
MS = Matrix Spike
MSD = Matrix Spike Duplicate
NA = not applicable
ng/g = nanograms per gram
PAH = polycyclic aromatic hydrocarbon
PARCCS = Precision, Accuracy, Representativeness, Completeness, Comparability and Sensitivity
PCB = polychlorinated biphenyl
pg/g = picograms per gram
PQL = Project Quantitation Limit
PSEP = Puget Sound Estuary Protocols
ROD = record of decision
RPD = Relative Percent Difference
SIM = Selective Ion Monitoring
SVOCs = semi volatile organic compounds
TA = TestAmerica
µg/kg = micrograms per kilogram

Table 2c. Cleanup Levels and Analytical Quantitation Limits for Chemicals of Potential Concern in Surface Water Samples

PARCCS:	Comparability			Sensitivity[1]				Accuracy and Precision[1]							
								MS/MSD				LCS/LCSD			
Parameter	CAS Number	Laboratory	Method	ROD Cleanup Levels[2]	Project Quantitation Limits	Achievable Laboratory MDLs	Units	*Percent Recovery (%)*			*RPD (%)*	*Percent Recovery (%)*			*RPD (%)*
Low Volume Surface Water Samples, PP Method (whole water)															
Ethylbenzene [3]															
Ethylbenzene	100-41-4	TA Seattle	EPA 8260C	7.3	3.0	0.21	µg/L	75	--	119	35	75	--	120	14
MCPP [3]															
MCPP	93-65-2	TA Seattle	EPA 8151A	16	0.25	0.020	µg/L	51	--	150	35	51	--	150	35
Semi Volatile Organic Compounds (SVOCs) [3]															
bis-(2-ethylhexyl) phthalate (BEHP)	117-81-7	ALS Kelso	EPA 8270D-LL	0.2	1	0.13	µg/L	10	--	171	30	42	--	147	30
Pentachlorophenol (PCP)	87-86-5	ALS Kelso	EPA 8270D-LL	**0.03**	**1**	**0.34**	µg/L	28	--	158	30	27	--	112	--
Pentachlorophenol (PCP)	87-86-5	ARI	EPA 8041A	0.03	0.025	0.014	µg/L	36	--	159	30	36	--	159	--
Total Solids [3]															
Total Suspended Solids	STL00177	TA Seattle	SM 2540D	NA	2.0	2.0	mg/L	--	--	--	--	70.6	--	120	20
Total Dissolved Solids	STL00242	TA Seattle	SM 2540C	NA	10.0	10.0	mg/L	--	--	--	--	80	--	120	20
Tributyltin [3]															
Tributyltin	NA	ALS Kelso	Unger et al.	0.063	0.05	0.012	µg/L	17	--	142	30	32	--	122	30
Metals (Total and Dissolved Fractions) [3, 4]															
Arsenic	7440-38-2	TA Seattle	EPA 6020B LL	**0.000018**	**0.0010**	**0.00027**	mg/L	80	--	120	20	80	--	120	20
Calcium (dissolved for hardness calculation)	7440-70-2	TA Seattle	EPA 6010C	NA	1.10	0.155	mg/L	75	--	125	20	80	--	120	20
Chromium	7440-43-9	TA Seattle	EPA 6020B LL	0.100	0.00040	0.000141	mg/L	80	--	120	20	80	--	120	20
Copper	7440-50-8	TA Seattle	EPA 6020B LL	0.00274	0.0020	0.000603	mg/L	80	--	120	20	80	--	120	20
Magnesium (dissolved for hardness calculation)	7439-95-4	TA Seattle	EPA 6010C	NA	1.1000	0.133	mg/L	75	--	125	20	80	--	120	20
Zinc	7440-66-6	TA Seattle	EPA 6020B LL	0.0365	0.0070	0.0019	mg/L	80	--	120	20	80	--	120	20
Hardness (by Calculation)	--	TA Seattle	SM2340B	NA	NA	NA	mg/L	--	--	--	--	--	--	--	--
Dissolved Organic Carbon [3, 4]															
Dissolved Organic Carbon	7440-44-0	TA Seattle	SM5310B	NA	1	0.19	mg/L	85	--	115	20	85	--	115	20
Dissolved Organic Carbon	7440-44-0	ARI	SM5310B	NA	0.5	0.5	mg/L	75	--	125	20	90	--	110	20
Total Organic Carbon [3]															
Total Organic Carbon	7440-44-0	TA Seattle	SM5310B	NA	1	0.19	mg/L	85	--	115	20	85	--	115	20
Total Organic Carbon	7440-44-0	ARI	SM5310B	NA	0.5	0.5	mg/L	75	--	125	20	90	--	110	20
High Volume Samples, Dissolved Phase, XAD2 Resin [5]															
Chlorinated Pesticides + Hexachlorobenzene [6]															
Aldrin	309-00-2	SGS AXYS	MLA-028/EPA 1699	0.00000077 µg/L	0.000000667	NA	µg/L	--	--	--	--	70	--	130	40
Chlordanes	57-74-9	SGS AXYS	MLA-028/EPA 1699	0.000081 µg/L	NA	NA	µg/L	--	--	--	--	--	--	--	--
Chlordane, oxy-	27304-13-8	SGS AXYS	MLA-028/EPA 1699	NA	0.000000667	NA	µg/L	--	--	--	--	70	--	130	40
Chlordane, gamma (trans)	5103-74-2	SGS AXYS	MLA-028/EPA 1699	NA	0.000000667	NA	µg/L	--	--	--	--	70	--	130	40
Chlordane, alpha (cis)	5103-71-9	SGS AXYS	MLA-028/EPA 1699	NA	0.000000667	NA	µg/L	--	--	--	--	70	--	130	40
Nonachlor, trans-	39765-80-5	SGS AXYS	MLA-028/EPA 1699	NA	0.000000667	NA	µg/L	--	--	--	--	70	--	130	40
Nonachlor, cis-	5103-73-1	SGS AXYS	MLA-028/EPA 1699	NA	0.000000667	NA	µg/L	--	--	--	--	70	--	130	40
DDx	NA	SGS AXYS	MLA-028/EPA 1699	0.01 µg/L	NA	NA	µg/L	--	--	--	--	--	--	--	--
DDD[7]	NA	SGS AXYS	MLA-028/EPA 1699	0.000031 µg/L	0.000000667	NA	µg/L	--	--	--	--	70	--	130	40
DDE[7]	NA	SGS AXYS	MLA-028/EPA 1699	0.000018 µg/L	0.000000667	NA	µg/L	--	--	--	--	70	--	130	40
DDT[7]	NA	SGS AXYS	MLA-028/EPA 1699	0.000022 µg/L	0.000000667	NA	µg/L	--	--	--	--	70	--	130	40
Hexachlorobenzene	118-74-1	SGS AXYS	MLA-028/EPA 1699	0.000029 µg/L	0.000000333	NA	µg/L	--	--	--	--	70	--	130	40
Dioxins/Furans [6]															
Dioxins/Furans (2,3,7,8 TCDD eq)	NA	SGS AXYS	MLA-017/EPA 1613B	**0.0000000005 ug/L**	**NA**	**NA**	ug/L	--	--	--	--	--	--	--	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1746-01-6	SGS AXYS	MLA-017/EPA 1613B	NA	0.00000000167	NA	ug/L	--	--	-	--	70	--	130	40
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	40321-76-4	SGS AXYS	MLA-017/EPA 1613B	NA	0.00000000167	NA	ug/L	--	--	-	--	70	--	130	40
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	39227-28-6	SGS AXYS	MLA-017/EPA 1613B	NA	0.00000000167	NA	ug/L	--	--	-	--	70	--	130	40
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	57653-85-7	SGS AXYS	MLA-017/EPA 1613B	NA	0.00000000167	NA	ug/L	--	--	-	--	76	--	130	40
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	19408-74-3	SGS AXYS	MLA-017/EPA 1613B	NA	0.00000000167	NA	ug/L	--	--	-	--	70	--	130	40
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	35822-46-9	SGS AXYS	MLA-017/EPA 1613B	NA	0.00000000167	NA	ug/L	--	--	-	--	70	--	130	40
1,2,3,4,5,6,7,8-Octachlorodibenzo-p-dioxin	3268-87-9	SGS AXYS	MLA-017/EPA 1613B	NA	0.00000000167	NA	ug/L	--	--	-	--	78	--	130	40
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	51207-31-9	SGS AXYS	MLA-017/EPA 1613B	NA	0.00000000167	NA	ug/L	--	--	-	--	70	--	130	40
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	57117-41-6	SGS AXYS	MLA-017/EPA 1613B	NA	0.00000000167	NA	ug/L	--	--	-	--	80	--	130	40
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	57117-31-4	SGS AXYS	MLA-017/EPA 1613B	NA	0.00000000167	NA	ug/L	--	--	-	--	70	--	130	40
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	70648-26-9	SGS AXYS	MLA-017/EPA 1613B	NA	0.00000000167	NA	ug/L	--	--	-	--	72	--	130	40
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	57117-44-9	SGS AXYS	MLA-017/EPA 1613B	NA	0.00000000167	NA	ug/L	--	--	-	--	84	--	130	40
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	72918-21-9	SGS AXYS	MLA-017/EPA 1613B	NA	0.00000000167	NA	ug/L	--	--	-	--	78	--	130	40
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	60851-34-5	SGS AXYS	MLA-017/EPA 1613B	NA	0.00000000167	NA	ug/L	--	--	-	--	70	--	130	40
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	67562-39-4	SGS AXYS	MLA-017/EPA 1613B	NA	0.00000000167	NA	ug/L	--	--	-	--	82	--	122	40
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	55673-89-7	SGS AXYS	MLA-017/EPA 1613B	NA	0.00000000167	NA	ug/L	--	--	-	--	78	--	130	40
1,2,3,4,5,6,7,8-Octachlorodibenzofuran (OCDF)	39001-02-0	SGS AXYS	MLA-017/EPA 1613B	NA	0.00000000167	NA	ug/L	--	--	-	--	70	--	130	40

Table 2c. Cleanup Levels and Analytical Quantitation Limits for Chemicals of Potential Concern in Surface Water Samples

PARCCS:	Comparability			Sensitivity[1]				Accuracy and Precision[1]							
								MS/MSD				LCS/LCSD			
Parameter	CAS Number	Laboratory	Method	ROD Cleanup Levels[2]	Project Quantitation Limits	Achievable Laboratory MDLs	Units	*Percent Recovery (%)*			*RPD (%)*	*Percent Recovery (%)*			*RPD (%)*
PCB Congeners [6]															
Total PCBs	NA	SGS AXYS	MLA-010/EPA 1668A	0.0000064 ug/L	NA	NA	µg/L	--	--	--	--	--	--	--	--
CL1-PCB-1	2051-60-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL1-PCB-2	2051-61-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL1-PCB-3	2051-62-9	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL2-PCB-4	13029-08-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000667	NA	µg/L	--	--	--	--	50	--	150	40
CL2-PCB-5	16605-91-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000667	NA	µg/L	--	--	--	--	50	--	150	40
CL2-PCB-6	25569-80-6	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000667	NA	µg/L	--	--	--	--	50	--	150	40
CL2-PCB-7	33284-50-3	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000667	NA	µg/L	--	--	--	--	50	--	150	40
CL2-PCB-8	34883-43-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000667	NA	µg/L	--	--	--	--	50	--	150	40
CL2-PCB-9	34883-39-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000667	NA	µg/L	--	--	--	--	50	--	150	40
CL2-PCB-10	33146-45-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000667	NA	µg/L	--	--	--	--	50	--	150	40
CL2-PCB-11	2050-67-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000667	NA	µg/L	--	--	--	--	50	--	150	40
CL2-PCB-12/13	2974-92-7/2974-90-5	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000667	NA	µg/L	--	--	--	--	50	--	150	40
CL2-PCB-14	34883-41-5	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000667	NA	µg/L	--	--	--	--	50	--	150	40
CL2-PCB-15	2050-68-2	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000667	NA	µg/L	--	--	--	--	50	--	150	40
CL3-PCB-16	38444-78-9	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL3-PCB-17	37680-66-3	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL3-PCB-19	38444-73-4	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL3-PCB-21/33	55702-46-0/38444-86-9	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL3-PCB-22	38444-85-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL3-PCB-23	55720-44-0	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL3-PCB-24	55702-45-9	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL3-PCB-25	55712-37-3	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL3-PCB-26/29	38444-81-4/15862-07-4	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL3-PCB-27	38444-76-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL3-PCB-28/20	7012-37-5/38444-84-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL3-PCB-30/18	35693-92-6/37680-65-2	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL3-PCB-31	16606-02-3	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL3-PCB-32	38444-77-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL3-PCB-34	37680-68-5	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL3-PCB-35	37680-69-6	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL3-PCB-36	38444-87-0	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL3-PCB-37	38444-90-5	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL3-PCB-38	53555-66-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL3-PCB-39	38444-88-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-41/40/71	52663-59-9/ 38444-93-8/41464-46-4	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-42	36559-22-5	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-43	70362-46-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-44/47/65	41464-39-5/ 2437-79-8/33284-54-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-45/51	70362-45-7/68194-04-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-46	41464-47-5	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-48	70362-47-9	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-50/53	62796-65-0/41464-41-9	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-52	35693-99-3	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-54	15968-05-5	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-55	74338-24-2	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-56	41464-43-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-57	70424-67-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-58	41464-49-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-59/62/75	74472-33-6/ 54230-22-7/32598-12-2	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-60	33025-41-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-61/70/74/76	33284-53-6/32598-11-1/ 32690-93-0/70362-48-0	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-63	74472-34-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-64	52663-58-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-66	32598-10-0	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-67	73575-53-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-68	73575-52-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-69/49	60233-24-1/41464-40-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-72	41464-42-0	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-73	74338-23-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-77	32598-13-3	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-78	70362-49-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-79	41464-48-6	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-80	33284-52-5	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-81	70362-50-4	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-82	52663-62-4	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-83/99	60145-20-2/38380-01-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-84	52663-60-2	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-88/91	55215-17-3/68194-05-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-89	73575-57-2	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-92	52663-61-3	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40

Table 2c. Cleanup Levels and Analytical Quantitation Limits for Chemicals of Potential Concern in Surface Water Samples

PARCCS:	Comparability			Sensitivity[1]				Accuracy and Precision[1]							
								MS/MSD				LCS/LCSD			
Parameter	CAS Number	Laboratory	Method	ROD Cleanup Levels[2]	Project Quantitation Limits	Achievable Laboratory MDLs	Units	*Percent Recovery (%)*			*RPD (%)*	*Percent Recovery (%)*			*RPD (%)*
CL5-PCB-94	73575-55-0	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-95/100/93/102/98	38379-99-6/39485-83-1/ 73575-56-1/68194-06-9/ 60233-25-2	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-96	73575-54-9	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-103	60145-21-3	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-104	56558-16-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-105	32598-14-4	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-106	70424-69-0	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-107/124	70424-68-9/70424-70-3	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-108/119/86/97/125/87	70362-41-3/56558-17-9/ 55312-69-1/41464-51-1/ 74472-39-2/38380-02-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-109	74472-35-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-110/115	38380-03-9/74472-38-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-111	39635-32-0	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-112	74472-36-9	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-113/90/101	68194-10-5/68194-07-0/ 37680-73-2	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-114	74472-37-0	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-117/116/85	68194-11-6/18259-05-7/ 65510-45-4	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-118	31508-00-6	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-120	68194-12-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-121	56558-18-0	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-122	76842-07-4	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-123	65510-44-3	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-126	57465-28-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-127	39635-33-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-128/166	38380-07-3/41411-63-6	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-130	52663-66-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-131	61798-70-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-132	38380-05-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-133	35694-04-3	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-134/143	52704-70-8/68194-15-0	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-136	38411-22-2	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-137	35694-06-5	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-138/163/129/160	35065-28-2/74472-44-9/ 55215-18-4/41411-62-5	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-139/140	56030-56-9/59291-64-4	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-141	52712-04-6	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-142	41411-61-4	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-144	68194-14-9	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-145	74472-40-5	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-146	51908-16-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-147/149	68194-13-8/38380-04-0	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-148	74472-41-6	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-150	68194-08-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-151/135/154	52663-63-5/52744-13-5/ 60145-22-4	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-152	68194-09-2	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-153/168	35065-27-1/59291-65-5	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-155	33979-03-2	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-156/157	38380-08-4/69782-90-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-158	74472-42-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-159	39635-35-3	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-161	74472-43-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-162	39635-34-2	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-164	74472-45-0	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-165	74472-46-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-167	52663-72-6	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-169	32774-16-6	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL7-PCB-170	35065-30-6	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL7-PCB-171/173	52663-71-5/68194-16-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL7-PCB-172	52663-74-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL7-PCB-174	38411-25-5	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL7-PCB-175	40186-70-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40

Table 2c. Cleanup Levels and Analytical Quantitation Limits for Chemicals of Potential Concern in Surface Water Samples

PARCCS:	Comparability			Sensitivity[1]				Accuracy and Precision[1]							
								MS/MSD				LCS/LCSD			
Parameter	CAS Number	Laboratory	Method	ROD Cleanup Levels[2]	Project Quantitation Limits	Achievable Laboratory MDLs	Units	*Percent Recovery (%)*			*RPD (%)*	*Percent Recovery (%)*			*RPD (%)*
CL7-PCB-176	52663-65-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL7-PCB-177	52663-70-4	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL7-PCB-178	52663-67-9	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL7-PCB-179	52663-64-6	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL7-PCB-180/193	35065-29-3/69782-91-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL7-PCB-181	74472-47-2	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL7-PCB-182	60145-23-5	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL7-PCB-183/185	52663-69-1/52712-05-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL7-PCB-184	74472-48-3	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL7-PCB-186	74472-49-4	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL7-PCB-187	52663-68-0	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL7-PCB-188	74487-85-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL7-PCB-189	39635-31-9	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL7-PCB-190	41411-64-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL7-PCB-191	74472-50-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL7-PCB-192	74472-51-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL8-PCB-194	35694-08-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL8-PCB-195	52663-78-2	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL8-PCB-196	42740-50-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL8-PCB-197/200	33091-17-7/52663-73-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL8-PCB-198/199	68194-17-2/52663-75-9	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL8-PCB-201	40186-71-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL8-PCB-202	2136-99-4	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL8-PCB-203	52663-76-0	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL8-PCB-204	74472-52-9	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL8-PCB-205	74472-53-0	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL9-PCB-206	40186-72-9	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL9-PCB-207	52663-79-3	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL9-PCB-208	52663-77-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL10-PCB-209	2051-24-3	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
PAHs[6]															
cPAHs (BaP equivalent)	NA	SGS AXYS	MLA-021/EPA 8270D/1625M	0.00012 ug/L	NA	NA	ug/L	--	--	--	--	--	--	--	--
Benzo(a)anthracene	56-55-3	SGS AXYS	MLA-021/EPA 8270D/1625M	0.0012 ug/L	0.000050	NA	ug/L	--	--	--	--	70	--	130	40
Benzo(a)pyrene	50-32-8	SGS AXYS	MLA-021/EPA 8270D/1625M	0.00012 ug/L	0.000050	NA	ug/L	--	--	--	--	70	--	130	40
Benzo(b)fluoranthene	205-99-2	SGS AXYS	MLA-021/EPA 8270D/1625M	0.0012 ug/L	0.000050	NA	ug/L	--	--	--	--	70	--	130	40
Benzo(k)fluoranthene	207-08-9	SGS AXYS	MLA-021/EPA 8270D/1625M	0.0013 ug/L	0.000050	NA	ug/L	--	--	--	--	70	--	130	40
Chrysene	218-01-9	SGS AXYS	MLA-021/EPA 8270D/1625M	0.0013 ug/L	0.000050	NA	ug/L	--	--	--	--	70	--	130	40
Dibenz(a,h)anthracene	53-70-3	SGS AXYS	MLA-021/EPA 8270D/1625M	0.00012 ug/L	0.00010	NA	ug/L	--	--	--	--	70	--	130	40
Indeno(1,2,3-cd)pyrene	193-39-5	SGS AXYS	MLA-021/EPA 8270D/1625M	0.0012 ug/L	0.00010	NA	ug/L	--	--	--	--	70	--	130	40
Naphthalene	91-20-3	SGS AXYS	MLA-021/EPA 8270D/1625M	12 ug/L	0.000050	NA	ug/L	--	--	--	--	70	--	130	40
High Volume Samples, Particulate (total fraction)[5]															
Chlorinated Pesticides + Hexachlorobenzene[6]															
Aldrin	309-00-2	SGS AXYS	MLA-028/EPA 1699	0.00000077 ug/L	0.000000667	NA	µg/L	--	--	--	--	70	--	130	40
Chlordanes	57-74-9	SGS AXYS	MLA-028/EPA 1699	0.000081 µg/L	NA	NA	µg/L	--	--	--	--	--	--	--	--
Chlordane, oxy-	27304-13-8	SGS AXYS	MLA-028/EPA 1699	NA	0.000000667	NA	µg/L	--	--	--	--	70	--	130	40
Chlordane, gamma (trans)	5103-74-2	SGS AXYS	MLA-028/EPA 1699	NA	0.000000667	NA	µg/L	--	--	--	--	70	--	130	40
Chlordane, alpha (cis)	5103-71-9	SGS AXYS	MLA-028/EPA 1699	NA	0.000000667	NA	µg/L	--	--	--	--	70	--	130	40
Nonachlor, trans-	39765-80-5	SGS AXYS	MLA-028/EPA 1699	NA	0.000000667	NA	µg/L	--	--	--	--	70	--	130	40
Nonachlor, cis-	5103-73-1	SGS AXYS	MLA-028/EPA 1699	NA	0.000000667	NA	µg/L	--	--	--	--	70	--	130	40
DDx	NA	SGS AXYS	MLA-028/EPA 1699	0.01 ug/L	NA	NA	µg/L	--	--	--	--	70	--	130	40
DDD[7]	NA	SGS AXYS	MLA-028/EPA 1699	0.000031 ug/L	0.000000667	NA	µg/L	--	--	--	--	70	--	130	40
DDE[7]	NA	SGS AXYS	MLA-028/EPA 1699	0.000018 ug/L	0.000000667	NA	µg/L	--	--	--	--	70	--	130	40
DDT[7]	NA	SGS AXYS	MLA-028/EPA 1699	0.000022 ug/L	0.000000667	NA	µg/L	--	--	--	--	70	--	130	40
Hexachlorobenzene	118-74-1	SGS AXYS	MLA-028/EPA 1699	0.000029 ug/L	0.000000333	NA	µg/L	--	--	--	--	70	--	130	40
Dioxins/Furans[6]															
Dioxins/Furans (2,3,7,8 TCDD eq)	NA	SGS AXYS	MLA-017/EPA 1613B	**0.0000000005 ug/L**	**NA**	**NA**	ug/L	--	--	--	--	--	--	--	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1746-01-6	SGS AXYS	MLA-017/EPA 1613B	NA	0.00000000167	NA	ug/L	--	--	-	--	70	--	130	40
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	40321-76-4	SGS AXYS	MLA-017/EPA 1613B	NA	0.00000000167	NA	ug/L	--	--	-	--	70	--	130	40
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	39227-28-6	SGS AXYS	MLA-017/EPA 1613B	NA	0.00000000167	NA	ug/L	--	--	-	--	70	--	130	40
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	57653-85-7	SGS AXYS	MLA-017/EPA 1613B	NA	0.00000000167	NA	ug/L	--	--	-	--	76	--	130	40
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	19408-74-3	SGS AXYS	MLA-017/EPA 1613B	NA	0.00000000167	NA	ug/L	--	--	-	--	70	--	130	40
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	35822-46-9	SGS AXYS	MLA-017/EPA 1613B	NA	0.00000000167	NA	ug/L	--	--	-	--	70	--	130	40
1,2,3,4,5,6,7,8-Octachlorodibenzo-p-dioxin	3268-87-9	SGS AXYS	MLA-017/EPA 1613B	NA	0.00000000167	NA	ug/L	--	--	-	--	78	--	130	40
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	51207-31-9	SGS AXYS	MLA-017/EPA 1613B	NA	0.00000000167	NA	ug/L	--	--	-	--	70	--	130	40
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	57117-41-6	SGS AXYS	MLA-017/EPA 1613B	NA	0.00000000167	NA	ug/L	--	--	-	--	80	--	130	40
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	57117-31-4	SGS AXYS	MLA-017/EPA 1613B	NA	0.00000000167	NA	ug/L	--	--	-	--	70	--	130	40
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	70648-26-9	SGS AXYS	MLA-017/EPA 1613B	NA	0.00000000167	NA	ug/L	--	--	-	--	72	--	130	40
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	57117-44-9	SGS AXYS	MLA-017/EPA 1613B	NA	0.00000000167	NA	ug/L	--	--	-	--	84	--	130	40
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	72918-21-9	SGS AXYS	MLA-017/EPA 1613B	NA	0.00000000167	NA	ug/L	--	--	-	--	78	--	130	40
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	60851-34-5	SGS AXYS	MLA-017/EPA 1613B	NA	0.00000000167	NA	ug/L	--	--	-	--	70	--	130	40
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	67562-39-4	SGS AXYS	MLA-017/EPA 1613B	NA	0.00000000167	NA	ug/L	--	--	-	--	82	--	122	40
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	55673-89-7	SGS AXYS	MLA-017/EPA 1613B	NA	0.00000000167	NA	ug/L	--	--	-	--	78	--	130	40
1,2,3,4,5,6,7,8-Octachlorodibenzofuran (OCDF)	39001-02-0	SGS AXYS	MLA-017/EPA 1613B	NA	0.00000000167	NA	ug/L	--	--	-	--	70	--	130	40

Table 2c. Cleanup Levels and Analytical Quantitation Limits for Chemicals of Potential Concern in Surface Water Samples

PARCCS:	Comparability			Sensitivity[1]				Accuracy and Precision[1]							
								MS/MSD				LCS/LCSD			
Parameter	CAS Number	Laboratory	Method	ROD Cleanup Levels[2]	Project Quantitation Limits	Achievable Laboratory MDLs	Units	*Percent Recovery (%)*			*RPD (%)*	*Percent Recovery (%)*			*RPD (%)*
PCB Congeners [6]															
Total PCBs	NA	SGS AXYS	MLA-010/EPA 1668A	0.0000064 ug/L	NA	NA	µg/L	--	--	--	--	--	--	--	--
CL1-PCB-1	2051-60-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL1-PCB-2	2051-61-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL1-PCB-3	2051-62-9	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL2-PCB-4	13029-08-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000667	NA	µg/L	--	--	--	--	50	--	150	40
CL2-PCB-5	16605-91-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000667	NA	µg/L	--	--	--	--	50	--	150	40
CL2-PCB-6	25569-80-6	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000667	NA	µg/L	--	--	--	--	50	--	150	40
CL2-PCB-7	33284-50-3	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000667	NA	µg/L	--	--	--	--	50	--	150	40
CL2-PCB-8	34883-43-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000667	NA	µg/L	--	--	--	--	50	--	150	40
CL2-PCB-9	34883-39-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000667	NA	µg/L	--	--	--	--	50	--	150	40
CL2-PCB-10	33146-45-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000667	NA	µg/L	--	--	--	--	50	--	150	40
CL2-PCB-11	2050-67-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000667	NA	µg/L	--	--	--	--	50	--	150	40
CL2-PCB-12/13	2974-92-7/2974-90-5	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000667	NA	µg/L	--	--	--	--	50	--	150	40
CL2-PCB-14	34883-41-5	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000667	NA	µg/L	--	--	--	--	50	--	150	40
CL2-PCB-15	2050-68-2	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000667	NA	µg/L	--	--	--	--	50	--	150	40
CL3-PCB-16	38444-78-9	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL3-PCB-17	37680-66-3	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL3-PCB-19	38444-73-4	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL3-PCB-21/33	55702-46-0/38444-86-9	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL3-PCB-22	38444-85-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL3-PCB-23	55720-44-0	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL3-PCB-24	55702-45-9	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL3-PCB-25	55712-37-3	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL3-PCB-26/29	38444-81-4/15862-07-4	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL3-PCB-27	38444-76-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL3-PCB-28/20	7012-37-5/38444-84-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL3-PCB-30/18	35693-92-6/37680-65-2	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL3-PCB-31	16606-02-3	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL3-PCB-32	38444-77-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL3-PCB-34	37680-68-5	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL3-PCB-35	37680-69-6	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL3-PCB-36	38444-87-0	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL3-PCB-37	38444-90-5	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL3-PCB-38	53555-66-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL3-PCB-39	38444-88-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-41/40/71	52663-59-9/38444-93-8/ 41464-46-4	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-42	36559-22-5	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-43	70362-46-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-44/47/65	41464-39-5/2437-79-8/ 33284-54-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-45/51	70362-45-7/68194-04-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-46	41464-47-5	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-48	70362-47-9	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-50/53	62796-65-0/41464-41-9	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-52	35693-99-3	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-54	15968-05-5	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-55	74338-24-2	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-56	41464-43-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-57	70424-67-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-58	41464-49-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-59/62/75	74472-33-6/54230-22-7/ 32598-12-2	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-60	33025-41-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-61/70/74/76	33284-53-6/32598-11-1/ 32690-93-0/70362-48-0	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-63	74472-34-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-64	52663-58-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-66	32598-10-0	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-67	73575-53-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-68	73575-52-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-69/49	60233-24-1/41464-40-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-72	41464-42-0	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-73	74338-23-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-77	32598-13-3	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-78	70362-49-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-79	41464-48-6	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-80	33284-52-5	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL4-PCB-81	70362-50-4	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-82	52663-62-4	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-83/99	60145-20-2/38380-01-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-84	52663-60-2	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-88/91	55215-17-3/68194-05-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-89	73575-57-2	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-92	52663-61-3	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-94	73575-55-0	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40

Table 2c. Cleanup Levels and Analytical Quantitation Limits for Chemicals of Potential Concern in Surface Water Samples

PARCCS:	Comparability			Sensitivity[1]				Accuracy and Precision[1]							
								MS/MSD				LCS/LCSD			
Parameter	CAS Number	Laboratory	Method	ROD Cleanup Levels[2]	Project Quantitation Limits	Achievable Laboratory MDLs	Units	*Percent Recovery (%)*			*RPD (%)*	*Percent Recovery (%)*			*RPD (%)*
CL5-PCB-95/100/93/102/98	38379-99-6/39485-83-1/ 73575-56-1/68194-06-9/ 60233-25-2	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-96	73575-54-9	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-103	60145-21-3	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-104	56558-16-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-105	32598-14-4	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-106	70424-69-0	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-107/124	70424-68-9/70424-70-3	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-108/119/86/97/125/87	70362-41-3/56558-17-9/ 55312-69-1/41464-51-1/ 74472-39-2/38380-02-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-109	74472-35-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-110/115	38380-03-9/74472-38-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-111	39635-32-0	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-112	74472-36-9	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-113/90/101	68194-10-5/68194-07-0/ 37680-73-2	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-114	74472-37-0	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-117/116/85	68194-11-6/18259-05-7/ 65510-45-4	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-118	31508-00-6	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-120	68194-12-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-121	56558-18-0	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-122	76842-07-4	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-123	65510-44-3	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-126	57465-28-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL5-PCB-127	39635-33-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-128/166	38380-07-3/41411-63-6	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-130	52663-66-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-131	61798-70-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-132	38380-05-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-133	35694-04-3	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-134/143	52704-70-8/68194-15-0	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-136	38411-22-2	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-137	35694-06-5	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-138/163/129/160	35065-28-2/74472-44-9/ 55215-18-4/41411-62-5	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-139/140	56030-56-9/59291-64-4	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-141	52712-04-6	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-142	41411-61-4	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-144	68194-14-9	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-145	74472-40-5	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-146	51908-16-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-147/149	68194-13-8/38380-04-0	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-148	74472-41-6	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-150	68194-08-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-151/135/154	52663-63-5/52744-13-5/ 60145-22-4	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-152	68194-09-2	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-153/168	35065-27-1/59291-65-5	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-155	33979-03-2	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-156/157	38380-08-4/69782-90-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-158	74472-42-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-159	39635-35-3	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-161	74472-43-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-162	39635-34-2	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-164	74472-45-0	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-165	74472-46-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-167	52663-72-6	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL6-PCB-169	32774-16-6	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL7-PCB-170	35065-30-6	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL7-PCB-171/173	52663-71-5/68194-16-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL7-PCB-172	52663-74-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL7-PCB-174	38411-25-5	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL7-PCB-175	40186-70-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL7-PCB-176	52663-65-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL7-PCB-177	52663-70-4	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL7-PCB-178	52663-67-9	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL7-PCB-179	52663-64-6	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL7-PCB-180/193	35065-29-3/69782-91-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL7-PCB-181	74472-47-2	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL7-PCB-182	60145-23-5	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL7-PCB-183/185	52663-69-1/52712-05-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL7-PCB-184	74472-48-3	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL7-PCB-186	74472-49-4	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL7-PCB-187	52663-68-0	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40

Table 2c. Cleanup Levels and Analytical Quantitation Limits for Chemicals of Potential Concern in Surface Water Samples

PARCCS:	Comparability			Sensitivity[1]				Accuracy and Precision[1]							
								MS/MSD				LCS/LCSD			
Parameter	CAS Number	Laboratory	Method	ROD Cleanup Levels[2]	Project Quantitation Limits	Achievable Laboratory MDLs	Units	*Percent Recovery (%)*			*RPD (%)*	*Percent Recovery (%)*			*RPD (%)*
CL7-PCB-188	74487-85-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL7-PCB-189	39635-31-9	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL7-PCB-190	41411-64-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL7-PCB-191	74472-50-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL7-PCB-192	74472-51-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL8-PCB-194	35694-08-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL8-PCB-195	52663-78-2	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL8-PCB-196	42740-50-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL8-PCB-197/200	33091-17-7/52663-73-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL8-PCB-198/199	68194-17-2/52663-75-9	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL8-PCB-201	40186-71-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL8-PCB-202	2136-99-4	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL8-PCB-203	52663-76-0	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL8-PCB-204	74472-52-9	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL8-PCB-205	74472-53-0	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL9-PCB-206	40186-72-9	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL9-PCB-207	52663-79-3	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL9-PCB-208	52663-77-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
CL10-PCB-209	2051-24-3	SGS AXYS	MLA-010/EPA 1668A	NA	0.00000000333	NA	µg/L	--	--	--	--	50	--	150	40
PAHs[6]															
cPAHs (BaP equivalent)	NA	SGS AXYS	MLA-021/EPA 8270D/1625M	0.00012 ug/L	NA	NA	ug/L	--	--	--	--	--	--	--	--
Benzo(a)anthracene	56-55-3	SGS AXYS	MLA-021/EPA 8270D/1625M	0.0012 ug/L	0.000050	NA	ug/L	--	--	--	--	70	--	130	40
Benzo(a)pyrene	50-32-8	SGS AXYS	MLA-021/EPA 8270D/1625M	0.00012 ug/L	0.000050	NA	ug/L	--	--	--	--	70	--	130	40
Benzo(b)fluoranthene	205-99-2	SGS AXYS	MLA-021/EPA 8270D/1625M	0.0012 ug/L	0.000050	NA	ug/L	--	--	--	--	70	--	130	40
Benzo(k)fluoranthene	207-08-9	SGS AXYS	MLA-021/EPA 8270D/1625M	0.0013 ug/L	0.000050	NA	ug/L	--	--	--	--	70	--	130	40
Chrysene	218-01-9	SGS AXYS	MLA-021/EPA 8270D/1625M	0.0013 ug/L	0.000050	NA	ug/L	--	--	--	--	70	--	130	40
Dibenz(a,h)anthracene	53-70-3	SGS AXYS	MLA-021/EPA 8270D/1625M	0.00012 ug/L	0.00010	NA	ug/L	--	--	--	--	70	--	130	40
Indeno(1,2,3-cd)pyrene	193-39-5	SGS AXYS	MLA-021/EPA 8270D/1625M	0.0012 ug/L	0.00010	NA	ug/L	--	--	--	--	70	--	130	40
Naphthalene	91-20-3	SGS AXYS	MLA-021/EPA 8270D/1625M	12 ug/L	0.000050	NA	ug/L	--	--	--	--	70	--	130	40

Notes:

bold font indicates that the project quantitation limit and method detection limit do not meet the ROD cleanup level

[1] Accuracy and precision values, as well as PQLs and MDLs were provided by the laboratory. These are presented for informational purposes only. Data review/validation will be based on the most current precision and accuracy limits in effect at the time of analysis.

A MS/MSD will not be performed for the 1600 series methods. A laboratory duplicate will be performed at a rate of 1 in 20 samples using the OPR (ongoing precision/recovery sample, essentially a LCS/LCSD).

[2] From Table 17 of the ROD.

[3] Sample results will be reported to the laboratory MDL. Detections between the MDL and the PQL (reporting limit) will be reported as estimated results using a "J" qualifier. The laboratory will provide both MDLs and PQLs (reporting limits) in their reports and EDDs.

[4] Dissolved fraction for grab samples will be field filtered using a 0.45-micron filter.

[5] Surface water samples will be collected using both grab sampling and high volume sampling (HVS) methods as described in the FSP. Each HVS sample consist of two analytical matrices. The particulate material collected through the vortex sampler to collect large particulate and the flat fiber filters (to 0.45 micron particle size) to collect smaller particulate represent the particulate fraction and is submitted in a single container for extraction and analysis.The dissolved phase surface water constituents are absorbed on XAD-2 resin, which is submitted to the laboratory for extraction and analysis. The results for each matrix are reported by the laboratory as mass per sample. The whole water concentration for a sample location will be calculated using the sum of the particulate and dissolved surface water results and adjusted based on the total volume of water passed through the sampler as adjusted for fractionation during the sample preparation and analysis. For example, if the extract is not fractionated by the laboratory for cleanup and the volume of water during sampling was 400 liters, the total of the particulate and dissolved results for each constituent in mass/sample will be divided by 400 to calculate the whole water concentration in mass/volume units in the sample collected. If the sample is fractionated in the laboratory for cleanup, then the percentage of the total extract volume for each fraction is included in the calculation by adjusting the water volume sampled. If organochlorine pesticides, PCB congeners, and dioxin/furan extract is one fraction and 75% of the total extract, then the sampling volume of 400 liters will be adjusted to 300 liters to calculate the whole water concentration of organochlorine pesticides, PCB congeners, and dioxin/furan for each sample. This whole water concentration in mass/volume units is compared directly to the ROD cleanup concentration for each constituent. The PQLs presented in the table are based on 400 liters of water being collected and fractionated in the laboratory so that 75% of total extract (300 liters) is used for organochlorine pesticide, PCB congeners, and dioxins and furans analysis, and 25% of the total extract (100 liters) is used for the PAH analysis.

[6] Samples will be reported to the Sample Detection Limit (SDL, equivalent to Estimated Detection Limit [EDL]), which are calculated per sample. The number shown in the Project Quantitation Limits column is based on SDL for surface water assuming 400 liter sample volume and 75%/25% fractionation step as described in footnote 5.

[7] The laboratory will analyze for both the 2,4 and 4,4 DDD, DDE and DDT isomers.

Abbreviations:

-- = not provided
ARI - Analytical Resources Incorporated
BaP = benzo(a)pyrene
BEHP = Bis(2-ethylhexyl) phthalate
CAS = Chemical Abstract Service
cPAH = carcinogenic polycyclic aromatic hydrocarbons
DDx = dichlorodiphenyltrichloroethane and its derivatives
EDD = Electronic Data Deliverable
EPA = Environmental Protection Agency
LCS = Laboratory Control Sample
LCSD = Laboratory Control Sample Duplicate
MCPP = methylchlorophenoxypropionic acid
MDL = Method Detection Limit
mg/L = milligrams per liter
MS = Matrix Spike
MSD = Matrix Spike Duplicate
NA = not applicable
PAH = polycyclic aromatic hydrocarbons
PARCCS = Precision, Accuracy, Representativeness, Completeness, Comparability and Sensitivity
PCB = polychlorinated biphenyl
PP = peristaltic pump method
PQL = Project Quantitation Limit
ROD = record of decision
RPD = Relative Percent Difference
SVOC = Semivolatile Organic Compounds
TA = TestAmerica
µg/L = micrograms per liter

Table 2d. Cleanup Levels and Analytical Quantitation Limits for Porewater Samples/Bulk Sediments

PARCCS:	Comparability			Sensitivity[1]				Accuracy and Precision[1]							
Parameter	CAS Number	Laboratory	Method	ROD Cleanup Levels[2]	Project Quantitation Limits	Achievable Laboratory MDLs	Units	MS/MSD				LCS/LCSD			
								Percent Recovery (%)			*RPD (%)*	*Percent Recovery (%)*			*RPD (%)*
Porewater [3]															
Arsenic	7440-38-2	TA Seattle	EPA 6020B LL	**0.00018**	**0.0010**	**0.00027**	mg/L	80	--	120	20	80	--	120	20
Manganese	7439-96-5	TA Seattle	EPA 6020B LL	0.430	0.0020	0.000459	mg/L	80	--	120	20	80	--	120	20
Bromide[4]	24959-67-9	TA Seattle	EPA 300.0	NA	1.00	0.25	mg/L	80	--	120	20	90	--	110	10
Bulk Sediment [3, 5]															
Arsenic	7440-38-2	TA Seattle	EPA 6020B	3	0.50	0.10	mg/kg	80	--	120	20	80	--	120	20
Manganese	7439-96-5	TA Seattle	EPA 6020B	NA	2.0	0.453	mg/kg	80	--	120	20	80	--	120	20

Notes:

bold font indicates that the project quantitation limit and method detection limit do not meet the ROD cleanup level

[1] Accuracy and precision values, as well as PQLs and MDLs were provided by the laboratory. These are presented for informational purposes only. Data review/validation will be based on the most current precision and accuracy limits in effect at the time of analysis.

[2] From Table 17 of the ROD

[3] Sample results will be reported to the laboratory MDL. Detections between the MDL and the PQL will be reported as estimated results using a "J" qualifier. The laboratory will provide both MDLs and PQLs in their reports and EDDs.

[4] Bromide will be used as a chemical tracer to evaluate achievement of equilbrium in porewater samplers.

[5] Project quantitation limits and MDLs are reported on a dry weight basis.

Abbreviations:

-- = not provided
CAS: Chemical Abstract Service
EDD = Electronic Data Deliverable
EPA = Environmental Protection Agency
LCS = Laboratory Control Sample
LCSD = Laboratory Control Sample Duplicate
MDL = Method Detection Limit
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
MS = Matrix Spike
MSD = Matrix Spike Duplicate
NA = not applicable
PARCCS = Precision, Accuracy, Representativeness, Completeness, Comparability and Sensitivity
PQL = Project Quantitation Limit
RPD = Relative Percent Difference
TA = TestAmerica

Table 2e. Cleanup Levels and Analytical Quantitation Limits for Chemicals of Potential Concern in SMB Fish Tissue Samples

PARCCS:	Comparability			Sensitivity[1]				Accuracy and Precision[1]							
Parameter	CAS Number	Laboratory	Method	ROD Cleanup Levels[2]	Project Quantitation Limits	Achievable Laboratory MDLs	Units (wet weight)	MS/MSD[3]				LCS/LCSD[3]			
								Percent Recovery (%)			*RPD (%)*	*Percent Recovery (%)*			*RPD (%)*
Chlorinated Pesticides + Hexachlorobenzene															
Aldrin	309-00-2	SGS AXYS	MLA-028/EPA 1699	0.06	0.02	NA	µg/kg	--	--	--	40	70	--	130	40
Chlordanes	57-74-9	SGS AXYS	MLA-028/EPA 1699	3	NA	NA	µg/kg	--	--	--			--		
Chlordane, oxy-	27304-13-8	SGS AXYS	MLA-028/EPA 1699	NA	0.02	NA	µg/kg	--	--	--	40	70	--	130	40
Chlordane, gamma (trans)	5103-74-2	SGS AXYS	MLA-028/EPA 1699	NA	0.02	NA	µg/kg	--	--	--	40	70	--	130	40
Chlordane, alpha (cis)	5103-71-9	SGS AXYS	MLA-028/EPA 1699	NA	0.02	NA	µg/kg	--	--	--	40	70	--	130	40
Nonachlor, trans-	39765-80-5	SGS AXYS	MLA-028/EPA 1699	NA	0.02	NA	µg/kg	--	--	--	40	70	--	130	40
Nonachlor, cis-	5103-73-1	SGS AXYS	MLA-028/EPA 1699	NA	0.02	NA	µg/kg	--	--	--	40	70	--	130	40
DDx	NA	SGS AXYS	MLA-028/EPA 1699	3	NA	NA	µg/kg	--	--	--	--	--	--	--	--
2,4-DDD	53-19-0	SGS AXYS	MLA-028/EPA 1699	NA	0.02	NA	µg/kg	--	--	--	40	70	--	130	40
4,4-DDD	72-54-8	SGS AXYS	MLA-028/EPA 1699	NA	0.02	NA	µg/kg	--	--	--	40	70	--	130	40
2,4-DDE	3424-82-6	SGS AXYS	MLA-028/EPA 1699	NA	0.02	NA	µg/kg	--	--	--	40	70	--	130	40
4,4-DDE	72-55-9	SGS AXYS	MLA-028/EPA 1699	NA	0.02	NA	µg/kg	--	--	--	40	70	--	130	40
2,4-DDT	789-02-6	SGS AXYS	MLA-028/EPA 1699	NA	0.02	NA	µg/kg	--	--	--	40	70	--	130	40
4,4-DDT	50-29-3	SGS AXYS	MLA-028/EPA 1699	NA	0.02	NA	µg/kg	--	--	--	40	70	--	130	40
Dieldrin	60-57-1	SGS AXYS	MLA-028/EPA 1699	0.06	0.05	NA	µg/kg	--	--	--	40	60	--	130	40
Hexachlorobenzene	118-74-1	SGS AXYS	MLA-028/EPA 1699	0.6	0.01	NA	µg/kg	--	--	--	40	70	--	130	40
Dioxins and Furans															
Dioxins/Furans (2,3,7,8 TCDD eq)	NA	SGS AXYS	MLA-017/EPA 1613B	NA	NA	NA	NA	--	--	--	--	--	--	--	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1746-01-6	SGS AXYS	MLA-017/EPA 1613B	**0.000008**	**0.00005**	NA	µg/kg	--	--	--	40	70	--	130	40
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	40321-76-4	SGS AXYS	MLA-017/EPA 1613B	**0.000008**	**0.00005**	NA	µg/kg	--	--	--	40	70	--	130	40
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	39227-28-6	SGS AXYS	MLA-017/EPA 1613B	NA	0.00005	NA	µg/kg	--	--	--	40	70	--	130	40
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	57653-85-7	SGS AXYS	MLA-017/EPA 1613B	NA	0.00005	NA	µg/kg	--	--	--	40	76	--	130	40
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	19408-74-3	SGS AXYS	MLA-017/EPA 1613B	NA	0.00005	NA	µg/kg	--	--	--	40	70	--	130	40
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	35822-46-9	SGS AXYS	MLA-017/EPA 1613B	NA	0.00005	NA	µg/kg	--	--	--	40	70	--	130	40
1,2,3,4,5,6,7,8-Octachlorodibenzo-p-dioxin (OCDD)	3268-87-9	SGS AXYS	MLA-017/EPA 1613B	NA	0.00005	NA	µg/kg	--	--	--	40	78	--	130	40
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	51207-31-9	SGS AXYS	MLA-017/EPA 1613B	0.00008	0.00005	NA	µg/kg	--	--	--	40	70	--	130	40
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	57117-41-6	SGS AXYS	MLA-017/EPA 1613B	NA	0.00005	NA	µg/kg	--	--	--	40	80	--	130	40
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	57117-31-4	SGS AXYS	MLA-017/EPA 1613B	**0.00003**	**0.00005**	NA	µg/kg	--	--	--	40	70	--	130	40
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	70648-26-9	SGS AXYS	MLA-017/EPA 1613B	0.00008	0.00005	NA	µg/kg	--	--	--	40	72	--	130	40
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	57117-44-9	SGS AXYS	MLA-017/EPA 1613B	NA	0.00005	NA	µg/kg	--	--	--	40	84	--	130	40
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	72918-21-9	SGS AXYS	MLA-017/EPA 1613B	NA	0.00005	NA	µg/kg	--	--	--	40	78	--	130	40
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	60851-34-5	SGS AXYS	MLA-017/EPA 1613B	NA	0.00005	NA	µg/kg	--	--	--	40	70	--	130	40
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	67562-39-4	SGS AXYS	MLA-017/EPA 1613B	NA	0.00005	NA	µg/kg	--	--	--	40	82	--	122	40
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	55673-89-7	SGS AXYS	MLA-017/EPA 1613B	NA	0.00005	NA	µg/kg	--	--	--	40	78	--	130	40
1,2,3,4,5,6,7,8-Octachlorodibenzofuran (OCDF)	39001-02-0	SGS AXYS	MLA-017/EPA 1613B	NA	0.00005	NA	µg/kg	--	--	--	40	70	--	130	40
Lipids															
Lipids	NA	SGS AXYS	Lab SOP - SLA 020	NA	--	--	NA	--	--	--	--	--	--	--	--
Metals															
Arsenic	7440-38-2	ALS Kelso	EPA 6020A	**0.001**	**0.5**	**0.02**	mg/kg	70	--	130	20	75	--	125	20
Mercury	7439-97-6	ALS Kelso	EPA 7471B	0.031	0.02	0.002	mg/kg	80	--	120	20	72	--	128	20
Polybrominated Diphenyl Ethers															
PBDEs	TBD	SGS AXYS	MLA-033/EPA 1614	26,000	1 to 20	NA	pg/g	--	--	--	--	--	--	--	--
BR2-DPE-7	171977-44-9	SGS AXYS	MLA-033/EPA 1614	NA	1.0	NA	pg/g	--	--	--	40	50	--	150	40
BR2-DPE-8/11	147217-71-8/ 6903-63-5	SGS AXYS	MLA-033/EPA 1614	NA	1.0	NA	pg/g	--	--	--	40	50	--	150	40
BR2-DPE-10	51930-04-2	SGS AXYS	MLA-033/EPA 1614	NA	1.0	NA	pg/g	--	--	--	40	50	--	150	40

Table 2e. Cleanup Levels and Analytical Quantitation Limits for Chemicals of Potential Concern in SMB Fish Tissue Samples

PARCCS:	Comparability			Sensitivity[1]				Accuracy and Precision[1]							
Parameter	CAS Number	Laboratory	Method	ROD Cleanup Levels[2]	Project Quantitation Limits	Achievable Laboratory MDLs	Units (wet weight)	MS/MSD[3]				LCS/LCSD[3]			
								Percent Recovery (%)			*RPD (%)*	*Percent Recovery (%)*			*RPD (%)*
BR2-DPE-12/13	189084-59-1/ 83694-71-7	SGS AXYS	MLA-033/EPA 1614	NA	1.0	NA	pg/g		--	--	40	50	--	150	40
BR2-DPE-15	2050-47-7	SGS AXYS	MLA-033/EPA 1614	NA	1.0	NA	pg/g	--	--	--	40	50	--	150	40
BR3-DPE-17/25	147217-75-2/ 147217-77-4	SGS AXYS	MLA-033/EPA 1614	NA	1.0	NA	pg/g	--	--	--	40	50	--	150	40
BR3-DPE-28/33	41318-75-6/ 147217-78-5	SGS AXYS	MLA-033/EPA 1614	NA	1.0	NA	pg/g	--	--	--	40	50	--	150	40
BR3-DPE-30	155999-95-4	SGS AXYS	MLA-033/EPA 1614	NA	1.0	NA	pg/g	--	--	--	40	50	--	150	40
BR3-DPE-32	189084-60-4	SGS AXYS	MLA-033/EPA 1614	NA	1.0	NA	pg/g	--	--	--	40	50	--	150	40
BR3-DPE-35	147217-80-9	SGS AXYS	MLA-033/EPA 1614	NA	1.0	NA	pg/g	--	--	--	40	50	--	150	40
BR3-DPE-37	147217-81-0	SGS AXYS	MLA-033/EPA 1614	NA	1.0	NA	pg/g	--	--	--	40	50	--	150	40
BR4-DPE-47	5436-43-1	SGS AXYS	MLA-033/EPA 1614	NA	1.0	NA	pg/g	--	--	--	40	50	--	150	40
BR4-DPE-49	243982-82-3	SGS AXYS	MLA-033/EPA 1614	NA	1.0	NA	pg/g	--	--	--	40	50	--	150	40
BR4-DPE-51	189084−57−9	SGS AXYS	MLA-033/EPA 1614	NA	1.0	NA	pg/g	--	--	--	40	50	--	150	40
BR4-DPE-66	189084-61-5	SGS AXYS	MLA-033/EPA 1614	NA	1.0	NA	pg/g	--	--	--	40	50	--	150	40
BR4-DPE-71	189084-62-6	SGS AXYS	MLA-033/EPA 1614	NA	1.0	NA	pg/g	--	--	--	40	50	--	150	40
BR4-DPE-75	189084-63-7	SGS AXYS	MLA-033/EPA 1614	NA	1.0	NA	pg/g	--	--	--	40	50	--	150	40
BR4-DPE-77	93703-48-1	SGS AXYS	MLA-033/EPA 1614	NA	1.0	NA	pg/g	--	--	--	40	50	--	150	40
BR4-DPE-79	446254−48−4	SGS AXYS	MLA-033/EPA 1614	NA	1.0	NA	pg/g	--	--	--	40	50	--	150	40
BR5-DPE-85	182346-21-0	SGS AXYS	MLA-033/EPA 1614	NA	1.0	NA	pg/g	--	--	--	40	50	--	150	40
BR5-DPE-99	60348-60-9	SGS AXYS	MLA-033/EPA 1614	NA	1.0	NA	pg/g	--	--	--	40	50	--	150	40
BR5-DPE-100	189084-64-8	SGS AXYS	MLA-033/EPA 1614	NA	1.0	NA	pg/g	--	--	--	40	50	--	150	40
BR5-DPE-105	373594−78−6	SGS AXYS	MLA-033/EPA 1614	NA	1.0	NA	pg/g	--	--	--	40	50	--	150	40
BR5-DPE-116	189084-65-9	SGS AXYS	MLA-033/EPA 1614	NA	1.0	NA	pg/g	--	--	--	40	50	--	150	40
BR5-DPE-119/120	189084-66-0/ 417727-71-0	SGS AXYS	MLA-033/EPA 1614	NA	1.0	NA	pg/g	--	--	--	40	50	--	150	40
BR5-DPE-126	366791−32−4	SGS AXYS	MLA-033/EPA 1614	NA	1.0	NA	pg/g	--	--	--	40	50	--	150	40
BR6-DPE-128	182677−28−7	SGS AXYS	MLA-033/EPA 1614	NA	1.0	NA	pg/g	--	--	--	40	50	--	150	40
BR6-DPE-138/166	182677-30-1/ 189084-58-0	SGS AXYS	MLA-033/EPA 1614	NA	1.0	NA	pg/g	--	--	--	40	50	--	150	40
BR6-DPE-140	243982-83-4	SGS AXYS	MLA-033/EPA 1614	NA	1.0	NA	pg/g	--	--	--	40	50	--	150	40
BR6-DPE-153	68631-49-2	SGS AXYS	MLA-033/EPA 1614	NA	1.0	NA	pg/g	--	--	--	40	50	--	150	40
BR6-DPE-154	207122-15-4	SGS AXYS	MLA-033/EPA 1614	NA	1.0	NA	pg/g	--	--	--	40	50	--	150	40
BR6-DPE-155	35854-94-5	SGS AXYS	MLA-033/EPA 1614	NA	1.0	NA	pg/g	--	--	--	40	50	--	150	40
BR7-DPE-181	189084−67−1	SGS AXYS	MLA-033/EPA 1614	NA	2.0	NA	pg/g	--	--	--	40	50	--	150	40
BR7-DPE-183	207122-16-5	SGS AXYS	MLA-033/EPA 1614	NA	2.0	NA	pg/g	--	--	--	40	50	--	150	40
BR7-DPE-190	189084−68−2	SGS AXYS	MLA-033/EPA 1614	NA	2.0	NA	pg/g	--	--	--	40	50	--	150	40
BR8-DPE-203	337513−72−1	SGS AXYS	MLA-033/EPA 1614	NA	2.0	NA	pg/g	--	--	--	40	50	--	150	40
BR9-DPE-206[4]	63387−28−0	SGS AXYS	MLA-033/EPA 1614	NA	10.0	NA	pg/g	--	--	--	40	50	--	150	40
BR9-DPE-207 [4]	437701−79−6	SGS AXYS	MLA-033/EPA 1614	NA	10.0	NA	pg/g	--	--	--	40	50	--	150	40
BR9-DPE-208 [4]	NA	SGS AXYS	MLA-033/EPA 1614	NA	10.0	NA	pg/g	--	--	--	40	50	--	150	40
BR10-DPE-209	1163-19-5	SGS AXYS	MLA-033/EPA 1614	NA	20.0	NA	pg/g	--	--	--	40	50	--	150	40
PCB Congeners															

Table 2e. Cleanup Levels and Analytical Quantitation Limits for Chemicals of Potential Concern in SMB Fish Tissue Samples

PARCCS:	Comparability			Sensitivity[1]				Accuracy and Precision[1]							
Parameter	CAS Number	Laboratory	Method	ROD Cleanup Levels[2]	Project Quantitation Limits	Achievable Laboratory MDLs	Units (wet weight)	MS/MSD[3]				LCS/LCSD[3]			
								Percent Recovery (%)			*RPD (%)*	*Percent Recovery (%)*			*RPD (%)*
Total PCBs		SGS AXYS	MLA-010/EPA 1668A	250		NA	pg/g	--	--	--	--	--	--	--	--
CL1-PCB-1	2051-60-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL1-PCB-2	2051-61-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL1-PCB-3	2051-62-9	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL2-PCB-4	13029-08-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL2-PCB-5	16605-91-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL2-PCB-6	25569-80-6	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL2-PCB-7	33284-50-3	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL2-PCB-8	34883-43-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL2-PCB-9	34883-39-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL2-PCB-10	33146-45-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL2-PCB-11	2050-67-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL2-PCB-12/13	2974-92-7/2974-90-5	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL2-PCB-14	34883-41-5	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL2-PCB-15	2050-68-2	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL3-PCB-16	38444-78-9	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL3-PCB-17	37680-66-3	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL3-PCB-19	38444-73-4	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL3-PCB-21/33	55702-46-0/38444-86-9	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL3-PCB-22	38444-85-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL3-PCB-23	55720-44-0	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL3-PCB-24	55702-45-9	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL3-PCB-25	55712-37-3	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL3-PCB-26/29	38444-81-4/15862-07-4	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL3-PCB-27	38444-76-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL3-PCB-28/20	7012-37-5/38444-84-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL3-PCB-30/18	35693-92-6/37680-65-2	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL3-PCB-31	16606-02-3	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL3-PCB-32	38444-77-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL3-PCB-34	37680-68-5	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL3-PCB-35	37680-69-6	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL3-PCB-36	38444-87-0	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL3-PCB-37	38444-90-5	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL3-PCB-38	53555-66-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL3-PCB-39	38444-88-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL4-PCB-41/40/71	52663-59-9 /38444-93-8/41464-46-4	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL4-PCB-42	36559-22-5	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL4-PCB-43	70362-46-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL4-PCB-44/47/65	41464-39-5/2437-79-8/33284-54-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL4-PCB-45/51	70362-45-7/68194-04-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40

Table 2e. Cleanup Levels and Analytical Quantitation Limits for Chemicals of Potential Concern in SMB Fish Tissue Samples

PARCCS:	Comparability			Sensitivity[1]				Accuracy and Precision[1]							
Parameter	CAS Number	Laboratory	Method	ROD Cleanup Levels[2]	Project Quantitation Limits	Achievable Laboratory MDLs	Units (wet weight)	MS/MSD[3]				LCS/LCSD[3]			
								Percent Recovery (%)			*RPD (%)*	*Percent Recovery (%)*			*RPD (%)*
CL4-PCB-46	41464-47-5	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL4-PCB-48	70362-47-9	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL4-PCB-50/53	62796-65-0/41464-41-9	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL4-PCB-52	35693-99-3	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL4-PCB-54	15968-05-5	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL4-PCB-55	74338-24-2	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL4-PCB-56	41464-43-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL4-PCB-57	70424-67-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL4-PCB-58	41464-49-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL4-PCB-59/62/75	74472-33-6/54230-22-7/32598-12-2	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL4-PCB-60	33025-41-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL4-PCB-61/70/74/76	33284-53-6/32598-11-1/32690-93-0/70362-48-0	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL4-PCB-63	74472-34-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL4-PCB-64	52663-58-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL4-PCB-66	32598-10-0	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL4-PCB-67	73575-53-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL4-PCB-68	73575-52-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL4-PCB-69/49	60233-24-1/41464-40-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL4-PCB-72	41464-42-0	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL4-PCB-73	74338-23-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL4-PCB-77	32598-13-3	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL4-PCB-78	70362-49-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL4-PCB-79	41464-48-6	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL4-PCB-80	33284-52-5	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL4-PCB-81	70362-50-4	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL5-PCB-82	52663-62-4	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL5-PCB-83/99	60145-20-2/38380-01-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL5-PCB-84	52663-60-2	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL5-PCB-88/91	55215-17-3/68194-05-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL5-PCB-89	73575-57-2	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL5-PCB-92	52663-61-3	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL5-PCB-94	73575-55-0	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL5-PCB-95/100/93/102/98	38379-99-6/39485-83-1/73575-56-1/68194-06-9/60233-25-2	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL5-PCB-96	73575-54-9	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL5-PCB-103	60145-21-3	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL5-PCB-104	56558-16-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40

Table 2e. Cleanup Levels and Analytical Quantitation Limits for Chemicals of Potential Concern in SMB Fish Tissue Samples

PARCCS:	Comparability			Sensitivity[1]				Accuracy and Precision[1]							
Parameter	CAS Number	Laboratory	Method	ROD Cleanup Levels[2]	Project Quantitation Limits	Achievable Laboratory MDLs	Units (wet weight)	MS/MSD[3]				LCS/LCSD[3]			
								Percent Recovery (%)			*RPD (%)*	*Percent Recovery (%)*			*RPD (%)*
CL5-PCB-105	32598-14-4	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL5-PCB-106	70424-69-0	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL5-PCB-107/124	70424-68-9/70424-70-3	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL5-PCB-108/119/86/97/125/87	70362-41-3/56558-17-9/55312-69-1/41464-51-1/74472-39-2/38380-02-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL5-PCB-109	74472-35-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL5-PCB-110/115	38380-03-9/74472-38-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL5-PCB-111	39635-32-0	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL5-PCB-112	74472-36-9	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL5-PCB-113/90/101	68194-10-5/68194-07-0/37680-73-2	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL5-PCB-114	74472-37-0	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL5-PCB-117/116/85	68194-11-6/18259-05-7/65510-45-4	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL5-PCB-118	31508-00-6	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL5-PCB-120	68194-12-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL5-PCB-121	56558-18-0	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL5-PCB-122	76842-07-4	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL5-PCB-123	65510-44-3	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL5-PCB-126	57465-28-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL5-PCB-127	39635-33-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL6-PCB-128/166	38380-07-3/41411-63-6	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL6-PCB-130	52663-66-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL6-PCB-131	61798-70-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL6-PCB-132	38380-05-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL6-PCB-133	35694-04-3	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL6-PCB-134/143	52704-70-8/68194-15-0	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL6-PCB-136	38411-22-2	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL6-PCB-137	35694-06-5	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL6-PCB-138/163/129/160	35065-28-2/74472-44-9/55215-18-4/41411-62-5	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL6-PCB-139/140	56030-56-9/59291-64-4	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL6-PCB-141	52712-04-6	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL6-PCB-142	41411-61-4	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL6-PCB-144	68194-14-9	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL6-PCB-145	74472-40-5	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40

Table 2e. Cleanup Levels and Analytical Quantitation Limits for Chemicals of Potential Concern in SMB Fish Tissue Samples

PARCCS:	Comparability			Sensitivity[1]				Accuracy and Precision[1]							
Parameter	CAS Number	Laboratory	Method	ROD Cleanup Levels[2]	Project Quantitation Limits	Achievable Laboratory MDLs	Units (wet weight)	MS/MSD[3]				LCS/LCSD[3]			
								Percent Recovery (%)			*RPD (%)*	*Percent Recovery (%)*			*RPD (%)*
CL6-PCB-146	51908-16-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL6-PCB-147/149	68194-13-8/38380-04-0	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL6-PCB-148	74472-41-6	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL6-PCB-150	68194-08-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL6-PCB-151/135/154	52663-63-5/52744-13-5/60145-22-4	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL6-PCB-152	68194-09-2	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL6-PCB-153/168	35065-27-1/59291-65-5	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL6-PCB-155	33979-03-2	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL6-PCB-156/157	38380-08-4/69782-90-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL6-PCB-158	74472-42-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL6-PCB-159	39635-35-3	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL6-PCB-161	74472-43-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL6-PCB-162	39635-34-2	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL6-PCB-164	74472-45-0	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL6-PCB-165	74472-46-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL6-PCB-167	52663-72-6	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL6-PCB-169	32774-16-6	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL7-PCB-170	35065-30-6	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL7-PCB-171/173	52663-71-5/68194-16-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL7-PCB-172	52663-74-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL7-PCB-174	38411-25-5	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL7-PCB-175	40186-70-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL7-PCB-176	52663-65-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL7-PCB-177	52663-70-4	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL7-PCB-178	52663-67-9	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL7-PCB-179	52663-64-6	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL7-PCB-180/193	35065-29-3/69782-91-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL7-PCB-181	74472-47-2	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL7-PCB-182	60145-23-5	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL7-PCB-183/185	52663-69-1/52712-05-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL7-PCB-184	74472-48-3	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL7-PCB-186	74472-49-4	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL7-PCB-187	52663-68-0	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL7-PCB-188	74487-85-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL7-PCB-189	39635-31-9	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL7-PCB-190	41411-64-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL7-PCB-191	74472-50-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL7-PCB-192	74472-51-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40

Table 2e. Cleanup Levels and Analytical Quantitation Limits for Chemicals of Potential Concern in SMB Fish Tissue Samples

PARCCS:	Comparability			Sensitivity[1]				Accuracy and Precision[1]							
Parameter	CAS Number	Laboratory	Method	ROD Cleanup Levels[2]	Project Quantitation Limits	Achievable Laboratory MDLs	Units (wet weight)	MS/MSD[3]				LCS/LCSD[3]			
								Percent Recovery (%)			*RPD (%)*	*Percent Recovery (%)*			*RPD (%)*
CL8-PCB-194	35694-08-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL8-PCB-195	52663-78-2	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL8-PCB-196	42740-50-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL8-PCB-197/200	33091-17-7/52663-73-7	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL8-PCB-198/199	68194-17-2/52663-75-9	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL8-PCB-201	40186-71-8	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL8-PCB-202	2136-99-4	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL8-PCB-203	52663-76-0	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL8-PCB-204	74472-52-9	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL8-PCB-205	74472-53-0	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL9-PCB-206	40186-72-9	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL9-PCB-207	52663-79-3	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL9-PCB-208	52663-77-1	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
CL10-PCB-209	2051-24-3	SGS AXYS	MLA-010/EPA 1668A	NA	0.05	NA	pg/g	--	--	--	40	50	--	150	40
Semivolatile Organic Compounds															
BEHP	117-81-7	ALS Kelso	EPA 8270DSIM	72	2000	12	µg/kg	56	--	136	40	56	--	136	40
Pentachlorophenol	87-86-5	ALS kelso	EPA 8270DSIM	**2.5**	**100**	**7.6**	µg/kg	41	--	105	40	41	--	105	40

Notes:

bold font indicates that the project quantitation limit and method detection limit do not meet the ROD cleanup level.

[1] Accuracy and precision values, as well as PQLs and MDLs were provided by the laboratory. These are presented for informational purposes only. Data review/validation will be based on the most current precision and accuracy limits in effect at the time of analysis. Sample results for 1600 series methods will be reported to the Sample Detection Limit (SDL, equivalent to Estimated Detection Limit [EDL]), which are calculated per sample. The number shown in the Project Quantitation Limits column is based on SDL for tissue assuming a 10 gram sample size by analytical method. Sample results for metals, BEHP, and pentachlorophenol will be reported to the laboratory MDL. Detections between the MDL and the PQL (reporting limit) will be reported as estimated results using a "J" qualifier. The laboratory will provide both MDLs and PQLs (reporting limits) in their reports and EDDs.

[2] From Table 17 of the ROD.

[3] A MS/MSD will not be performed for the 1600 series methods. A laboratory duplicate will be performed at a rate of 1 in 20 samples using sample volume.

[4] Concentration of compound is an estimated maximum value as it may originate from BR10-DPE-209 breakdown.

Abbreviations:

-- = not provided
µg/kg = micrograms per kilogram
BEHP = Bis(2-ethylhexyl) phthalate
CAS = Chemical Abstract Service
EPA = Environmental Protection Agency
DDx = dichlorodiphenyltrichloroethane and its derivatives
LCS = Laboratory Control Sample
LCSD = Laboratory Control Sample Duplicate
MDL = Method Detection Limit
mg/kg = milligrams per kilogram
MS = Matrix Spike
MSD = Matrix Spike Duplicate
NA = not applicable
PARCCS = Precision, Accuracy, Representativeness, Completeness, Comparability and Sensitivity
PCB = polychlorinated biphenyl
ROD = record of decision
RPD = Relative Percent Difference
SMB = smallmouth bass
TA = TestAmerica

Table 3. Data Quality Objectives for Individual Project Tasks

DQO STEP:	STEP 1	STEP 2	STEP 3	STEP 4	STEP 5	STEP 6	STEP 7
Task	**State the Problem**	**Identify the Goals of the Study (excerpted from Table 4 of PDI Work Plan)**	**Identify the Information Inputs**	**Define the Boundaries of the Study**	**Determine the Analytic Approach (excerpted from Table 8 of PDI Work Plan)**	**Specify Performance or Acceptance Criteria**	**Describe the Plan for Obtaining the Data**
Bathymetry Survey	The most recent bathymetry survey was conducted in 2002. The new bathymetry survey will document current bed elevations relative to the remedial technology assignment requirements and assess changes in elevation/sedimentation over the past 15 years.	Obtain SMA baseline characterization data adequate to refine the remedial footprint for allocation purposes (goal 1) and establish current baseline conditions (goal 2).	Multi-beam sonar throughout the site, supplemented with lead-line and single-beam measurements in difficult to access areas.	Geographic Boundary: The bathymetry survey will be conducted over the entire Site from RM 1.9 to RM 11.8. Temporal Boundary: The bathymetry survey will be conducted during the first quarter of 2018.	Run the new 2018 surface sediment data and bathymetry data through the ROD decision tree to refine the active remedy footprint. Changes in sediment elevation will be a modifying factor for volume estimates to inform the 30% design estimates.	Decisions concerning the bathymetry survey are expected to be straightforward. Ground truthing of the digital terrain model created from the bathymetric survey will provide an assessment tool to determine the acceptability of the dataset.	A bank-to-bank survey using multi-beam sonar will be conducted throughout the Site in the first quarter of 2018. The rationale for the testing strategy is further explained in the PDI Work Plan and task-specific FSP.
Surface Sediment Sampling	Many of the surface sediment data for the Site are over 10 years old. Updating the surface sediment dataset is key to refining the active remedial SMA footprints and updating the CSM.	Obtain SMA baseline characterization data adequate to refine the remedial footprint for allocation purposes (goal 1), establish current baseline conditions to evaluate future remedy performance (goal 2), evaluate recovery changes within the site (goal 3), and update the upriver reach datasets (goal 4).	428 random stratified surface sediment samples from throughout the site and 178 discrete targeted surface sediment samples located in SMAs and 60 targeted surface sediment samples co-located with sediment cores will be collected. The analytical suite for the samples is shown in Tables 2a and 2b of the QAPP.	Geographic Boundary: The random stratified samples will be distributed over the entire Site from RM 1.9 to RM 11.8, whereas the targeted samples will focus on the SMAs. Upriver samples will be distributed from RM 11.8 to 26.4. Temporal Boundary: The surface sediment samples will be collected in the first half of 2018.	See Table 8.	The acceptance criteria will entail the attainment of laboratory QA/QC results consistent with Section 3 of the QAPP.	The surface sediment samples will be collected from the upper 30 centimeters of sediment from three sampling points at each sampling location and homogenized into a three-point composite sample. The rationale for the sampling locations and analytical strategy is further explained in the PDI Work Plan and task-specific FSP.
Fish Acoustic Tracking Study	A more refined approach is needed to provide fine-scale and presence/absence data that can be used to understand SMB movement in the Study Area.	Establish current baseline conditions (CSM) (goal 2).	A properly designed array of acoustic receivers will be used to provide fine-scale and presence/absence data of SMB.	Geographic Boundary: Within the Site boundaries. Temporal Boundary: Data will be collected over a 1-year period targeting spring 2018 through winter 2019 to capture seasonal home range patterns.	Evaluate the fish tracking results to evaluate the home range of SMB. Maps, home range estimates, and summary tables will be generated. Note: results may inform the fish tissue sampling program and the appropriate scale for calculating baseline conditions with respect to fish; refine the CSM and reduce uncertainty about remedy effectiveness for fish tissue recovery and inform fish consumption advisory updates.	Decisions concerning the fish acoustic tracking study are expected to be straightforward. A pilot test performed in June 2017 included mobile and stationary testing of acoustic tags to evaluate the range of reception and position accuracy of both vendors' systems and will be the basis for Performance Criteria.	An array of acoustic receivers will be mounted to the bottom of the river at a scale appropriate to provide fine-scale and presence/absence data for 1 year.
Fish Tissue Sampling	New baseline data is needed on COC concentrations in fish tissue that have a high site fidelity and limited mobility to establish baseline conditions and to evaluate the degree of accumulation in relation to sediment and surface water concentrations.	Establish current baseline conditions to evaluate future remedy performance (goal 2), evaluate recovery changes within the site (goal 3), and update the upriver reach datasets (goal 4).	95 SMB samples will be collected from five distinct segments within the Site, 20 SMB samples will be collected from the Downtown Reach, and 20 SMB samples will be collected from the Upriver Reach. The analytical suite for the samples is shown in Table 2e of the QAPP.	Geographic Boundary: The fish tissue samples will be collected from five distinct river segments within the Site with an effort to collect samples from the east and west sides of each segment; the samples collected from the D/U Reaches will be distributed throughout the reaches. Temporal Boundary: The fish tissue samples will be collected in summer/fall of 2018.	See Table 8.	The acceptance criteria will entail the attainment of laboratory QA/QC results consistent with Section 3 of the QAPP. Fillet concentrations will be calculated based on whole body/fillet relationships established during the RI.	Whole fish samples will be collected and submitted for analysis. The rationale for the sampling locations and analytical strategy is further explained in the Workplan and task-specific FSP.
Sediment Trap Study	Data on contaminant loading entering the Site from upstream due to deposition of suspended sediment is needed to understand ongoing upstream input to the Site.	Update upriver reach datasets.	Two sediment traps will be deployed along each of two upriver transects. Sediment collected in the traps will be sampled and analyzed for all sediment COCs over three sampling rounds.	Geographic Boundary: Upriver (Downtown Reach) Temporal Boundary: The sediment trap samples will be collected in coordination with the surface water sampling program (three events over 1 year targeting 2018).	If sediment trap data indicate elevated concentrations of sediment COCs, the data will be used to refine the CSM; refine understanding of upstream conditions into the Site for potential recontamination; serve as a line of evidence to help refine contaminant loading into the Site for potential recontamination; and further inform remedial action objectives, if appropriate.	The acceptance criteria will entail the attainment of laboratory QA/QC results consistent with Section 3 of the QAPP.	Two sediment traps will be deployed at RM 11.8 and 16.2 for about 3 months each. Collected suspended sediment will be sampled over three rounds over a 1-year period.
Subsurface Sediment Coring	The vertical land horizontal extent of subsurface contamination has not been fully defined in SMAs with active remediation by previous studies.	Obtain SMA baseline characterization data adequate to refine the remedial footprint for allocation purposes (goal 1) andevaluate recovery changes within the site (goal 3).	90 subsurface sediment cores will be collected in SMAs that have limited data coverage. Target depths for sampling are based on the vertical extent of contamination observed in surrounding cores and anticipated depth to native material. If the vertical depth of contamination was not reached in a previous core, the depth of the current core will be extended an additional 2 to 4 feet. The analytical suite for the samples is shown in Table 2a of the QAPP.	Geographic Boundary: Sediment cores will be collected from target area within or along SMA boundaries. Temporal Boundary: The subsurface sediment samples will be collected in summer of 2018.	See Table 8.	The acceptance criteria will entail the attainment of laboratory QA/QC results consistent with Section 3 of the QAPP.	The subsurface samples will be subsampled into 2-foot increments (unless stratigraphy indicates otherwise) and homogenized. 1-foot intervals near the bottom of contamination may be archived. The rationale for the sampling locations and analytical strategy is further explained in the PDI Work Plan and task-specific FSP.
Surface Water Study	Surface water data are needed to provide synoptic baseline river conditions along with the sediment and fish tissue data collected as part of this study. Surface water data are also needed to refine the SMS for remedial design purposes.	Same as fish tissue goals.	Seven composite water samples will be collected from five transects distributed across the Site and two transects in the D/U Reaches over three flow conditions (summer low flow, winter high flow, and storm flood-influenced conditions).	Geographic Boundary: Surface water will be collected from river transects at RMs 1.8, 3, 4, 7, 8.8, 11.8, and 16.2. Temporal Boundary: The surface water samples will be collected during 3 field events in 2018 and early 2019.	See Table 8.	The acceptance criteria will entail the attainment of laboratory QA/QC results consistent with Section 3 of the QAPP.	Surface water composite samples will be collected by sampling equal volumes from three locations (east shore, navigation channel, and west shore) and at three depths per location – upper, near bottom , and middle. The rationale for the sampling locations and analytical strategy is further explained in the PDI Work Plan and task-specific FSP.
Background Porewater Study	Background metals concentrations in porewater were not defined during previous studies and metals, such as arsenic and manganese, are present in relatively high concentrations in volcanic rock, which is the primary source of Willamette River sediment.	Determine background concentrations of naturally occurring metals COCs in porewater (goal 4).	Porewater samplers will be placed at eight locations in upstream areas or other relevant areas from within the Site.	Geographic Boundary: The porewater sampling boundary is not yet clearly defined, but will likely be upstream of the Site. Temporal Boundary: The porewater samples will be collected in summer of 2018.	Provide sufficient data to derive porewater background for metals (arsenic and manganese) using the passive porewater samples from the upriver reach or other appropriate background areas.	The acceptance criteria will entail the attainment of laboratory QA/QC results consistent with Section 3 of the QAPP.	Porewater peepers will be deployed in triplicate at eight locations for 28 days. After retrieval, samples will be analyzed for arsenic and manganese at an accredited analytical laboratory. The rationale for the sampling locations and analytical strategy is further explained in the PDI Work Plan and task-specific FSP.

Abbreviations:

COC = contaminant of concern
CSM = conceptual site model
D/U = downtown/upstream
DQO = Data Quality Objective
FSP = Field Sampling Plan
PCB = polychlorinated biphenyl
QA/QC = quality assurance/quality control
QAPP = Quality Assurance Project Plan
PDI Work Plan = ASAOC Pre-Remedial Design Investigation and Baseline Sampling Work Plan
RAL = remedial action level
RM = river mile
ROD = Record of Decision
SMA = sediment management area
SMB = smallmouth bass
SMS = Sediment Management Standards
SWAC = surface weighted average sediment concentration

Table 4. Sample Nomenclature

Component 1	Component 2	Component 3		Component 4			Component 5
Study Name	**Sample Matrix**	**Type**	**Sample Station No. (Sequential)**	**Core Depth Intervals (ft)**	**Seasonal Sampling Round**	**Other**	**QA/QC**
PDI	SG = sediment grab	B = baseline	"B001 thru B428" = baseline at PHSS "B429 thru B489" = downtown/upriver reaches	NA	NA	BL1 = Baseline Round 1	D = Field duplicate
PDI	SG = sediment grab	S = sediment management area	"S001 through S168" = SMA grabs and cores			NA	
PDI	SC = sediment core			0to2, 2to4, 4to6 etc.			
PDI	WS = water, surface water	T = transect	T01 through T07	NA	1803, 1807 or 1811 (March 2018, July 2018 or Nov. 2018)		
PDI	ST = sediment trap	T= transect	T06a, T06b, T07a, T07b				
PDI	WP = water, porewater	B or S (co-located with a surface sediment grab sample)	B001 - B428 or S001 - S168 (co-located with surface sediment station)		NA		NA
PDI	TF = tissue fish	SMB = smallmouth bass	SMB01 to SMB136				
PDI	AR = Acoustic Receiver	A	A01 to A34				
PDI	AT = Acoustic Tag	SMBT = smallmouth bass tag	SMBT01 to SMBT40				
PDI	RB = rinsate blank	NA	VV, ST, SC, ST, SS, PP, XD,XF (equipment type, see below)			YYMMDD	1430 (time of sample collection if more than one blank is collected in a day; military time)
PDI	TB = trip blank		NA			YYMMDD	

Table 4. Sample Nomenclature

Notes:

1) Location ID will be Component 1 and Component 3.

PDI Study Sample Nomenclature Examples
Components are separated by dashes.

Surface Sediment Examples (N=428 baseline; N=60 downtown/upriver reaches; and N=178 SMA)
PDI-SG-B001-BL1 = Pre-design investigation, surface sediment grab, baseline station #001, baseline round 1
PDI-SG-S001 = Pre-design investigation, surface sediment grab, SMA station #001.
PDI-SG-B001-BL1-MSD = Pre-design investigation, surface sediment grab, baseline station #001, baseline round 1, matrix spike duplicate sample

Subsurface Sediment Examples (N=90 stations)
PDI-SC-S001-2to4 = Pre-design investigation, subsurface sediment core, SMA station #1, depth 2 to 4 feet
PDI-SC-S012-4to6-D = Pre-design investigation, subsurface sediment core, SMA station #12, depth 4 to 6 feet, field duplicate

Surface Water Examples
Seven transects on the river and three rounds of sampling.
PDI-WS-T04-1803 = Pre-design investigation, surface water sample, transect #4, collected March 2018
PDI-WS-T04-1803 = Pre-design investigation, surface water sample, transect #4, collected March 2018
PDI-WS-T01N-1803 = Pre-design investigation, surface water sample, transect #1, collected from navigation channel March 2018 (applicable to collection for ethylbenzene analysis only)

Sediment Trap Examples (N = 4 stations)
Two sediment trap locations at T6 and T7, two stations at each location A and B, and three rounds of sampling.
PDI-ST-T07A-1803 = Pre-design investigation, sediment trap sample, transect 7 station A, from March 2018 sampling round
PDI-ST-T07B-1803-D = Pre-design investigation, sediment trap, transect seven station B, March 2018, field duplicate sample

Porewater Examples (N= 8 stations)
PDI-WP-B001 = Pre-design investigation, porewater sample, co-located with baseline surface sediment station # 1
PDI-WP-S042 = Pre-design investigation, porewater sample, co-located with SMA surface sediment station #42

Fish Tissue Examples (N=135 samples)
PDI-TF-SMB005- = Pre-design investigation, fish tissue, smallmouth bass sample #5

Fish Tracking (N=34 receivers and N=40 fish)
PDI-AR-A032 = Pre-design investigation, acoustic receiver, from receiver station 32
PDI-AT-SMBT40 = Pre-design investigation, acoustic tag placed on individual smallmouth bass with tag #40.

Rinsate Blanks / Equipment Blanks
PDI-RB-SC-180612-1430 = Pre-design investigation, rinsate blank, from sediment core tube, collected June 12, 2018, at 2:30 p.m.

Below is the list of the equipment codes for equipment that will require rinsate blanks

VV = van veen sampler	XD = XAD sampler
SC = sediment core tube	XF = XAD filter
SS = spoons and bowls	ST = sediment trap
PP = peristaltic pump (and carboy)	PW = porewater sampler

Trip Blanks
PDI-TB-180515-0830 = Pre-design investigation, trip blank, collected May 15, 2018 at 8:30 am

Table 5. Sample Containers, Methods, Sample Preservation, and Holding Times

Matrix	Parameter (Analysis)	Method	Sample Container[1]	Preservation	Archive Preservation (up to 1 year)	Holding Time at 0-6°C	Holding Time at <-10°C
Sediments	BEHP (SVOC)	EPA 8270D-LL	1x 8-ounce glass jar	Cool to 0-6°C	Freeze to <-10°C	14 days from collection to preparation; 40 days from extraction to analysis	1 year from collection to preparation; 40 days from extraction to analysis
	Chlorinated Pesticides	EPA GC/MS/MS1699M; EPA HR-GCMS 1699	1x 8-ounce amber glass jar	Cool to 0-6°C	Freeze to <-10°C	14 days from collection to preparation; 40 days from extraction to analysis	1 year from collection to preparation; 40 days from extraction to analysis
	Dioxins/Furans	EPA 1613B	1x 8-ounce amber glass jar with Teflon®-lined lid	Cool to 0-6°C and store in the dark until receipt by laboratory. Then store in the dark at <-10° C	Freeze to <-10°C, store in the dark	NA	1 year from collection to preparation; 1 year from extraction to analysis
	Grain Size	ASTM D7928 and D6913	1x 16-ounce glass or plastic jar	NA	NA	None	None
	Atterberg Limits	ASTM D4318	1x16-ounce plastic jar	NA	NA	None	None
	Metals	EPA Method 6020B	1x 8-ounce glass jar with Teflon®-lined lid	Cool to 0-6°C	Freeze to <-10°C	180 days from collection to analysis	2 years from collection to analysis
	Mercury	EPA Method 7471A	1x 8-ounce glass jar with Teflon®-lined lid	Cool to 0-6°C	Freeze to <-10°C	28 days from collection to analysis	1 year from collection to analysis
	PAHs	EPA 8270D SIM	1x 8-ounce glass jar	Cool to 0-6°C	Freeze to <-10°C	14 days from collection to preparation; 40 days from extraction to analysis	1 year from collection to preparation; 40 days from extraction to analysis
	PCB Aroclors	EPA 8082A-LL	1x 8-ounce glass jar with Teflon®-lined lid	Cool to 0-6°C	Freeze to <-10°C	14 days from collection to preparation; 40 days from extraction to analysis	1 year from collection to preparation; 40 days from extraction to analysis
	PCB Congeners	EPA 1668A	1x 4-ounce amber glass jar filled 2/3 full	Cool to 0-6°C and store in the dark until receipt by laboratory. Then store in the dark at <-10° C	Freeze to <-10°C	NA	1 year from collection to preparation; 1 year from extraction to analysis
	Total Organic Carbon	EPA Method 9060	1x 4-ounce glass jar	Cool to 0-6°C	Freeze to <-10°C	28 days from collection to analysis	6 months from collection to analysis
	Total Solids	EPA 160.3 Modified/ASTM D-2216	1x 4-ounce glass jar	Cool to 0-6°C	Freeze to <-10°C	7 days from collection to analysis	6 months from collection to analysis
	TPH-Diesel	Ecology NWTPH-Dx	1x 8-ounce glass jar with Teflon®-lined lid or stainless steel liner	Cool to 0-6°C	Freeze to -10°C	14 days from collection to preparation; 40 days from extraction to analysis	1 year from collection to preparation; 40 days from extraction to analysis
	Tributyltin	Krone et al	1x 8-ounce glass jar	Cool to 0-6°C	Freeze to <-10°C	14 days from collection to preparation; 40 days from extraction to analysis	1 year from collection to preparation; 40 days from extraction to analysis
Fish Tissue	BEHP + Pentachlorophenol (SVOC)	EPA 8270D SIM	Aluminum Foil in Ziploc bag	Freeze to <-10°C	Freeze to <-10°C	NA	1 year from collection to preparation; 40 days from extraction to analysis
	Chlorinated Pesticides + Hexachlorobenzene	MLA-028/EPA 1699	Aluminum Foil in Ziploc bag	Freeze to <-10°C	Freeze to <-10°C	NA	1 year from collection to preparation; 1 year from extraction to analysis
	Dioxins/Furans	MLA-017/EPA 1613B	Aluminum Foil in Ziploc bag	Freeze to <-10°C	Freeze to <-10°C		
	Lipids	SGS AXYS SOP SLA-020	Aluminum Foil in Ziploc bag	Freeze to <-10°C	Freeze to <-10°C		
	Arsenic	EPA Method 6020B	Aluminum Foil in Ziploc bag	Freeze to <-10°C	Freeze to <-10°C	NA	2 years from collection to analysis
	Mercury	EPA Method 7471A	Aluminum Foil in Ziploc bag	Freeze to <-10°C	Freeze to <-10°C	NA	1 year from collection to analysis
	PCB congeners	MLA-010/EPA 1668A	Aluminum Foil in Ziploc bag	Freeze to <-10°C	Freeze to <-10°C	NA	1 year from collection to preparation; 1 year from extraction to analysis
	PBDEs	MLA-033 / EPA 1614	Aluminum Foil in Ziploc bag	Freeze to <-10°C	Freeze to <-10°C		
Surface Water	BEHP	EPA 8270D-LL	1-liter Amber Glass	Cool to 0-6°C	Extracts freeze <-10°C	7 days from collection to preparation; 40 days from extraction to analysis	NA
	High Volume Samples, XAD2 (dissolved phase)		XAD2 ™ Column	Cool to 0-6°C, store in dark	Extracts freeze <-10°C, store in the dark	NA	1 year from collection to preparation; 1 year from extraction to analysis
	Chlorinated Pesticides + Hexachlorobenzene	MLA-028/EPA 1699					
	Dioxins/Furans	MLA-017/EPA 1613B					
	PCB congeners	MLA-010/EPA 1668A					
	PAHs	MLA-021/EPA8270D/1625M					
	High Volume Samples, Particulate (total fraction)		Solids and flat filters	Containerize in clean glass sample jar. Cool to 0-6°C and store in the dark until receipt by laboratory. Then store in the dark at <-10° C	Extracts freeze <-10°C, store in the dark	NA	1 year from collection to preparation; 1 year from extraction to analysis
	Chlorinated Pesticides + Hexachlorobenzene	MLA-028/EPA 1699					
	Dioxins/Furans	MLA-017/EPA 1613B					
	PCB congeners	MLA-010/EPA 1668A					
	PAHs	MLA-021/EPA8270D/1625M					
	Dissolved Organic Carbon [2]	SM5310B	1x 250-milliliter Amber Glass Bottle	Field filter using 0.45 µm pore-size filter before acidifying, H_2SO_4, Cool to 0-6°	NA	28 days from collection to analysis	NA
	Ethylbenzene	EPA 8260C	3x 40-milliliter VOA vials	HCl to pH<2, Cool to 0-6°C, No Headspace	NA	14 days from collection to analysis	NA
	MCPP	EPA 8151A	2x 1-liter Amber Glass Bottles	Cool to 0-6°C	Extracts freeze <-10°C	7 days from collection to preparation; 40 days from extraction to analysis	NA
	Metals [2]	EPA 6010C/6020B LL	1x 250-milliliter HDPE	HNO3 to pH <2	NA	180 days from collection to analysis	NA
	Pentachlorophenol	EPA 8270D-LL	1-Liter Amber Glass	Cool to 0-6°C	Extracts freeze <-10°C	7 days from collection to preparation; 40 days from extraction to analysis	NA
	Pentachlorophenol	EPA 8041A	1-Liter Amber Glass	Cool to 0-6°C	Extracts freeze <-10°C	7 days from collection to preparation; 40 days from extraction to analysis	NA
	Total Dissolved Solids	Standard Method 2540C	1x 1-liter HDPE	Cool to 0-6°C	NA	7 days from collection to analysis	NA
	Total Organic Carbon	SM5310B	1x 250-milliliter Amber Glass Bottle	H_2SO_4, Cool to 0-6°C	NA	28 days from collection to analysis	NA
	Total Suspended Solids	Standard Method 2540D	1x 1-liter HDPE	Cool to 0-6°C	NA	7 days from collection to analysis	NA
	Tributyltin	Unger et al	1-liter Amber Glass	Cool to 0-6°C	Extracts freeze <-10°C	7 days from collection to preparation; 40 days from extraction to analysis	NA
Porewater	Metals	EPA Method 6020B-LL	1x 250-milliliter HDPE	HNO_3 to pH <2	NA	180 days from collection to analysis	NA
	Anions (Bromide)	EPA Method 300.0	1x125-milliliter HDPE	Cool to 0-6°C	NA	28 days from collection to analysis	NA
Bulk Sediment (adjacent to porewater peepers)	Metals	EPA Method 6020B	1x 8-ounce glass jar with Teflon®-lined lid	Cool to 0-6°C	Freeze to <-10°C	180 days from collection to analysis	2 years from collection to analysis

Notes:

[1] The sample containers shown for sediment are based on individual analyses. For efficiency and in consultation with the laboratories conducting the analyses, samples for analytical testing with equivalent jar requirements can be combined to minimize the bottle requirements.

[2] Dissolved analyses will be field filtered followed by preservation with appropriate acid.

Abbreviations:

ASTM = American Society for Testing and Materials
BEHP = Bis(2-ethylhexyl) phthalate
C = centigrade
DRO = diesel range organics
EPA = United States Environmental Protection Agency
HCL = hydrochloric acid
HDPE = high-density polyethylene
HNO_3 = nitric aAcid
MCPP = methylchlorophenoxypropionic acid
NA = not applicable
PAH = polycyclic aromatic hydrocarbons
PBDEs = polybrominated diphenyl ethers
PCB = polychlorinated biphenyl
SIM = Selective Ion Monitoring
SVOC = semi-volatile organic compound
TPH = total petroleum hydrocarbon
VOA = volatile organic analyte

Table 6. Field Quality Control Sample Frequency

Matrix	Parameter	Trip Blanks	MS/MSD[1]	Equipment Rinsate Blanks[2]	Field Duplicate Samples
Sediments	Chlorinated Pesticides	NA	1 per 20 samples	1 per 20 samples	1 per 20 samples
	Dioxins/Furans		NA	1 per 20 samples	1 per 20 samples
	Grain Size		NA	NA	NA
	Atterberg Limits		NA	NA	NA
	Mercury		1 set/20 samples	1 per 20 samples	1 per 20 samples
	Metals		1 set/20 samples	1 per 20 samples	1 per 20 samples
	PAHs		1 set/20 samples	1 per 20 samples	1 per 20 samples
	PCB Aroclors		1 set/20 samples	1 per 20 samples	1 per 20 samples
	PCB Congeners		NA	1 per 20 samples	1 per 20 samples
	BEHP (SVOC)		1 set/20 samples	1 per 20 samples	1 per 20 samples
	Total Organic Carbon		1 set/20 samples	1 per 20 samples	1 per 20 samples
	TPH-Diesel		1 set/20 samples	1 per 20 samples	1 per 20 samples
	Tributyltin		1 set/20 samples	1 per 20 samples	1 per 20 samples
Fish Tissue	Chlorinated Pesticides/Hexachlorobenzene	NA	NA	NA	NA
	Dioxins/Furans		NA		
	Lipids		NA		
	Mercury		1 set/20 samples		
	Metals		1 set/20 samples		
	PBDEs		NA		
	PCB Congeners		NA		
	BEHP/PCP (SVOCs)		1 set/20 samples		
Surface Water[3]	Chlorinated Pesticides/ Hexachlorobenzene	NA	NA	1 per sampling event	NA
	Dioxins/Furans		NA	1 per sampling event	NA
	Ethylbenzene	1 per cooler of VOC samples	1 set/20 samples	1 per sampling event	1 per sampling event
	MCPP	NA	1 set/20 samples	1 per sampling event	1 per sampling event
	Metals		1 set/20 samples	1 per sampling event	1 per sampling event
	PAHs		NA	1 per sampling event	NA
	PCB Congeners		NA	1 per sampling event	NA
	BEHP/PCP (SVOCs)		1 set/20 samples	1 per sampling event	1 per sampling event
	Dissolved Organic Carbon		1 set/20 samples	1 per sampling event	1 per sampling event
	Total Dissolved Solids		NA	1 per sampling event	1 per sampling event
	Total Organic Carbon		1 set/20 samples	1 per sampling event	1 per sampling event
	Total Suspended Solids		NA	1 per sampling event	1 per sampling event
	Tributyltin		1 set/20 samples	1 per sampling event	1 per sampling event
Porewater	Metals	NA	1 set/20 samples	NA	NA
	Anions (bromide)	NA	NA	NA	NA
Bulk Sediment (adjacent to porewater peepers)	Metals	NA	1 set/20 samples	1 per 20 samples	1 per 20 samples

Notes:

[1] Field personnel must collect triple volume to account for MS/MSD samples where needed except for fish tissue. Analyses performed by 1600 series methods will not require MS/MSD.

[2] No equipment blanks are required for disposable or dedicated field sampling equipment. Filter blanks will be conducted for XAD surface water samplers, one per event. Equipment blanks will target about one per week, one per event, or one per piece of equipment for overall project average of 1 per 20 samples.

[3] Field duplicates will only be collected and analyzed on samples collected by peristaltic pump.

Abbreviations:

MCPP = methylchlorophenoxypropionic acid
BEHP = Bis(2-ethylhexyl) phthalate
MS/MSD = Matrix Spike/Matrix Spike Duplicate
NA = not applicable
PAH = polycyclic aromatic hydrocarbons
PBDEs = polybrominated diphenyl ethers
PCB = polychlorinated biphenyl
PCP = pentachlorophenol
SVOCs = semi volatile organic compounds
TPH = total petroleum hydrocarbon
VOC = volatile organic compound

Table 7. Laboratory Quality Control Sample Frequency

Matrix	Parameter	Method	Method Blanks	MS/MSD	LCS/LCSD	Laboratory Duplicate	Surrogate Recovery
Water/ Sediment/ Tissue	Chlorinated Pesticides/Hexachlorobenzene	EPA GC/MS/MS 1699M; EPA HR-GCMS 1699; or MLA-028/EPA 1699	1 per extraction batch	1 per 20 for GC/MS/MS but NA for remainder	Per method	NA	Per method
	Ethylbenzene	EPA 8260C	1 per analytical batch	1 per 20 samples	1 per analytical batch	NA	Per method
	BEHP and/or PCP	EPA 8270D-LL; EPA 8041A (PCP only)	1 per extraction batch	1 per 20 samples	1 per extraction batch	NA	Per method
	PAHs	EPA 8270D-SIM or MLA-021/EPA 8270D/1625M	1 per extraction batch	1 per 20 samples[1]	1 per extraction batch[1]	1 per 20 samples or Per method	Per method
	MCPP	EPA 8151A	1 per extraction batch	1 per 20 samples	1 per extraction batch	NA	Per method
	PCB Aroclors	EPA 8082A-LL	1 per extraction batch	1 per 20 samples	1 per extraction batch	NA	Per method
	Total Organic Carbon / Dissolved Organic Carbon	EPA 9060 or SM5310B	1 per extraction batch	1 per 20 samples	1 per extraction batch	NA	NA
	PCB Congeners	EPA 1668A or MLA-010/EPA 1668A	1 per extraction batch	NA	Per method	Per method	Per method
	Dioxins/Furans	EPA 1613B or MLA-017/EPA 1613B	1 per extraction batch	NA	Per method	Per Method	Per method
	TPH-Diesel	Ecology NWTPH-Dx	1 per extraction batch	1 per 20 samples	1 per extraction batch	NA	Per method
	Tributyltin	Unger et al., Krone et al.	1 per extraction batch	1 per 20 samples	1 per extraction batch	NA	Per method
	Lipids	SGS Axys SOP - SLA-020	NA	NA	NA	1 per 20 samples	NA
	Metals	EPA 6020B LL/6010C	1 per digestion batch	1 per 20 samples	1 per digestion batch	1 per 20 samples	NA
	Mercury	EPA 7471A	1 per digestion batch	1 per 20 samples	1 per digestion batch	1 per 20 samples	NA
	PDBEs	MLA-033/EPA 1614	1 per extraction batch	NA	Per method	Per Method	Per method
	Bromide	EPA 300.0	1 per analytical batch	NA	1 per analytical batch	1 per 20 samples	NA
	Grain Size	ASTM D7928/D6913	NA	NA	NA	Triplicate analysis per 20 samples	NA
	Atterberg Limits	ASTM D4318	NA	NA	NA	NA	NA
	Total Dissolved Solids	SM 2540C	1 per analytical batch	NA	1 per analytical batch	1 per 10 samples	NA
	Total Suspended Solids	SM 2540D	1 per analytical batch	NA	1 per analytical batch	1 per 10 samples	NA
	Total Solids	EPA 160.3M; ASTM D-2216	1 per analytical batch	NA	NA	1 per 20 samples	NA

Footnote:

[1] Frequency noted is for samples analyzed by EPA 8270D-SIM. An MS/MSD is not required for method EPA 8270D/1625M. An LCS will be performed per method requirements.

Abbreviations:

DRO = Diesel Range Organics
ASTM = American Society for Testing and Materials
BEHP = Bis(2-ethylhexyl) phthalate
EPA = Environmental Protection Agency
LCS = Laboratory Control Sample
LCSD = Laboratory Control Sample Duplicate
MCPP = methylchlorophenoxypropionic acid
MS = Matrix Spike
MSD = Matrix Spike Duplicate
NA = Not Applicable
PAH = polycyclic aromatic hydrocarbons
PBDEs = polybrominated diphenyl ethers
PCB = polychlorinated biphenyl
PCP = pentachlorophenol
SM = Standard Method
TPH = total petroleum hydrocarbon

Table 8. Data Interpretation and Analysis Plan (copy of Table 8 of PDI Work Plan)

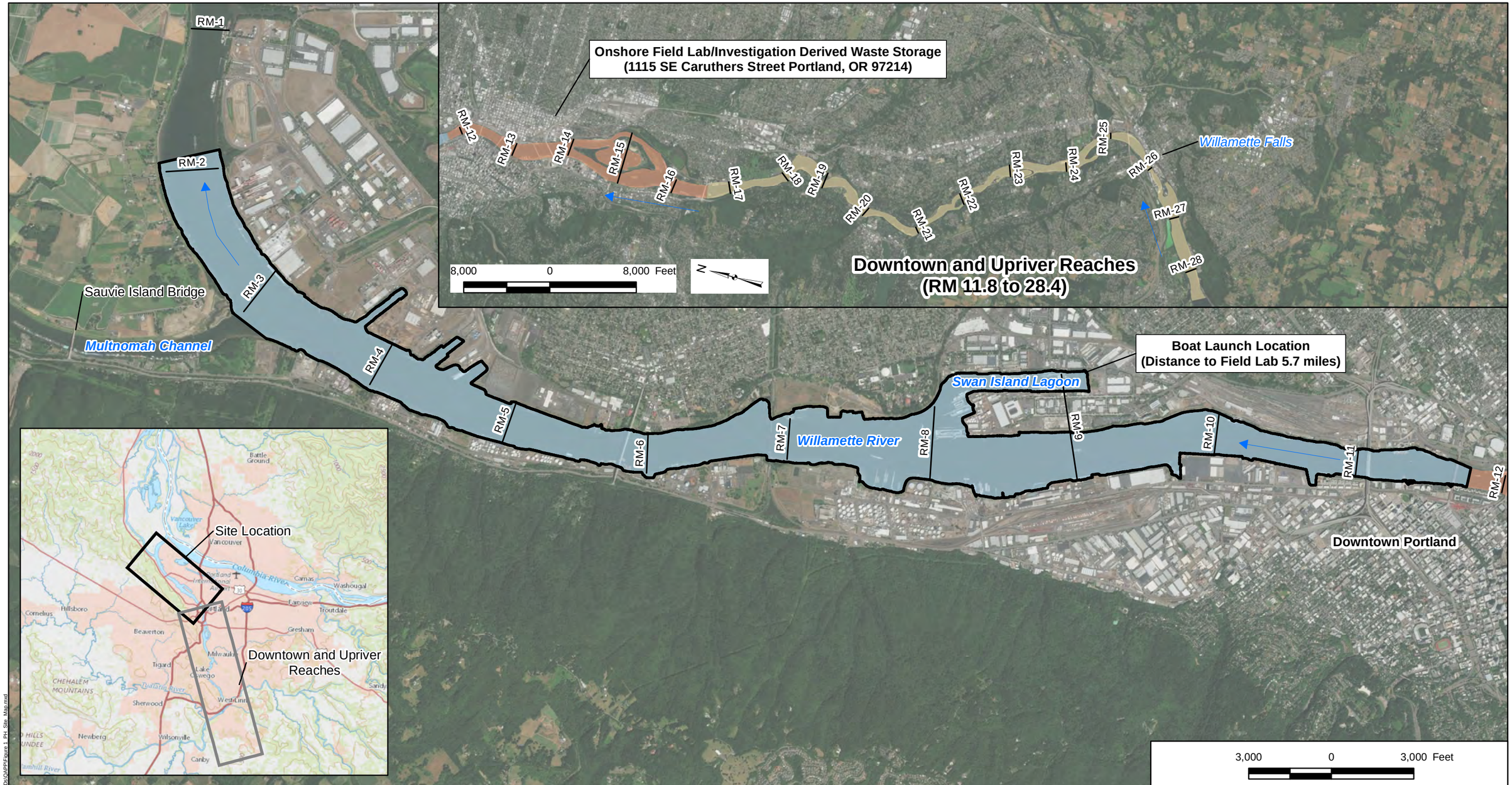
Table 8. Data Interpretation and Analysis Plan
Portland Harbor Pre-Remedial Design Investigation Work Plan
Portland, OR

Data Utilization	Description
Current Conditions and Sediment SWACs for baseline dataset	Generate summary tables and maps with the new 2018 data and baseline the river for sediment, SMB fish tissue, and surface water for media-specific COCs and selected other COCs. Generate sediment SWACs for the Site on a site-wide and other spatial scales using Theissen Polygons for the 606-sample plan, and the statistical mean for both the stratified random 428 sample plan and 606 sample plan.
Concentration Changes Over Time (focused COCs)	Provide plot of the tissue data over time. Provide surface water data with simple data plots of baseline and previous applicable surface water data. Compare the new 2018 data to the RI/FS dataset for sediment (2004 in particular), tissue (2002, 2007 and 2012), and surface water media, and evaluate changes since the RI: (1) The new sediment SWAC and arithmetic mean of unbiased dataset (stratified random) will be compared to the 2004 data at site-wide, segment-wide scales, and river mile-scales to look for differences in the last 14 years. (2) Datasets will also be compared to the Downtown/Upriver Reaches (are the three populations different, how different, and is site recontamination expected?). (3) Additional surface sediment locations may be re-occupied from 2004, and these two populations will be compared for changes. *Note: The data permits statistical comparisons at the site-wide and other spatial scales such as rolling river mile one-side, 21 segments (10 segments with east and west side plus Swan Island Lagoon), and 9 segments (8 segments each 2 to 3 miles one-side plus Swan Island Lagoon).*
Alt F Mod Active SMA Footprint (1)	Refine the SMA footprints using new data collected during the PDI. SMA delineation activity to evaluate these data, bathymetry, and applicable historical data will be run through the ROD decision tree to support allocation. Run the new 2018 surface sediment data and bathymetry data through the ROD decision tree to refine the active remedy footprint. The 2018 core data will be combined with RI/FS subsurface coring data to update the conceptual site model understanding of subsurface contamination, collectively these data will also run through the ROD decision tree to refine the active remedy footprint and dredge volume estimate. Changes in sediment elevation will be a modifying factor for volume estimates to inform the 30% design estimates.
Downtown/Upriver Baseline	Report data separately to EPA by reach (Downtown / Upriver Reach). Evaluate current upriver conditions by SWAC and summary distribution statistics for other media, for future long-term comparative analysis with Site. Generate tables, maps, and summary statistics for all new 2018 data (sediment, SMB tissue, surface water, and sediment traps) as 2018 baseline conditions. These data may be compared to new site data, and qualitatively compared to older downtown/upriver data to evaluate changes and provide a first look at what may be achievable at the site for focused COCs.
Background Porewater	Provide porewater data to EPA, provide sufficient data to derive porewater background for metals using the passive porewater samples from the upriver reach or other appropriate background areas (see EPA March 13, 2017 framework).
Fish Tracking Results	Provide fish tracking data to be presented as a tabular spreadsheet deliverable that includes location, tag IDs, and time stamps for each of the tagged fish. Data processing for data report limited to tabular and graphical outputs showing locations/tag IDs of fish movement (e.g. heat maps). Evaluate the fish tracking results to evaluate the home range of SMB. Maps, home range estimates, and summary tables will be generated. *Note: results may inform the fish tissue sampling program and the appropriate scale for calculating baseline conditions with respect to fish; refine the CSM and reduce uncertainty about remedy effectiveness for fish tissue recovery and inform fish consumption advisory updates.*
Data Design for Long-term Monitoring	The PDI Evaluation Report will include an evaluation of the 2018 data for purpose of potentially focusing the list of COCs for future monitoring rounds.

Notes:
(1) Pre-Design Core data collection may have limitations for characterizing final SMA footprint delineation. Accordingly, any final decision on the SMA footprint will be pending full remedial design and confirmation sampling results obtained during remedy implementation.

Abbreviations:
COCs - chemicals of concern; CSM - conceptual site model; PDI - pre-remedial design investigation; RI/FS - remedial investigation/feasibility study; RAO - remedial action objective; RM - river mile; ROD - Record of Decision; SMA - sediment management area; SMB - small mouth bass; SWAC - surface weighted average concentrations

FIGURES



Legend

- Flow Direction
- River Mile Marker
- Superfund Site Boundary (RM 1.9 to 11.8)

Study Area

- Site Area (RM 1.9 to 11.8)
- Downtown Reach (RM 11.8 to 16.6)
- Upriver Reach (RM 16.6 to 28.4)

Note:
1. Aerial Imagery provided by ESRI Basemaps 2016

Portland Harbor Site Map

Portland Harbor Superfund Site
PDI Quality Assurance Project Plan

AECOM | Geosyntec consultants

MI/SEA | March 23, 2018

Figure 1

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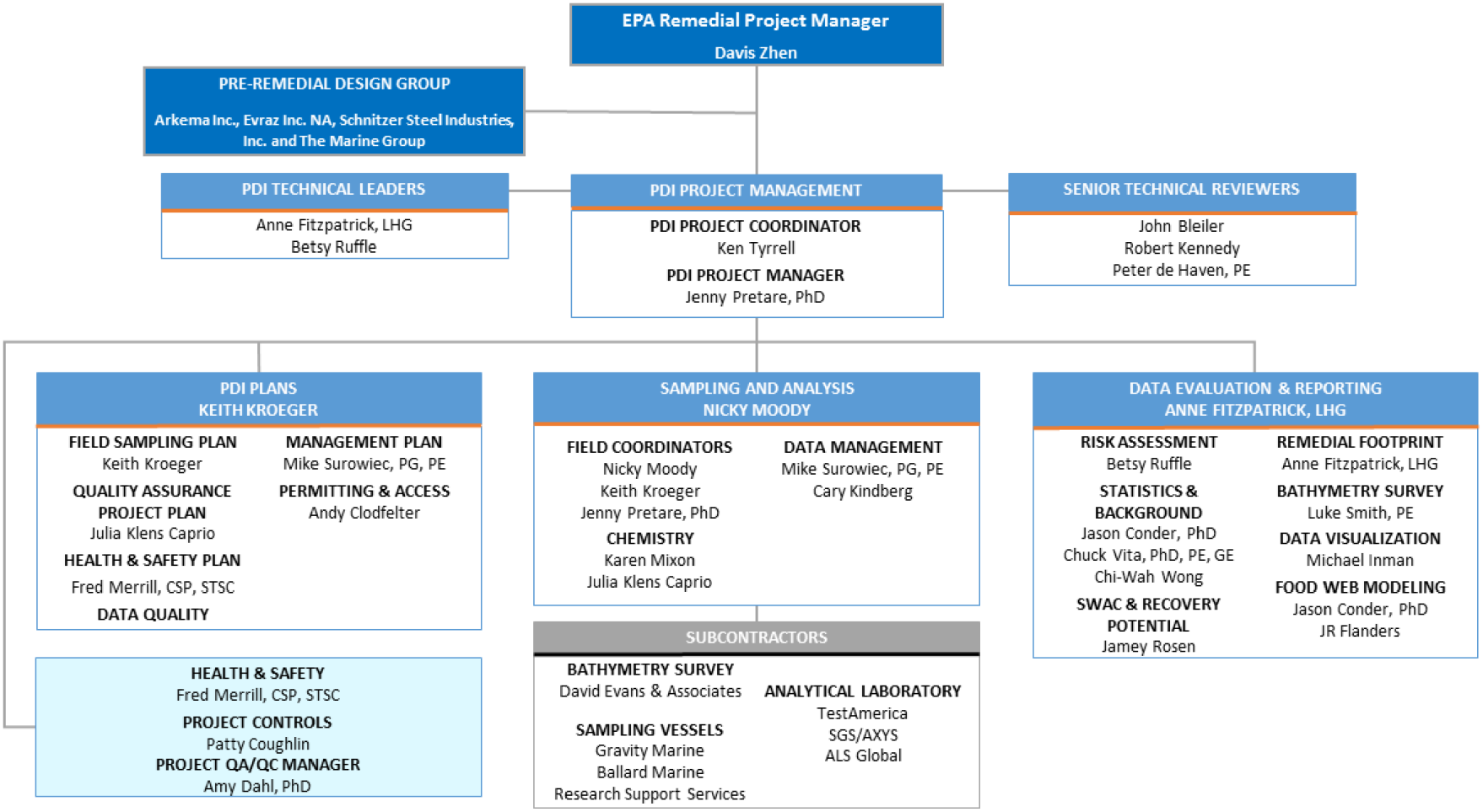

Project Organizational Chart

Portland Harbor Superfund Site
PDI Quality Assurance Project Plan

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Figure 2

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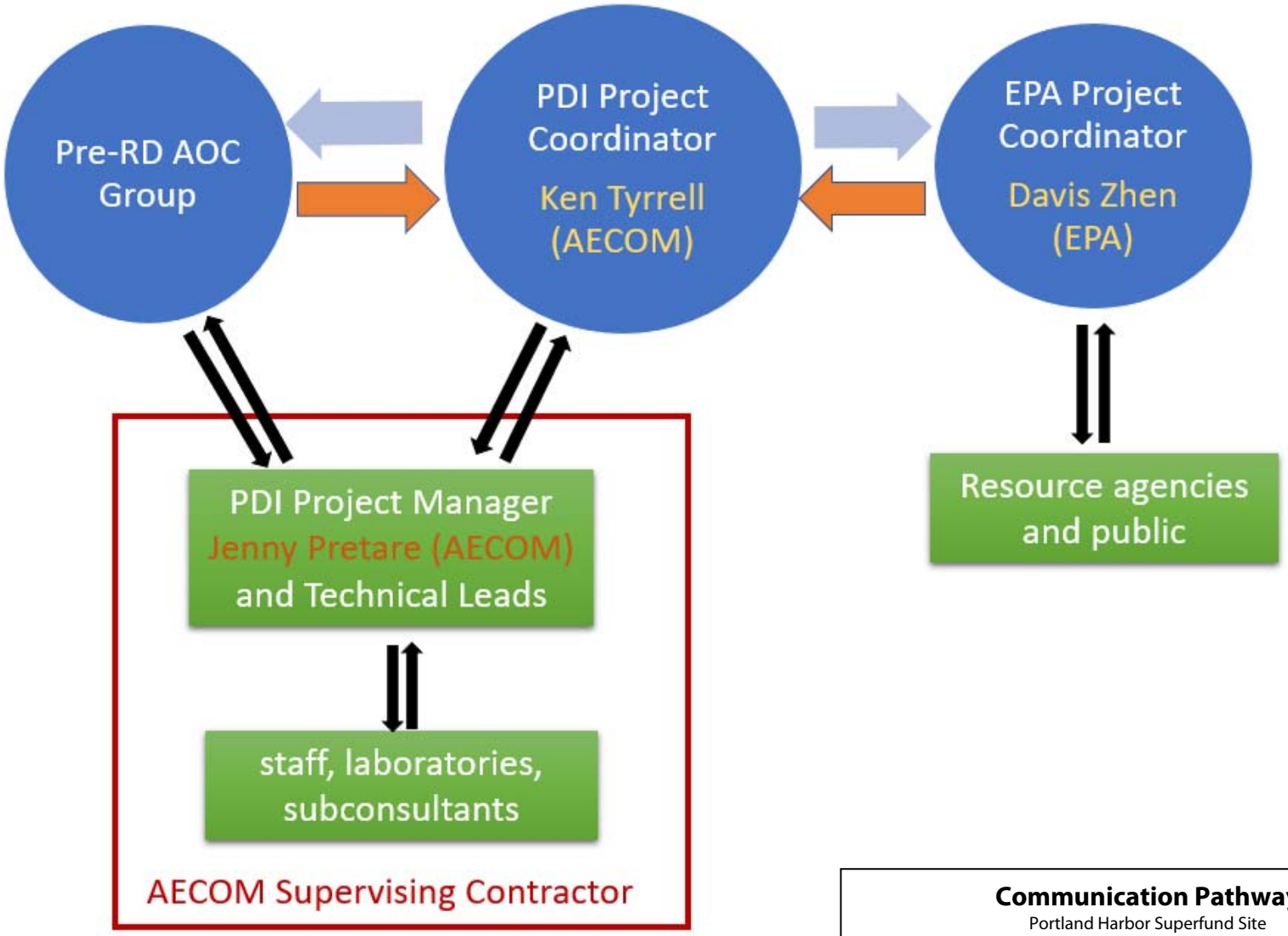

Notes: PDI = Pre-Remedial Design Investigation

Communication Pathway

Portland Harbor Superfund Site

PDI Quality Assurance Project Plan

Geosyntec consultants | AECOM | Figure 3

Seattle, Washington | March 23, 2018

APPENDIX A

Supplemental Laboratory Information: Laboratory Standard Operating Procedures and Quality Information

- Laboratory Document References
- ALS Environmental Kelso Certification
- ALS Environmental Kelso Quality Assurance Manual
- ALS Environmental Burlington Certification
- ALS Environmental Burlington Quality Assurance Manual
- ARI Certification
- ARI Quality Assurance Plan
- SGS AXYS Certification
- SGS AXYS Quality Assurance Manual
- TestAmerica Burlington Quality Assurance Manual
- TestAmerica Knoxville Certification
- TestAmerica Knoxville Quality Assurance Manual
- TestAmerica Sacramento Certification
- TestAmerica Sacramento Quality Assurance Manual
- TestAmerica Seattle Certification
- TestAmerica Seattle Quality Assurance Manual

Laboratory Document References

Laboratory	Laboratory Quality Assurance Plan (QAP) (Title, Date, Version)	Media	Method Reference	Laboratory SOP Identification/Revision/Date
ALS Environmental, Kelso, WA	ALSKL-QAM, 11/1/2016, Rev 25	Sediment	BEHP/EPA 8270D-LL	SVM-8270L / Rev 10 / 2/3/2017
			Chlorinated Pesticides/EPA 1699, HR-GC/MS/MS	SVM-PEST2 / Rev 5 / 2/3/2017
			PAHs/EPA 8270D-SIM	SVM-8270S / Rev 8 / 2/3/2017
			Total Solids/EPA 160.3M	GEN-160.3 / Rev 14 / 3/29/2017
			Tributyltin/Krone et al.	SOC-BUTYL / Rev 14 / 4/28/2017
			Auto-Sox Ext EPA 3541	EXT-3541 / Rev 10 / 4/10/1017
		Surface Water	BEHP/EPA 8270D-LL	SVM-8270L / Rev 10 / 2/3/2017
			Pentachlorophenol/EPA 8270D-LL	SVM-8270L / Rev 10 / 2/3/2017
			Liquid-Liquid Ext EPA 3520C	EXT-3520 / Rev 17 / 3/31/2017
			Tributyltin/Unger et. Al.	SOC-BUTYL / Rev 14 / 4/28/2017
		Fish Tissue	BEHP, Pentachlorophenol/EPA 8270D-SIM	SVM-8270S / Rev 8 / 2/3/2017
			Auto-Sox Ext EPA 3541	EXT-3541 / Rev 10 / 4/10/1017
			Arsenic/EPA 6020A	MET-6020 / Rev 17 / 3/3/2017
			Metals Tissue Digest Prep	MET-TDIG / Rev 5 / 5/11/2017
			Mercury/EPA 7471B	MET-7471 / Rev 18 / 3/15/2017
ALS Environmental, Burlington, Ontario, Canada	NA-QM-0002, v01 Quality Manual, March 1, 2018	Sediment	Chlorinated Pesticides/EPA 1699, HR-GC/MS	BU-TM-1103 v07 OCP/ 2/2/2017
Analytical Resources, Inc. (ARI), Tukwila, WA	Laboratory Quality Assurance Plan, Rev. 016, 7/27/2018	Surface Water	Pentachlorophenol/EPA 8041A	Chlorinated Phenols, EPA Method 8041A, SOP 412S, Rev 005.3, 12/3/2016
		Surface Water	Dissolved Organic Carbon/TOC/SM5310B	SOP 649S, Rev 03/25/15, 04/08/15
SGS AXYS, Sidney, BC, Canada	Quality Assurance/Quality Control (QA/QC) Policies and Procedures Manual; QDO-001 Rev No. 28; April 6, 2017	Surface Water (XAD / Filter)	Chlorinated Pesticides/EPA 1699	MLA-028 Rev.6, Ver.9 18/12/2015
			Hexachlorobenzene/EPA 1699	MLA-028 Rev.6, Ver.9 18/12/2015
			Dioxins/Furans/ EPA 1613B	MLA-017 Rev.20, Ver. 10 07/07/2017
			PCB Congeners/EPA 1668A	MLA-010 Rev.12, Ver.1, 28/06/2017
			PAHs EPA 8270D modified by EPA 1625	MLA-021 Rev.12, Ver. 4, 05/02/2015
		XAD/ Filter and equipment prep.	In-House	SLA-010 Flat Filter Preparation for Field Use Rev.4 - 01/15/2015 SLA-035 Cleaning of Glass Wool for XAD-2 Columns Rev.6 - 05/04/2017 SLA-048 Cleaning of XAD-2 Bulk Resin Rev.6 - 05/06/2015 SLA-049 Cleaning and Packing of Sampling Columns Rev.8 – 05/16/2016
		Fish Tissue	Homogenization (Tissue)	SLA-013 Procedures for Homogenization of Solids and Tissues Rev. 10 - 02/09/2018
			Chlorinated Pesticides/EPA 1699	MLA-028 Rev.6, Ver.9, 18/12/2015
			Hexachlorobenzene/EPA 1699	MLA-028 Rev.6, Ver.9, 18/12/2015
			Dioxins/Furans/ EPA 1613B	MLA-017 Rev.20, Ver.10 07/07/2017
			Gravimetric Lipids	SLA-020 - Gravimetric Lipid Determination by Weight of Extract - Rev.5 - 07-Feb-2018
			PBDEs/EPA 1614A	MLA-033 Rev.6, Ver.4, 19/12/2016
			PCB Congeners/EPA 1668 A/C	MLA-010 Rev.12, Ver.1, 28/06/2017
TestAmerica, Burlington, VT	Quality Assurance Manual, BR-QAM, Rev 7, 3/19/2018	Sediment	Atterberg Limits, ASTM D4318	BR-GT-011, Rev 8, 7/5/2016

Laboratory	Laboratory Quality Assurance Plan (QAP) (Title, Date, Version)	Media	Method Reference	Laboratory SOP Identification/Revision/Date
TestAmerica, Knoxville, TN	Quality Assurance Manual KX-QAM, Rev 4.3, 12/11/2017	Sediment	PCB Congeners/EPA 1668A	KNOX-ID-0013, Rev. 13, 11/16/15 (Analytical) KNOX-OP-0021, Rev. 7, 8/29/17 (Prep)
TestAmerica, Sacramento, CA	Quality Assurance Manual WS-QAM, Rev. 5.6, 5/19/2017	Sediment	Dioxins/Furans/ EPA 1613B	WS-ID-0007, Rev. 4.1, 6/15/2017 (Analytical) WS-IDP-0007, Rev. 3.3, 8/16/2017 (Prep)
TestAmerica, Seattle, WA	Quality Assurance Manual TA-QAM, Rev. 10, 3/8/2017	Sediment	BEHP/EPA 8270D-LL	TA-MS-0315, Rev. 4, 4/25/2018 (Analytical) TA-OP-0302, Rev. 18.1, 4/17/2018 (Prep)
			Grain Size/ASTM D7928 and D6913	TA-WC-0183, Rev. 5, 10/25/2016 (D422) revision in process TA-WC-0185, Rev. 5, 4/11/2017 (PSEP)
			Total Organic Carbon/EPA 9060	TA-WC-0192, Rev. 4, 10/4/2016
			Total Solids/ASTM D2216	TA-WC-0160, Rev. 20.1, 3/23/2018
			PCB Aroclors/EPA 8082A-LL	TA-GS-0351, Rev. 24, 10/17/2017 (Analytical) TA-OP-0302, Rev. 17, 10/17/2017 (Prep)
			PAHs/EPA 8270D-SIM	TA-MS-0315, Rev. 4, 4/25/2018 (Analytical) TA-OP-0367, Rev. 7, 12/29/2017 (Prep)
			As, Cd, Cu, Pb, Zn/EPA 6020B	TA-MT-0217, Rev. 27, 5/12/2017 (Analytical) TA-IP-0220, Rev. 10, 10/6/2015 (Prep)
			Hg/EPA 7471A	TA-MT-0202, Rev. 25, 11/1/2017
			TPH-diesel range/NWTPH-Dx	TA-GS-0339, Rev. 16, 4/11/2017 (Analytical) TA-OP-0302, Rev. 17, 10/17/2017 (Prep)
			Tributyltin/Krone et al.	TA-MS-0346, Rev. 14, 10/17/2017
		Surface Water	Ethylbenzene/EPA 82060C	TA-MV-0312, Rev. 28, 6/30/2017
			MCPP/EPA 8151A	TA-MS-0310, Rev. 18, 4/25/2017
			As, Cr, Cu, Zn/ EPA 6020B-LL	TA-MT-0217, Rev. 27, 5/12/2017 (Analytical) TA-IP-0205, Rev. 22, 7/18/2017 (Prep)
			Hardness (Calculation)	TA-WX-019 Rev 16, 3/29/2017
			Ca, Mg/EPA 6010C	TA-MT-0200, Rev. 27, 2/21/2017 (Analytical) TA-IP-0205, Rev. 22, 7/18/2017 (Prep)
			Total Suspended Solids/SM 2540D	TA-WC-0125, Rev. 16, 7/18/2017
			Total Dissolved Solids/SM 2540C	TA-WC-0125, Rev. 16, 7/18/2017
			Dissolved Organic Carbon/TOC/SM5310B	TA-WC-0156, Rev. 10, 1/8/2016
		Porewater	As, Mn/EPA 6020B-LL	TA-MT-0217, Rev. 27, 5/12/2017 (Analytical) TA-IP-0205, Rev. 22, 7/18/2017 (Prep)
			Bromide/EPA 300.0	TA-WC-0161, Rev 25, 10/16/2017
		Bulk Sediment	As, Mn/EPA 6020B	TA-MT-0217, Rev. 27, 5/12/2017 (Analytical) TA-IP-0205, Rev. 22, 7/18/2017 (Prep)

Acronyms:
BEHP = bis-(2-ethylhexyl)phthalate
EPA = U.S. Environmental Protection Agency
PAH = polycyclic aromatic hydrocarbon
PBDEs = polybrominated diphenyl ethers
PCB = polychlorinated biphenyls
QAP = quality assurance plan
SOP = standard operating procedure
TOC = total organic carbon

OREGON

Environmental Laboratory Accreditation Program

NELAP Recognized

ALS Environmental, Kelso

WA100010

1317 South 13th Ave.

Kelso, WA 98626

IS GRANTED APPROVAL BY ORELAP UNDER THE 2009 TNI STANDARDS, TO PERFORM ANALYSES ON ENVIRONMENTAL SAMPLES IN MATRICES AS LISTED BELOW :

Air	*Drinking Water*	*Non Potable Water*	*Solids and Chem. Waste*	*Tissue*
	Chemistry	Chemistry	Chemistry	Chemistry
	Microbiology	Microbiology		

AND AS RECORDED IN THE LIST OF APPROVED ANALYTES, METHODS, ANALYTICAL TECHNIQUES, AND FIELDS OF TESTING ISSUED CONCURRENTLY WITH THIS CERTIFICATE AND REVISED AS NECESSARY.

ACCREDITED STATUS DEPENDS ON SUCCESSFUL ONGOING PARTICIPATION IN THE PROGRAM AND CONTINUED COMPLIANCE WITH THE STANDARDS.

CUSTOMERS ARE URGED TO VERIFY THE LABORATORY'S CURRENT ACCREDITATION STATUS IN OREGON.

Christopher L. Redman

Christopher L. Redman, BA
Oregon State Public Health Laboratory
ORELAP Program Manager
7202 NE Evergreen Parkway, Suite 100
Hillsboro, OR 97124

EFFECTIVE DATE : 02/11/2018

EXPIRATION DATE : 02/10/2019

Certificate No : WA100010 - 017

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Environmental Laboratory Accreditation Program

ORELAP Fields of Accreditation

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ALS Environmental, Kelso

EPA CODE: WA01276

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Kelso, WA 98626

Issue Date: 6/15/2018 Expiration Date: 2/10/2019

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MATRIX	Reference	Code	Analyte	Code	Description
Biological Tissue					
	ALS Kelso LCP-PFC 4			60001505	ALS Kelso - Perfluorinated Compounds by HPLC-MS-MS
		6911	Perfluorobutane Sulfonate (PFBS)		
		9562	Perfluorodecane Sulfonate (PFDS)		
		6905	Perfluorodecanoic acid (PFDA)		
		6903	Perfluorododecanoic (PFDDA)		
		6908	Perfluoroheptanoic acid (PFHpA)		
		6910	Perfluorohexane Sulfonate (PFHS)		
		6913	Perfluorohexanoic acid (PFHXA)		
		6906	Perfluorononanoic acid (PFNA)		
		6912	Perfluorooctanoic acid		
		6909	Perfluorooctanoic Sulfonate (PFOS)		
		6914	Perfluoropentanoic acid (PFPEA)		
		6904	Perfluoroundecanoic acid (PFUDA)		
	CAS SOC-Butyl 10			60035009	Butyltin by GC/Flame Photometric Detector
		1201	Butyltin trichloride		
		1202	Dibutyltin dichloride		
		1209	Tetrabutyltin		
		1203	Tributyltin chloride		
	EPA 1630			10122608	Methyl Mercury by Purge & Trap Cold Vapor Atomic Fluorescence Spectrometry
		1205	Methyl Mercury		
	EPA 1631E			10237204	Mercury in Water by Oxidation, Purge & Trap, and Cold Vapor Atomic Fluorescence
		1095	Mercury		
	EPA 1632A			10123407	Arsenic in Water by Gaseous Hydride Atomic Absorption
		1010	Arsenic		
		1012	Arsenite (As+3)		
		6138	Dimethylarsinic acid (DMA)		
		1207	Monomethylarsonic acid (MMA)		
	EPA 3540C			10140202	Soxhlet Extraction
		8031	Extraction/Preparation		
	EPA 3541			10140406	Automated Soxhlet Extraction
		8031	Extraction/Preparation		
	EPA 3630C			10146802	Silica gel cleanup
		8031	Extraction/Preparation		

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EPA 3640A			10147203	Gel Preparation Cleanup
	8031	Extraction/Preparation		
EPA 365.3			10070607	Phosphorous - Colorimetric, two reagent.
	1908	Total Phosphate		
EPA 3660B			10148400	Sulfur cleanup
	8031	Extraction/Preparation		
EPA 3665A			10148808	Sulfuric Acid / permanganate Cleanup
	8031	Extraction/Preparation		
EPA 5035A			10284807	Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples
	8031	Extraction/Preparation		
EPA 6010C			10155803	ICP - AES
	1000	Aluminum		
	1005	Antimony		
	1010	Arsenic		
	1015	Barium		
	1020	Beryllium		
	1025	Boron		
	1030	Cadmium		
	1040	Chromium		
	1050	Cobalt		
	1055	Copper		
	1070	Iron		
	1075	Lead		
	1090	Manganese		
	1100	Molybdenum		
	1105	Nickel		
	1140	Selenium		
	1150	Silver		
	1175	Tin		
	1185	Vanadium		
	1190	Zinc		
EPA 6020A			10156408	Inductively Coupled Plasma-Mass Spectrometry
	1000	Aluminum		
	1005	Antimony		
	1010	Arsenic		
	1015	Barium		
	1020	Beryllium		
	1030	Cadmium		
	1040	Chromium		

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EPA 6020A	1050	Cobalt		
	1055	Copper		
	1070	Iron		
	1075	Lead		
	1090	Manganese		
	1100	Molybdenum		
	1105	Nickel		
	1140	Selenium		
	1150	Silver		
	1165	Thallium		
	1185	Vanadium		
	1190	Zinc		
EPA 7196A			10162400	Chromium Hexavalent colorimetric
	1045	Chromium VI		
EPA 7471B			10166402	Mercury by Cold Vapor Atomic Absorption
	1095	Mercury		
EPA 7742			10169207	Selenium by Borohydride Reduction and Atomic Absorption
	1140	Selenium		
EPA 8081B			10178800	Organochlorine Pesticides by GC/ECD
	8580	2,4'-DDD		
	8585	2,4'-DDE		
	8590	2,4'-DDT		
	7355	4,4'-DDD		
	7360	4,4'-DDE		
	7365	4,4'-DDT		
	7005	Alachlor		
	7025	Aldrin		
	7110	alpha-BHC (alpha-Hexachlorocyclohexane)		
	7115	beta-BHC (beta-Hexachlorocyclohexane)		
	7250	Chlordane (tech.)		
	7300	Chlorpyrifos		
	7240	cis-chlordane (alpha-Chlordane)		
	7925	cis-Nonachlor		
	7105	delta-BHC		
	7470	Dieldrin		
	7510	Endosulfan I		
	7515	Endosulfan II		
	7520	Endosulfan sulfate		
	7540	Endrin		
	7530	Endrin aldehyde		

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EPA 8081B	7535	Endrin ketone	
	7120	gamma-BHC (Lindane, gamma-HexachlorocyclohexanE)	
	7685	Heptachlor	
	7690	Heptachlor epoxide	
	6275	Hexachlorobenzene	
	4835	Hexachlorobutadiene	
	4840	Hexachloroethane	
	7725	Isodrin	
	7810	Methoxychlor	
	7870	Mirex	
	3890	Oxychlordane	
	8250	Toxaphene (Chlorinated camphene)	
	7245	trans-chlordane (gamma-Chlordane)	
	7910	trans-Nonachlor	
EPA 8082A			10179201 Polychlorinated Biphenyls (PCBs) by GC/ECD
	9095	2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ-206)	
	9090	2,2',3,3',4,4',5,5'-Octachlorobiphenyl (BZ-194)	
	9103	2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ-195)	
	9065	2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ-170)	
	9020	2,2',3,3',4,4'-Hexachlorobiphenyl (BZ-128)	
	9112	2,2',3,3',4,5',6,6'-Octachlorobiphenyl (BZ-201)	
	9116	2,2',3,3',4,5,6'-Heptachlorobiphenyl (BZ-174)	
	9114	2,2',3,3',4,5',6'-Heptachlorobiphenyl (BZ-177)	
	9120	2,2',3,3',4,6'-Hexachlorobiphenyl (BZ-132)	
	9133	2,2',3,4,4',5,5',6-Octachlorobiphenyl (BZ-203)	
	9134	2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ-180)	
	9075	2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ-183)	
	9025	2,2',3,4,4',5'-Hexachlorobiphenyl (BZ-138)	
	9139	2,2',3,4,4',6,6'-Heptachlorobiphenyl (BZ-184)	
	9080	2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ-187)	
	9030	2,2',3,4,5,5'-Hexachlorobiphenyl (BZ-141)	

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EPA 8082A

9151	2,2',3,4',5',6-Hexachlorobiphenyl (BZ-149)
8975	2,2',3,4,5'-Pentachlorobiphenyl (BZ-87)
9155	2,2',3,4',5-Pentachlorobiphenyl (BZ-90)
9154	2,2',3,4',5'-Pentachlorobiphenyl (BZ-97)
9035	2,2',3,5,5',6-Hexachlorobiphenyl (BZ-151)
9166	2,2',3,5',6-Pentachlorobiphenyl (BZ-95)
8945	2,2',3,5'-Tetrachlorobiphenyl (BZ-44)
9040	2,2',4,4',5,5'-Hexachlorobiphenyl (BZ-153)
9174	2,2',4,4',5,6'-Hexachlorobiphenyl (BZ-154)
9175	2,2',4,4',5-Pentachlorobiphenyl (BZ-99)
8980	2,2',4,5,5'-Pentachlorobiphenyl (BZ-101)
8950	2,2',4,5'-Tetrachlorobiphenyl (BZ-49)
8955	2,2',5,5'-Tetrachlorobiphenyl (BZ-52)
8930	2,2',5-Trichlorobiphenyl (BZ-18)
9085	2,3,3',4,4',5,5'-Heptachlorobiphenyl (BZ-189)
9050	2,3,3',4,4',5-Hexachlorobiphenyl (BZ-156)
9045	2,3,3',4,4',5'-Hexachlorobiphenyl (BZ-157)
9193	2,3,3',4,4',6-Hexachlorobiphenyl (BZ-158)
8985	2,3,3',4,4'-Pentachlorobiphenyl (BZ-105)
8990	2,3,3',4',6-Pentachlorobiphenyl (BZ-110)
9207	2,3,3',4'-Tetrachlorobiphenyl (BZ-56)
9055	2,3',4,4',5,5'-Hexachlorobiphenyl (BZ-167)
9218	2,3',4,4',5',6-Hexachlorobiphenyl (BZ-168)
9005	2,3,4,4',5-Pentachlorobiphenyl (BZ-114)
8995	2,3',4,4',5-Pentachlorobiphenyl (BZ-118)
9000	2,3',4,4',5'-Pentachlorobiphenyl (BZ-123)
9220	2,3',4,4',6-Pentachlorobiphenyl (BZ-119)
9221	2,3,4,4'-Tetrachlorobiphenyl (BZ-60)
8960	2,3',4,4'-Tetrachlorobiphenyl (BZ-66)
9230	2,3',4',5-Tetrachlorobiphenyl (BZ-70)
9239	2,3',4'-Trichlorobiphenyl (BZ-33)

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EPA 8082A	8920	2,3-Dichlorobiphenyl (BZ-5)			
	9250	2,4,4',5-Tetrachlorobiphenyl (BZ-74)			
	9252	2,4,4'-Trichlorobiphenyl (BZ-28)			
	8940	2,4',5-Trichlorobiphenyl (BZ-31)			
	8915	2-Chlorobiphenyl (BZ-1)			
	9060	3,3',4,4',5,5'-Hexachlorobiphenyl (BZ-169)			
	9015	3,3',4,4',5-Pentachlorobiphenyl (BZ-126)			
	8965	3,3',4,4'-Tetrachlorobiphenyl (BZ-77)			
	8970	3,4,4',5-Tetrachlorobiphenyl (BZ-81)			
	9266	3,4,4'-Trichlorobiphenyl (BZ-37)			
	8880	Aroclor-1016 (PCB-1016)			
	8885	Aroclor-1221 (PCB-1221)			
	8890	Aroclor-1232 (PCB-1232)			
	8895	Aroclor-1242 (PCB-1242)			
	8900	Aroclor-1248 (PCB-1248)			
	8905	Aroclor-1254 (PCB-1254)			
	8910	Aroclor-1260 (PCB-1260)			
	8912	Aroclor-1262 (PCB-1262)			
	8913	Aroclor-1268 (PCB-1268)			
	9105	Decachlorobiphenyl (BZ-209)			
EPA 8270D SIM			10242509	Semivolatile Organic compounds by GC/MS Selective Ion Monitoring	
	5155	1,2,4-Trichlorobenzene			
	4610	1,2-Dichlorobenzene			
	6221	1,2-Diphenylhydrazine			
	4615	1,3-Dichlorobenzene			
	4620	1,4-Dichlorobenzene			
	6380	1-Methylnaphthalene			
	9501	1-Methylphenanthrene			
	6852	2,3,5-Trimethylnaphthalene			
	6835	2,4,5-Trichlorophenol			
	6840	2,4,6-Trichlorophenol			
	6000	2,4-Dichlorophenol			
	6130	2,4-Dimethylphenol			
	6175	2,4-Dinitrophenol			
	6185	2,4-Dinitrotoluene (2,4-DNT)			
	6188	2,6-Dimethylnaphthalene			
	6190	2,6-Dinitrotoluene (2,6-DNT)			
	5795	2-Chloronaphthalene			
	5800	2-Chlorophenol			
	6360	2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)			
	6385	2-Methylnaphthalene			

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EPA 8270D SIM

6400	2-Methylphenol (o-Cresol)
6460	2-Nitroaniline
6490	2-Nitrophenol
6412	3 & 4 Methylphenol
5660	4-Bromophenyl phenyl ether (BDE-3)
5700	4-Chloro-3-methylphenol
5825	4-Chlorophenyl phenylether
6410	4-Methylphenol (p-Cresol)
6470	4-Nitroaniline
6500	4-Nitrophenol
5500	Acenaphthene
5505	Acenaphthylene
5555	Anthracene
5575	Benzo(a)anthracene
5580	Benzo(a)pyrene
5605	Benzo(e)pyrene
5590	Benzo(g,h,i)perylene
9309	Benzo(j)fluoranthene
5600	Benzo(k)fluoranthene
5585	Benzo[b]fluoranthene
5630	Benzyl alcohol
5640	Biphenyl
5760	bis(2-Chloroethoxy)methane
5765	bis(2-Chloroethyl) ether
5780	bis(2-Chloroisopropyl) ether
5670	Butyl benzyl phthalate
5680	Carbazole
5855	Chrysene
6065	Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate, DEHP)
5895	Dibenz(a,h) anthracene
5905	Dibenzofuran
6070	Diethyl phthalate
6135	Dimethyl phthalate
5925	Di-n-butyl phthalate
6200	Di-n-octyl phthalate
6265	Fluoranthene
6270	Fluorene
6275	Hexachlorobenzene
4835	Hexachlorobutadiene
4840	Hexachloroethane
6315	Indeno(1,2,3-cd) pyrene
6320	Isophorone
5005	Naphthalene

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EPA 8270D SIM	5015	Nitrobenzene
	6525	n-Nitrosodiethylamine
	6545	n-Nitrosodi-n-propylamine
	6535	n-Nitrosodiphenylamine
	6605	Pentachlorophenol
	6608	Perylene
	6615	Phenanthrene
	6625	Phenol
	6665	Pyrene

Drinking Water

ALS Kelso LCP-PFC 4			60001505	ALS Kelso - Perfluorinated Compounds by HPLC-MS-MS
	199	10:2 Fluorotelomer sulfonate (10:2FTS)		
	4846	2-(N-Ethyl-perfluorooctane sufonamido) acetic acid (EtFOSAA)		
	4847	2-(N-Methyl-perfluorooctane sulfonamido) acetic acid (MeFOSAA)		
	198	2,3,3,3-Tetrafluoro-2-(1,1,2,2,3,3,3-heptafluoropropoxy)propanoic acid (HFPO-DA)		
	9437	4:2 Fluorotelomer sulfonate (4:2FTS)		
	6457	6:2 Fluorotelomersulfonate (6:2FTS)		
	6461	8:2 Fluorotelomersulfonate (8:2FTS)		
	9395	N-Ethylperfluorooctanesulfonamide (EtFOSA)		
	9431	N-Ethylperfluorooctanesulfonamidoethanol (EtFOSE)		
	9433	N-Methylperfluorooctanesulfonamide (MeFOSA)		
	9434	N-Methylperfluorooctanesulfonamidoethanol (MeFOSA)		
	6911	Perfluorobutane Sulfonate (PFBS)		
	6915	Perfluorobutyric acid (PFBA)		
	9562	Perfluorodecane Sulfonate (PFDS)		
	6905	Perfluorodecanoic acid (PFDA)		
	6903	Perfluorododecanoic (PFDDA)		
	9470	Perfluoroheptanesulfonic acid (PFHpS)		
	6908	Perfluoroheptanoic acid (PFHpA)		
	6910	Perfluorohexane Sulfonate (PFHS)		
	6913	Perfluorohexanoic acid (PFHXA)		
	6906	Perfluorononanoic acid (PFNA)		
	6917	Perfluorooctane Sulfonamide (PFOSA)		
	6912	Perfluorooctanoic acid		
	6909	Perfluorooctanoic Sulfonate (PFOS)		

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ALS Kelso LCP-PFC 4	6914	Perfluoropentanoic acid (PFPEA)		
	6902	Perfluorotetradecanoic acid (PFTDA)		
	9563	Perfluorotridecanoic (PFTRIA)		
	6904	Perfluoroundecanoic acid (PFUDA)		
EPA 180.1			10011402	Turbidity - Nephelometric
	2055	Turbidity		
EPA 200.7 4.4			10013806	ICP - metals
	1000	Aluminum		
	1005	Antimony		
	1015	Barium		
	1020	Beryllium		
	1025	Boron		
	1030	Cadmium		
	1035	Calcium		
	1040	Chromium		
	1055	Copper		
	1760	Hardness (calc.)		
	1070	Iron		
	1085	Magnesium		
	1090	Manganese		
	1100	Molybdenum		
	1105	Nickel		
	1125	Potassium		
	1990	Silica as SiO2		
	1150	Silver		
	1155	Sodium		
	1185	Vanadium		
	1190	Zinc		
EPA 200.8 5.4			10014605	Metals by ICP-MS
	1000	Aluminum		
	1005	Antimony		
	1010	Arsenic		
	1015	Barium		
	1020	Beryllium		
	1030	Cadmium		
	1040	Chromium		
	1055	Copper		
	1075	Lead		
	1090	Manganese		
	1105	Nickel		
	1140	Selenium		
	1150	Silver		

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EPA 200.8 5.4	1165	Thallium		
EPA 245.1 3			10036609	Mercury by Cold Vapor Atomic Absorption
	1095	Mercury		
EPA 300.0 2.1			10053200	Methods for the Determination of Inorganic Substances in Environmental Samples
	1575	Chloride		
	1730	Fluoride		
	1810	Nitrate as N		
	1820	Nitrate-nitrite		
	1840	Nitrite as N		
	2000	Sulfate		
EPA 300.1			10053608	Ion chromatography - anions.
	1535	Bromate		
	1540	Bromide		
	1570	Chlorate		
	1595	Chlorite		
EPA 314.0			10055400	Perchlorate in Drinking Water by Ion Chromatography
	1895	Perchlorate		
EPA 335.4			10061208	Methods for the Determination of Inorganic Substances in Environmental Samples
	1645	Total cyanide		
EPA 353.2 2			10067604	Nitrate/Nitrite Nitrogen - Automated, Cadmium
	1810	Nitrate as N		
	1823	Nitrate plus Nitrite as N		
	1840	Nitrite as N		
EPA 504.1			10082607	EDB/DBCP/TCP micro-extraction, GC/ECD
	5180	1,2,3-Trichloropropane		
	4570	1,2-Dibromo-3-chloropropane (DBCP)		
	4585	1,2-Dibromoethane (EDB, Ethylene dibromide)		
EPA 524.2 4.1			10088809	Volatile Organic Compounds GC/MS Capillary Column
	5105	1,1,1,2-Tetrachloroethane		
	5160	1,1,1-Trichloroethane		
	5110	1,1,2,2-Tetrachloroethane		
	5165	1,1,2-Trichloroethane		
	4630	1,1-Dichloroethane		
	4640	1,1-Dichloroethylene		
	4670	1,1-Dichloropropene		

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Drinking Water

EPA 524.2 4.1	5150	1,2,3-Trichlorobenzene
	5180	1,2,3-Trichloropropane
	5155	1,2,4-Trichlorobenzene
	5210	1,2,4-Trimethylbenzene
	4570	1,2-Dibromo-3-chloropropane (DBCP)
	4610	1,2-Dichlorobenzene
	4635	1,2-Dichloroethane (Ethylene dichloride)
	4655	1,2-Dichloropropane
	5215	1,3,5-Trimethylbenzene
	4615	1,3-Dichlorobenzene
	4660	1,3-Dichloropropane
	4620	1,4-Dichlorobenzene
	4665	2,2-Dichloropropane
	4535	2-Chlorotoluene
	4540	4-Chlorotoluene
	4910	4-Isopropyltoluene (p-Cymene)
	4375	Benzene
	4385	Bromobenzene
	4390	Bromochloromethane
	4395	Bromodichloromethane
	4397	Bromoethane (Ethyl Bromide)
	4400	Bromoform
	4455	Carbon tetrachloride
	4475	Chlorobenzene
	4575	Chlorodibromomethane
	4485	Chloroethane (Ethyl chloride)
	4505	Chloroform
	4645	cis-1,2-Dichloroethylene
	4680	cis-1,3-Dichloropropene
	4595	Dibromomethane (Methylene bromide)
	4625	Dichlorodifluoromethane (Freon-12)
	4765	Ethylbenzene
	4835	Hexachlorobutadiene
	4900	Isopropylbenzene (Cumene)
	5240	m+p-xylene
	4950	Methyl bromide (Bromomethane)
	4960	Methyl chloride (Chloromethane)
	5000	Methyl tert-butyl ether (MTBE)
	4975	Methylene chloride (Dichloromethane)
	5005	Naphthalene
	4435	n-Butylbenzene
	5090	n-Propylbenzene
	5250	o-Xylene

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EPA 524.2 4.1	4440	sec-Butylbenzene		
	5100	Styrene		
	4445	tert-Butylbenzene		
	5115	Tetrachloroethylene (Perchloroethylene)		
	5140	Toluene		
	5205	Total trihalomethanes		
	4700	trans-1,2-Dichloroethylene		
	4685	trans-1,3-Dichloropropylene		
	5170	Trichloroethene (Trichloroethylene)		
	5175	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)		
	5235	Vinyl chloride		
	5260	Xylene (total)		
EPA 537 1.1			10091675	Perfluorinated Alkyl Acids in Drinking Water by SPE and LC/MS/MS
	4846	2-(N-Ethyl-perfluorooctane sufonamido) acetic acid (EtFOSAA)		
	4847	2-(N-Methyl-perfluorooctane sulfonamido) acetic acid (MeFOSAA)		
	6911	Perfluorobutane Sulfonate (PFBS)		
	6905	Perfluorodecanoic acid (PFDA)		
	6903	Perfluorododecanoic (PFDDA)		
	6908	Perfluoroheptanoic acid (PFHpA)		
	6910	Perfluorohexane Sulfonate (PFHS)		
	6913	Perfluorohexanoic acid (PFHXA)		
	6906	Perfluorononanoic acid (PFNA)		
	6912	Perfluorooctanoic acid		
	6909	Perfluorooctanoic Sulfonate (PFOS)		
	6902	Perfluorotetradecanoic acid (PFTDA)		
	9563	Perfluorotridecanoic (PFTRIA)		
	6904	Perfluoroundecanoic acid (PFUDA)		
EPA 552.2 1			10095804	Haloacetic Acid/Dalapon, Liquid/Liquid Extraction, Derivitization and GC/ECD
	9312	Bromoacetic acid		
	9315	Bromochloroacetic acid		
	9336	Chloroacetic acid		
	9357	Dibromoacetic acid		
	9360	Dichloroacetic acid		
	9414	Total haloacetic acids		
	9642	Trichloroacetic acid		
SM 2120 B 20th ED			20224004	Color by Visual Comparison
	1605	Color		
SM 2320 B 20th ED			20045209	Alkalinity by Titration
	1505	Alkalinity as CaCO3		

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SM 2340 B 20th ED	1750	Hardness	20046202	Hardness by calculation
SM 2510 B 20th ED	1610	Conductivity	20048208	Conductivity by Probe
SM 2540 C 20th ED	1955	Residue-filterable (TDS)	20050004	Total Dissolved Solids
SM 4500-Cl F 20th ED	1945	Residual free chlorine	20080506	Residual Chlorine by DPD Ferrous Titration
SM 4500-F⁻ C 20th ED	1730	Fluoride	20102005	Fluoride by Ion Selective Electrode
SM 4500-H+ B 20th ED	1900	pH	20104807	pH by Probe
SM 4500-P E 20th ED	1870	Orthophosphate as P	20123802	Phosphorus by Ascorbic Acid Reduction
SM 5310 C 20th ED	2040	Total organic carbon	20138403	Total Organic Carbon by Persulfate-Ultraviolet Oxidation Method
SM 9215 B (PCA) 20th ED	2555	Heterotrophic plate count	20181208	Heterotrophic Plate Count Pour Plate (plate count agar): Heterotrophic Bacteria
SM 9223 B (Colilert®) 20th ED	2525	Escherichia coli	20212208	Chromogenic/Fluorogenic Qualitative (Colilert®): Total Coliform and E. coli
	2500	Total coliforms		
SM 9223 B (Colilert®-18 Quanti-Tray®) 20th ED	2525	Escherichia coli	20213201	Chromogenic/Fluorogenic Quantitative (Colilert®-18): Total Coliform and E. coli
SM 9223 B (Colilert®-18) 20th ED	2525	Escherichia coli	20214204	Chromogenic/Fluorogenic Qualitative (Colilert®-18): Total Coliform and E. coli
	2500	Total coliforms		
SM 9223 B (Colilert®-18) 21st ED	2525	Escherichia coli	20214408	Chromogenic/Fluorogenic Qualitative (Colilert®-18): Total Coliform and E. coli
	2500	Total coliforms		
SM 9223 B (Colilert-18® Multiple-tube) 20th ED	2530	Fecal coliforms	20229407	Chromogenic/Fluorogenic Quantitative: Total Coliform and E. coli

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AK101 GRO			90015002	Determination of Gasoline Range Organics - Alaska Department of Environmental Conservation
	9408	Gasoline range organics (GRO)		
AK102 DRO			90015206	Determination of Diesel Range Organics - Alaska Department of Environmental Conservation
	9369	Diesel range organics (DRO)		
AK103 RRO			90015400	Determination of Residual Range Organics - Alaska Department of Environmental Conservation
	9499	Motor Oil		
ALS Kelso LCP-Acryl 1			60001712	ALS Kelso - Acrylamide by HPLC/MS/MS
	4330	Acrylamide		
ALS Kelso LCP-PFC 4			60001505	ALS Kelso - Perfluorinated Compounds by HPLC-MS-MS
	199	10:2 Fluorotelomer sulfonate (10:2FTS)		
	4846	2-(N-Ethyl-perfluorooctane sufonamido) acetic acid (EtFOSAA)		
	4847	2-(N-Methyl-perfluorooctane sulfonamido) acetic acid (MeFOSAA)		
	198	2,3,3,3-Tetrafluoro-2-(1,1,2,2,3,3,3-heptafluoropropoxy)propanoic acid (HFPO-DA)		
	9437	4:2 Fluorotelomer sulfonate (4:2FTS)		
	6457	6:2 Fluorotelomersulfonate (6:2FTS)		
	6461	8:2 Fluorotelomersulfonate (8:2FTS)		
	9395	N-Ethylperfluorooctanesulfonamide (EtFOSA)		
	9431	N-Ethylperfluorooctanesulfonamidoethanol (EtFOSE)		
	9433	N-Methylperfluorooctanesulfonamide (MeFOSA)		
	9434	N-Methylperfluorooctanesulfonamidoethanol (MeFOSA)		
	6911	Perfluorobutane Sulfonate (PFBS)		
	6915	Perfluorobutyric acid (PFBA)		
	9562	Perfluorodecane Sulfonate (PFDS)		
	6905	Perfluorodecanoic acid (PFDA)		
	6903	Perfluorododecanoic (PFDDA)		
	9470	Perfluoroheptanesulfonic acid (PFHpS)		
	6908	Perfluoroheptanoic acid (PFHpA)		
	6910	Perfluorohexane Sulfonate (PFHS)		
	6913	Perfluorohexanoic acid (PFHXA)		
	6906	Perfluorononanoic acid (PFNA)		

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ALS Kelso LCP-PFC 4	6917	Perfluorooctane Sulfonamide (PFOSA)		
	6912	Perfluorooctanoic acid		
	6909	Perfluorooctanoic Sulfonate (PFOS)		
	6914	Perfluoropentanoic acid (PFPEA)		
	6902	Perfluorotetradecanoic acid (PFTDA)		
	9563	Perfluorotridecanoic (PFTRIA)		
	6904	Perfluoroundecanoic acid (PFUDA)		
ALS Kelso SOC-8151M 11			60001754	ALS Kelso - Chlorinated Pesticides by GC/ECD
	6730	2,3,4,5-Tetrachlorophenol		
	6740	2,3,5,6-Tetrachlorophenol		
	6835	2,4,5-Trichlorophenol		
	6840	2,4,6-Trichlorophenol		
	6818	3,4,5-Trichlorophenol		
	5997	3,4-Dichlorophenol		
	6397	3,5-Dichlorophenol		
	6605	Pentachlorophenol		
ASTM D1426-08B			30007397	Ammonia by Titration
	1515	Ammonia as N		
ASTM D1426-98B			30023406	Ammonia by Titration
	1515	Ammonia as N		
ASTM D3590-02(06)A			30016819	Total Kjeldahl Nitrogen in Water
	1795	Kjeldahl nitrogen - total		
ASTM D3590-89B			30016809	Total Kjeldahl Nitrogen in Water
	1795	Kjeldahl nitrogen - total		
ASTM D4129 05			30018907	Total and Organic Carbon in Water by High Temperature Oxidation and by Coulometric Detection
	2040	Total organic carbon		
Brooks Rand SOP BR-0002 (1631) method ID# 1225	4930	Methanol	60002804	Selected HAPS in Condensates by GC/FID
CAS PestMS2 (1699 modified) 2			60035101	Chlorinated Pesticides by GC/MS/MS
	8580	2,4'-DDD		
	8585	2,4'-DDE		
	8590	2,4'-DDT		
	7355	4,4'-DDD		
	7360	4,4'-DDE		
	7365	4,4'-DDT		
	7025	Aldrin		
	7110	alpha-BHC (alpha-Hexachlorocyclohexane)		

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CAS PestMS2 (1699 modified) 2	7115	beta-BHC (beta-Hexachlorocyclohexane)		
	7300	Chlorpyrifos		
	7240	cis-chlordane (alpha-Chlordane)		
	7925	cis-Nonachlor		
	7105	delta-BHC		
	7470	Dieldrin		
	7510	Endosulfan I		
	7515	Endosulfan II		
	7520	Endosulfan sulfate		
	7540	Endrin		
	7530	Endrin aldehyde		
	7535	Endrin ketone		
	7120	gamma-BHC (Lindane, gamma-HexachlorocyclohexanE)		
	7685	Heptachlor		
	7690	Heptachlor epoxide		
	6275	Hexachlorobenzene		
	7725	Isodrin		
	7810	Methoxychlor		
	7870	Mirex		
	5553	Octachlorostyrene		
	3890	Oxychlordane		
	7245	trans-chlordane (gamma-Chlordane)		
	7910	trans-Nonachlor		
CAS SOC-Butyl 10			60035009	Butyltin by GC/Flame Photometric Detector
	1201	Butyltin trichloride		
	1202	Dibutyltin dichloride		
	1209	Tetrabutyltin		
	1203	Tributyltin chloride		
Enterolert®			60030208	Chromogenic/Fluorogenic Quantitative (Enterolert®): Enterococci
	2520	Enterococci		
EPA 1020A			10117007	Ignitability Setaflash Closed-cup Method
	1780	Ignitability		
EPA 160.4			10256801	Total Volatile Solids, ignition @ 550 C.
	4075	Vol. residue, density, water & solids content of coatings		
EPA 1630			10122608	Methyl Mercury by Purge & Trap Cold Vapor Atomic Fluorescence Spectrometry
	1205	Methyl Mercury		

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Non-Potable Water

EPA 1631E			10237204	Mercury in Water by Oxidation, Purge & Trap, and Cold Vapor Atomic Fluorescence
	1095	Mercury		
EPA 1632A			10123407	Arsenic in Water by Gaseous Hydride Atomic Absorption
	1010	Arsenic		
	1012	Arsenite (As+3)		
	6138	Dimethylarsinic acid (DMA)		
	1207	Monomethylarsonic acid (MMA)		
EPA 1650C			10125005	Adsorbable Organic Halides by Adsorption and Coulometric Titration
	4345	Adsorbable organic halogens (AOX)		
EPA 1653A			10125403	Chlorinated Phenolics by "In Situ" Acetylation and GC/MS
	6735	2,3,4,6-Tetrachlorophenol		
	6835	2,4,5-Trichlorophenol		
	6840	2,4,6-Trichlorophenol		
	6805	3,4,5-Trichlorocatechol		
	6815	3,4,5-Trichloroguaiacol		
	6810	3,4,6-Trichlorocatechol		
	6820	3,4,6-Trichloroguaiacol		
	6825	4,5,6-Trichloroguaiacol		
	6605	Pentachlorophenol		
	6720	Tetrachlorocatechol		
	6725	Tetrachloroguaiacol		
	6875	Trichlorosyringol		
EPA 1664A (HEM)			10127807	N-Hexane Extractable Material (Oil and Grease) by Extraction and Gravimetry
	1803	n-Hexane Extractable Material (O&G)		
	1860	Oil & Grease		
EPA 1694 1.0			10132908	Pharmaceuticals and Personal Care Products by HPLC/MS/MS
	6769	17a-estradiol		
	6771	17a-ethynylestradiol		
	6773	17ß-estradiol		
	7052	Androstenedione		
	7065	Atrazine		
	9301	Bisphenol A		
	7194	Carbamazepine		
	7375	DEET		
	7086	Diazepam		
	7087	Diclofenac		
	7253	Estriol		
	7254	Estrone		
	7257	Fluoxetine		

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EPA 1694 1.0				
	7258	Gemfibrozil		
	7219	Hydrocodone		
	7259	Ibuprofen		
	7719	Iopromide		
	7313	Meprobamate		
	7316	Methadone		
	7269	Naproxen		
	7317	Oxybenzone		
	7318	Pentoxifylline		
	7284	Progesterone		
	9585	Salicylic acid		
	7297	Sulfamethoxazole		
	7301	Testosterone		
	7304	Triclosan		
	7307	Trimethoprim		
EPA 1694 Modified			812	Pharmaceuticals and Personal Care Products by HPLC/MS/MS
	4307	Acetominophen		
	5675	Caffeine		
	6075	Diethylstilbestrol		
EPA 180.1			10011402	Turbidity - Nephelometric
	2055	Turbidity		
EPA 200.7 4.4			10013806	ICP - metals
	1000	Aluminum		
	1005	Antimony		
	1010	Arsenic		
	1015	Barium		
	1020	Beryllium		
	1025	Boron		
	1030	Cadmium		
	1035	Calcium		
	1040	Chromium		
	1050	Cobalt		
	1055	Copper		
	1760	Hardness (calc.)		
	1070	Iron		
	1075	Lead		
	1085	Magnesium		
	1090	Manganese		
	1100	Molybdenum		
	1105	Nickel		
	1125	Potassium		
	1140	Selenium		

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EPA 200.7 4.4				
	1990	Silica as SiO2		
	1150	Silver		
	1155	Sodium		
	1160	Strontium		
	1175	Tin		
	1180	Titanium		
	1185	Vanadium		
	1190	Zinc		
EPA 200.8 5.4			10014605	Metals by ICP-MS
	1000	Aluminum		
	1005	Antimony		
	1010	Arsenic		
	1015	Barium		
	1020	Beryllium		
	1030	Cadmium		
	1040	Chromium		
	1050	Cobalt		
	1055	Copper		
	1070	Iron		
	1075	Lead		
	1090	Manganese		
	1100	Molybdenum		
	1105	Nickel		
	1140	Selenium		
	1150	Silver		
	1165	Thallium		
	3035	Uranium		
	1185	Vanadium		
	1190	Zinc		
EPA 245.1 3			10036609	Mercury by Cold Vapor Atomic Absorption
	1095	Mercury		
EPA 300.0 2.1			10053200	Methods for the Determination of Inorganic Substances in Environmental Samples
	1540	Bromide		
	1575	Chloride		
	1730	Fluoride		
	1810	Nitrate as N		
	1820	Nitrate-nitrite		
	1840	Nitrite as N		
	2000	Sulfate		

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EPA 3005A			10133207	Acid Digestion of waters for Total Recoverable or Dissolved Metals
	8031	Extraction/Preparation		
EPA 3010A			10133605	Acid Digestion of Aqueous samples and Extracts for Total Metals
	8031	Extraction/Preparation		
EPA 3020A			10134404	Acid Digestion of Aqueous samples and Extracts for Total Metals for Analysis by GFAA
	8031	Extraction/Preparation		
EPA 314.0			10055400	Perchlorate in Drinking Water by Ion Chromatography
	1895	Perchlorate		
EPA 330.4			10059004	Residual Chlorine - DPD-FAS Titration
	1940	Total residual chlorine		
EPA 335.4			10061208	Methods for the Determination of Inorganic Substances in Environmental Samples
	1645	Total cyanide		
EPA 3510C			10138202	Separatory Funnel Liquid-liquid extraction
	8031	Extraction/Preparation		
EPA 3511			10279808	Organic Compounds in Water by Microextraction
	8031	Extraction/Preparation		
EPA 3520C			10139001	Continuous Liquid-liquid extraction
	8031	Extraction/Preparation		
EPA 353.2 2			10067604	Nitrate/Nitrite Nitrogen - Automated, Cadmium
	1810	Nitrate as N		
	1823	Nitrate plus Nitrite as N		
	1840	Nitrite as N		
EPA 3535A			10139409	Solid-Phase Extraction (SPE)
	8031	Extraction/Preparation		
EPA 3610B			10144602	Alumina Cleanup
	8031	Extraction/Preparation		
EPA 3620C			10146006	Florisil Cleanup
	8031	Extraction/Preparation		
EPA 3630C			10146802	Silica gel cleanup
	8031	Extraction/Preparation		
EPA 3640A			10147203	Gel Preparation Cleanup
	8031	Extraction/Preparation		

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EPA 365.3			10070607	Phosphorous - Colorimetric, two reagent.
	1870	Orthophosphate as P		
	1908	Total Phosphate		
EPA 3660B			10148400	Sulfur cleanup
	8031	Extraction/Preparation		
EPA 3665A			10148808	Sulfuric Acid / permanganate Cleanup
	8031	Extraction/Preparation		
EPA 420.1			10079206	Phenolics - Spectrophotometric, manual.
	1905	Total phenolics		
EPA 5030B			10153409	Purge and trap for aqueous samples
	8031	Extraction/Preparation		
EPA 6010C			10155803	ICP - AES
	1000	Aluminum		
	1005	Antimony		
	1010	Arsenic		
	1015	Barium		
	1020	Beryllium		
	1025	Boron		
	1030	Cadmium		
	1035	Calcium		
	1040	Chromium		
	1050	Cobalt		
	1055	Copper		
	1070	Iron		
	1075	Lead		
	1085	Magnesium		
	1090	Manganese		
	1100	Molybdenum		
	1105	Nickel		
	1125	Potassium		
	1140	Selenium		
	1150	Silver		
	1155	Sodium		
	1160	Strontium		
	1165	Thallium		
	1175	Tin		
	1180	Titanium		
	1185	Vanadium		
	1190	Zinc		

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EPA 6020A		10156408	Inductively Coupled Plasma-Mass Spectrometry
1000	Aluminum		
1005	Antimony		
1010	Arsenic		
1015	Barium		
1020	Beryllium		
1030	Cadmium		
1040	Chromium		
1050	Cobalt		
1055	Copper		
1070	Iron		
1075	Lead		
1090	Manganese		
1100	Molybdenum		
1105	Nickel		
1140	Selenium		
1150	Silver		
1160	Strontium		
1165	Thallium		
3035	Uranium		
1185	Vanadium		
1190	Zinc		
EPA 608		10103603	Organochlorine Pesticides & PCBs by GC/ECD
7355	4,4'-DDD		
7360	4,4'-DDE		
7365	4,4'-DDT		
7025	Aldrin		
7110	alpha-BHC (alpha-Hexachlorocyclohexane)		
8880	Aroclor-1016 (PCB-1016)		
8885	Aroclor-1221 (PCB-1221)		
8890	Aroclor-1232 (PCB-1232)		
8895	Aroclor-1242 (PCB-1242)		
8900	Aroclor-1248 (PCB-1248)		
8905	Aroclor-1254 (PCB-1254)		
8910	Aroclor-1260 (PCB-1260)		
7115	beta-BHC (beta-Hexachlorocyclohexane)		
7250	Chlordane (tech.)		
7105	delta-BHC		
7470	Dieldrin		
7510	Endosulfan I		
7515	Endosulfan II		

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EPA 608			
	7520	Endosulfan sulfate	
	7540	Endrin	
	7530	Endrin aldehyde	
	7120	gamma-BHC (Lindane, gamma-HexachlorocyclohexanE)	
	7685	Heptachlor	
	7690	Heptachlor epoxide	
	7810	Methoxychlor	
	8250	Toxaphene (Chlorinated camphene)	
EPA 624		10107207	Volatile Organic Compounds by purge and trap GC/MS
	5160	1,1,1-Trichloroethane	
	5110	1,1,2,2-Tetrachloroethane	
	5165	1,1,2-Trichloroethane	
	4630	1,1-Dichloroethane	
	4640	1,1-Dichloroethylene	
	5155	1,2,4-Trichlorobenzene	
	4610	1,2-Dichlorobenzene	
	4635	1,2-Dichloroethane (Ethylene dichloride)	
	4655	1,2-Dichloropropane	
	4615	1,3-Dichlorobenzene	
	4620	1,4-Dichlorobenzene	
	4500	2-Chloroethyl vinyl ether	
	4995	4-Methyl-2-pentanone (MIBK)	
	4325	Acrolein (Propenal)	
	4340	Acrylonitrile	
	4375	Benzene	
	4395	Bromodichloromethane	
	4400	Bromoform	
	4455	Carbon tetrachloride	
	4475	Chlorobenzene	
	4575	Chlorodibromomethane	
	4485	Chloroethane (Ethyl chloride)	
	4505	Chloroform	
	4680	cis-1,3-Dichloropropene	
	4625	Dichlorodifluoromethane (Freon-12)	
	4765	Ethylbenzene	
	4950	Methyl bromide (Bromomethane)	
	4960	Methyl chloride (Chloromethane)	
	4975	Methylene chloride (Dichloromethane)	
	5100	Styrene	
	5115	Tetrachloroethylene (Perchloroethylene)	
	5140	Toluene	
	4700	trans-1,2-Dichloroethylene	

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EPA 624	4685	trans-1,3-Dichloropropylene	
	5170	Trichloroethene (Trichloroethylene)	
	5175	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	
	5235	Vinyl chloride	
	5260	Xylene (total)	
EPA 625			10300002 Base/Neutrals and Acids by GC/MS
	5155	1,2,4-Trichlorobenzene	
	6221	1,2-Diphenylhydrazine	
	4659	2,2-Oxybis(1-chloropropane)	
	6840	2,4,6-Trichlorophenol	
	6000	2,4-Dichlorophenol	
	6130	2,4-Dimethylphenol	
	6175	2,4-Dinitrophenol	
	6185	2,4-Dinitrotoluene (2,4-DNT)	
	6190	2,6-Dinitrotoluene (2,6-DNT)	
	5795	2-Chloronaphthalene	
	5800	2-Chlorophenol	
	6360	2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	
	6490	2-Nitrophenol	
	5945	3,3'-Dichlorobenzidine	
	5660	4-Bromophenyl phenyl ether (BDE-3)	
	5700	4-Chloro-3-methylphenol	
	5825	4-Chlorophenyl phenylether	
	6500	4-Nitrophenol	
	5500	Acenaphthene	
	5505	Acenaphthylene	
	5555	Anthracene	
	5595	Benzidine	
	5575	Benzo(a)anthracene	
	5580	Benzo(a)pyrene	
	5590	Benzo(g,h,i)perylene	
	5600	Benzo(k)fluoranthene	
	5585	Benzo[b]fluoranthene	
	5760	bis(2-Chloroethoxy)methane	
	5765	bis(2-Chloroethyl) ether	
	5780	bis(2-Chloroisopropyl) ether	
	5670	Butyl benzyl phthalate	
	5855	Chrysene	
	6065	Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate, DEHP)	
	5895	Dibenz(a,h) anthracene	
	6070	Diethyl phthalate	

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EPA 625	6135	Dimethyl phthalate		
	5925	Di-n-butyl phthalate		
	6200	Di-n-octyl phthalate		
	6265	Fluoranthene		
	6270	Fluorene		
	6275	Hexachlorobenzene		
	4835	Hexachlorobutadiene		
	6285	Hexachlorocyclopentadiene		
	4840	Hexachloroethane		
	6315	Indeno(1,2,3-cd) pyrene		
	6320	Isophorone		
	5005	Naphthalene		
	5015	Nitrobenzene		
	6530	n-Nitrosodimethylamine		
	6545	n-Nitrosodi-n-propylamine		
	6535	n-Nitrosodiphenylamine		
	6605	Pentachlorophenol		
	6615	Phenanthrene		
	6625	Phenol		
	6665	Pyrene		
EPA 6850			10304606	Perchlorate in Water, Soils and Solid Wastes Using High Performance Liquid Chromatography/Electrospray Ionization/Mass Spectrometry
	1895	Perchlorate		
EPA 7062			10159407	Antimony and Arsenic by Borohydride Reduction and Atomic Absorption
	1010	Arsenic		
EPA 7196A			10162400	Chromium Hexavalent colorimetric
	1045	Chromium VI		
EPA 7470A			10165807	Mercury in Liquid Waste by Cold Vapor Atomic Absorption
	1095	Mercury		
EPA 7742			10169207	Selenium by Borohydride Reduction and Atomic Absorption
	1140	Selenium		
EPA 8015C			10173805	Non-halogenated organics using GC/FID
	9369	Diesel range organics (DRO)		
	4785	Ethylene glycol		
	9408	Gasoline range organics (GRO)		
EPA 8081B			10178800	Organochlorine Pesticides by GC/ECD
	8580	2,4'-DDD		
	8585	2,4'-DDE		
	8590	2,4'-DDT		

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EPA 8081B	7355	4,4'-DDD			
	7360	4,4'-DDE			
	7365	4,4'-DDT			
	7005	Alachlor			
	7025	Aldrin			
	7110	alpha-BHC (alpha-Hexachlorocyclohexane)			
	7115	beta-BHC (beta-Hexachlorocyclohexane)			
	7250	Chlordane (tech.)			
	7300	Chlorpyrifos			
	7240	cis-chlordane (alpha-Chlordane)			
	7925	cis-Nonachlor			
	7105	delta-BHC			
	7470	Dieldrin			
	7510	Endosulfan I			
	7515	Endosulfan II			
	7520	Endosulfan sulfate			
	7540	Endrin			
	7530	Endrin aldehyde			
	7535	Endrin ketone			
	7120	gamma-BHC (Lindane, gamma-HexachlorocyclohexanE)			
	7685	Heptachlor			
	7690	Heptachlor epoxide			
	6275	Hexachlorobenzene			
	4835	Hexachlorobutadiene			
	4840	Hexachloroethane			
	7725	Isodrin			
	7810	Methoxychlor			
	7870	Mirex			
	3890	Oxychlordane			
	8250	Toxaphene (Chlorinated camphene)			
	7245	trans-chlordane (gamma-Chlordane)			
	7910	trans-Nonachlor			
EPA 8082A				10179201	Polychlorinated Biphenyls (PCBs) by GC/ECD
	9095	2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ-206)			
	9090	2,2',3,3',4,4',5,5'-Octachlorobiphenyl (BZ-194)			
	9103	2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ-195)			
	9065	2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ-170)			

Non-Potable Water

EPA 8082A

9020	2,2',3,3',4,4'-Hexachlorobiphenyl (BZ-128)
9112	2,2',3,3',4,5',6,6'-Octachlorobiphenyl (BZ-201)
9116	2,2',3,3',4,5,6'-Heptachlorobiphenyl (BZ-174)
9114	2,2',3,3',4,5',6'-Heptachlorobiphenyl (BZ-177)
9120	2,2',3,3',4,6'-Hexachlorobiphenyl (BZ-132)
9133	2,2',3,4,4',5,5',6-Octachlorobiphenyl (BZ-203)
9134	2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ-180)
9075	2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ-183)
9025	2,2',3,4,4',5'-Hexachlorobiphenyl (BZ-138)
9139	2,2',3,4,4',6,6'-Heptachlorobiphenyl (BZ-184)
9080	2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ-187)
9030	2,2',3,4,5,5'-Hexachlorobiphenyl (BZ-141)
9151	2,2',3,4',5',6-Hexachlorobiphenyl (BZ-149)
8975	2,2',3,4,5'-Pentachlorobiphenyl (BZ-87)
9155	2,2',3,4',5-Pentachlorobiphenyl (BZ-90)
9154	2,2',3,4',5'-Pentachlorobiphenyl (BZ-97)
9035	2,2',3,5,5',6-Hexachlorobiphenyl (BZ-151)
9166	2,2',3,5',6-Pentachlorobiphenyl (BZ-95)
8945	2,2',3,5'-Tetrachlorobiphenyl (BZ-44)
9040	2,2',4,4',5,5'-Hexachlorobiphenyl (BZ-153)
9174	2,2',4,4',5,6'-Hexachlorobiphenyl (BZ-154)
9175	2,2',4,4',5-Pentachlorobiphenyl (BZ-99)
8980	2,2',4,5,5'-Pentachlorobiphenyl (BZ-101)
8950	2,2',4,5'-Tetrachlorobiphenyl (BZ-49)
8955	2,2',5,5'-Tetrachlorobiphenyl (BZ-52)
8930	2,2',5-Trichlorobiphenyl (BZ-18)
9085	2,3,3',4,4',5,5'-Heptachlorobiphenyl (BZ-189)
9050	2,3,3',4,4',5-Hexachlorobiphenyl (BZ-156)
9045	2,3,3',4,4',5'-Hexachlorobiphenyl (BZ-157)

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EPA 8082A	9193	2,3,3',4,4',6-Hexachlorobiphenyl (BZ-158)
	8985	2,3,3',4,4'-Pentachlorobiphenyl (BZ-105)
	8990	2,3,3',4',6-Pentachlorobiphenyl (BZ-110)
	9207	2,3,3',4'-Tetrachlorobiphenyl (BZ-56)
	9055	2,3',4,4',5,5'-Hexachlorobiphenyl (BZ-167)
	9217	2,3,4,4',5,6-Hexachlorobiphenyl (BZ-166)
	9218	2,3',4,4',5',6-Hexachlorobiphenyl (BZ-168)
	9005	2,3,4,4',5-Pentachlorobiphenyl (BZ-114)
	8995	2,3',4,4',5-Pentachlorobiphenyl (BZ-118)
	9000	2,3',4,4',5'-Pentachlorobiphenyl (BZ-123)
	9220	2,3',4,4',6-Pentachlorobiphenyl (BZ-119)
	9221	2,3,4,4'-Tetrachlorobiphenyl (BZ-60)
	8960	2,3',4,4'-Tetrachlorobiphenyl (BZ-66)
	9230	2,3',4',5-Tetrachlorobiphenyl (BZ-70)
	9239	2,3',4'-Trichlorobiphenyl (BZ-33)
	8920	2,3-Dichlorobiphenyl (BZ-5)
	9250	2,4,4',5-Tetrachlorobiphenyl (BZ-74)
	9252	2,4,4'-Trichlorobiphenyl (BZ-28)
	8940	2,4',5-Trichlorobiphenyl (BZ-31)
	9256	2,4'-Dichlorobiphenyl (BZ-8)
	8915	2-Chlorobiphenyl (BZ-1)
	9060	3,3',4,4',5,5'-Hexachlorobiphenyl (BZ-169)
	9015	3,3',4,4',5-Pentachlorobiphenyl (BZ-126)
	8965	3,3',4,4'-Tetrachlorobiphenyl (BZ-77)
	8970	3,4,4',5-Tetrachlorobiphenyl (BZ-81)
	9266	3,4,4'-Trichlorobiphenyl (BZ-37)
	8880	Aroclor-1016 (PCB-1016)
	8885	Aroclor-1221 (PCB-1221)
	8890	Aroclor-1232 (PCB-1232)
	8895	Aroclor-1242 (PCB-1242)
	8900	Aroclor-1248 (PCB-1248)
	8905	Aroclor-1254 (PCB-1254)
	8910	Aroclor-1260 (PCB-1260)
	8912	Aroclor-1262 (PCB-1262)
	8913	Aroclor-1268 (PCB-1268)

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EPA 8082A	9105	Decachlorobiphenyl (BZ-209)		
EPA 8141B			10182204	Organophosphorous Pesticides by GC/NPD
	7075	Azinphos-methyl (Guthion)		
	7125	Bolstar (Sulprofos)		
	7300	Chlorpyrifos		
	7315	Coumaphos		
	7395	Demeton-o		
	7385	Demeton-s		
	7410	Diazinon		
	8610	Dichlorovos (DDVP, Dichlorvos)		
	7475	Dimethoate		
	8625	Disulfoton		
	7550	EPN		
	7570	Ethoprop		
	7600	Fensulfothion		
	7605	Fenthion		
	7770	Malathion		
	7785	Merphos		
	7825	Methyl parathion (Parathion, methyl)		
	7850	Mevinphos		
	7955	Parathion, ethyl		
	7985	Phorate		
	8110	Ronnel		
	8155	Sulfotepp		
	8200	Tetrachlorvinphos (Stirophos, Gardona) Z-isomer		
	8245	Tokuthion (Prothiophos)		
	8275	Trichloronate		
EPA 8151A			10183207	Chlorinated Herbicides by GC/ECD
	8655	2,4,5-T		
	8545	2,4-D		
	8560	2,4-DB		
	8555	Dalapon		
	8595	Dicamba		
	8605	Dichloroprop (Dichlorprop)		
	8620	Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)		
	7775	MCPA		
	7780	MCPP		
	8650	Silvex (2,4,5-TP)		

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EPA 8260C — 10307003 — Volatile Organics: GC/MS (capillary column)

5105	1,1,1,2-Tetrachloroethane
5185	1,1,1-Trichloro-2,2,2-trifluoroethane
5160	1,1,1-Trichloroethane
5110	1,1,2,2-Tetrachloroethane
5195	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)
5165	1,1,2-Trichloroethane
5167	1,1,2-Trichlorofluoroethane
4630	1,1-Dichloroethane
4640	1,1-Dichloroethylene
4670	1,1-Dichloropropene
5150	1,2,3-Trichlorobenzene
5180	1,2,3-Trichloropropane
5155	1,2,4-Trichlorobenzene
5210	1,2,4-Trimethylbenzene
4570	1,2-Dibromo-3-chloropropane (DBCP)
4585	1,2-Dibromoethane (EDB, Ethylene dibromide)
4610	1,2-Dichlorobenzene
4635	1,2-Dichloroethane (Ethylene dichloride)
4655	1,2-Dichloropropane
6800	1,3,5-Trichlorobenzene
5215	1,3,5-Trimethylbenzene
4615	1,3-Dichlorobenzene
4660	1,3-Dichloropropane
4620	1,4-Dichlorobenzene
4735	1,4-Dioxane (1,4- Diethyleneoxide)
4510	1-Chlorohexane
4665	2,2-Dichloropropane
4410	2-Butanone (Methyl ethyl ketone, MEK)
4500	2-Chloroethyl vinyl ether
4535	2-Chlorotoluene
4860	2-Hexanone (MBK)
5020	2-Nitropropane
4536	4-Bromofluorobenzene
4540	4-Chlorotoluene
4910	4-Isopropyltoluene (p-Cymene)
4995	4-Methyl-2-pentanone (MIBK)
4305	Acetamide
4315	Acetone
4320	Acetonitrile
4325	Acrolein (Propenal)

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EPA 8260C

4330	Acrylamide
4340	Acrylonitrile
4355	Allyl chloride (3-Chloropropene)
4375	Benzene
4385	Bromobenzene
4390	Bromochloromethane
4395	Bromodichloromethane
4400	Bromoform
4450	Carbon disulfide
4455	Carbon tetrachloride
4475	Chlorobenzene
4575	Chlorodibromomethane
4485	Chloroethane (Ethyl chloride)
4505	Chloroform
4525	Chloroprene (2-Chloro-1,3-butadiene)
4705	cis & trans-1,2-Dichloroethene
4645	cis-1,2-Dichloroethylene
4680	cis-1,3-Dichloropropene
4595	Dibromomethane (Methylene bromide)
4625	Dichlorodifluoromethane (Freon-12)
4725	Diethyl ether
4755	Ethyl acetate
4810	Ethyl methacrylate
4765	Ethylbenzene
4835	Hexachlorobutadiene
4870	Iodomethane (Methyl iodide)
4875	Isobutyl alcohol (2-Methyl-1-propanol)
4900	Isopropylbenzene (Cumene)
5240	m+p-xylene
4925	Methacrylonitrile
4950	Methyl bromide (Bromomethane)
4960	Methyl chloride (Chloromethane)
5000	Methyl tert-butyl ether (MTBE)
4975	Methylene chloride (Dichloromethane)
5245	m-Xylene
5005	Naphthalene
4435	n-Butylbenzene
5090	n-Propylbenzene
5250	o-Xylene
4440	sec-Butylbenzene
5100	Styrene
4370	T-amylmethylether (TAME)
4445	tert-Butylbenzene

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EPA 8260C	5115	Tetrachloroethylene (Perchloroethylene)	
	5140	Toluene	
	4700	trans-1,2-Dichloroethylene	
	4685	trans-1,3-Dichloropropylene	
	4605	trans-1,4-Dichloro-2-butene	
	5170	Trichloroethene (Trichloroethylene)	
	5175	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	
	5225	Vinyl acetate	
	5235	Vinyl chloride	
	5260	Xylene (total)	
EPA 8270D			10186002 Semivolatile Organic compounds by GC/MS
	6715	1,2,4,5-Tetrachlorobenzene	
	5155	1,2,4-Trichlorobenzene	
	4610	1,2-Dichlorobenzene	
	6221	1,2-Diphenylhydrazine	
	4615	1,3-Dichlorobenzene	
	4620	1,4-Dichlorobenzene	
	6380	1-Methylnaphthalene	
	4659	2,2-Oxybis(1-chloropropane)	
	6735	2,3,4,6-Tetrachlorophenol	
	6835	2,4,5-Trichlorophenol	
	6840	2,4,6-Trichlorophenol	
	6000	2,4-Dichlorophenol	
	6130	2,4-Dimethylphenol	
	6175	2,4-Dinitrophenol	
	6185	2,4-Dinitrotoluene (2,4-DNT)	
	6190	2,6-Dinitrotoluene (2,6-DNT)	
	5735	2-Chloroaniline	
	5795	2-Chloronaphthalene	
	5800	2-Chlorophenol	
	6360	2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	
	6385	2-Methylnaphthalene	
	6400	2-Methylphenol (o-Cresol)	
	6460	2-Nitroaniline	
	6490	2-Nitrophenol	
	6412	3 & 4 Methylphenol	
	5945	3,3'-Dichlorobenzidine	
	6405	3-Methylphenol (m-Cresol)	
	6465	3-Nitroaniline	
	5660	4-Bromophenyl phenyl ether (BDE-3)	
	5700	4-Chloro-3-methylphenol	

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EPA 8270D

5745	4-Chloroaniline
5825	4-Chlorophenyl phenylether
6410	4-Methylphenol (p-Cresol)
6470	4-Nitroaniline
6500	4-Nitrophenol
5500	Acenaphthene
5505	Acenaphthylene
5510	Acetophenone
5545	Aniline
5555	Anthracene
7065	Atrazine
5562	Azobenzene
5570	Benzaldehyde
5575	Benzo(a)anthracene
5580	Benzo(a)pyrene
5590	Benzo(g,h,i)perylene
9309	Benzo(j)fluoranthene
5600	Benzo(k)fluoranthene
5585	Benzo[b]fluoranthene
5610	Benzoic acid
5630	Benzyl alcohol
5640	Biphenyl
5760	bis(2-Chloroethoxy)methane
5765	bis(2-Chloroethyl) ether
5780	bis(2-Chloroisopropyl) ether
5670	Butyl benzyl phthalate
7180	Caprolactam
5680	Carbazole
5855	Chrysene
6065	Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate, DEHP)
5895	Dibenz(a,h) anthracene
5905	Dibenzofuran
6070	Diethyl phthalate
6135	Dimethyl phthalate
5925	Di-n-butyl phthalate
6200	Di-n-octyl phthalate
6265	Fluoranthene
6270	Fluorene
6275	Hexachlorobenzene
4835	Hexachlorobutadiene
6285	Hexachlorocyclopentadiene
4840	Hexachloroethane
6315	Indeno(1,2,3-cd) pyrene

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EPA 8270D	6320	Isophorone		
	5005	Naphthalene		
	5015	Nitrobenzene		
	6530	n-Nitrosodimethylamine		
	6545	n-Nitrosodi-n-propylamine		
	6535	n-Nitrosodiphenylamine		
	6590	Pentachlorobenzene		
	6605	Pentachlorophenol		
	6615	Phenanthrene		
	6625	Phenol		
	6665	Pyrene		
	5095	Pyridine		
EPA 8270D SIM			10242509	Semivolatile Organic compounds by GC/MS Selective Ion Monitoring
	4735	1,4-Dioxane (1,4- Diethyleneoxide)		
	6380	1-Methylnaphthalene		
	9501	1-Methylphenanthrene		
	6852	2,3,5-Trimethylnaphthalene		
	6188	2,6-Dimethylnaphthalene		
	6385	2-Methylnaphthalene		
	5500	Acenaphthene		
	5505	Acenaphthylene		
	5555	Anthracene		
	5575	Benzo(a)anthracene		
	5580	Benzo(a)pyrene		
	5605	Benzo(e)pyrene		
	5590	Benzo(g,h,i)perylene		
	9309	Benzo(j)fluoranthene		
	5600	Benzo(k)fluoranthene		
	5585	Benzo[b]fluoranthene		
	5640	Biphenyl		
	5680	Carbazole		
	5855	Chrysene		
	5895	Dibenz(a,h) anthracene		
	5905	Dibenzofuran		
	5910	Dibenzothiophene		
	6265	Fluoranthene		
	6270	Fluorene		
	6315	Indeno(1,2,3-cd) pyrene		
	5005	Naphthalene		
	6605	Pentachlorophenol		
	6608	Perylene		
	6615	Phenanthrene		
	6665	Pyrene		

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EPA 8315A		10188008	Determination of Carbonyl Compounds by HPLC/UV-VIS
4815	Formaldehyde		
EPA 8321B		10189205	Solvent Extractable non-volatile compounds by HPLC/TS/MS
7010	Aldicarb (Temik)		
7040	Aminocarb		
7080	Barban		
7130	Bromacil		
7195	Carbaryl (Sevin)		
7205	Carbofuran (Furaden)		
7275	Chloropropham		
7505	Diuron		
7610	Fenuron		
7630	Fluometuron		
7765	Linuron (Lorox)		
7800	Methiocarb (Mesurol)		
7805	Methomyl (Lannate)		
7855	Mexacarbate		
7885	Monuron		
7915	Neburon		
7940	Oxamyl		
8075	Propham		
8080	Propoxur (Baygon)		
8120	Siduron		
EPA 8330B		10308006	Nitroaromatics, Nitramines and Nitrate Esters by High Performance Liquid Chromatography (HPLC)
6885	1,3,5-Trinitrobenzene (1,3,5-TNB)		
6160	1,3-Dinitrobenzene (1,3-DNB)		
9651	2,4,6-Trinitrotoluene (2,4,6-TNT)		
6185	2,4-Dinitrotoluene (2,4-DNT)		
6190	2,6-Dinitrotoluene (2,6-DNT)		
9303	2-Amino-4,6-dinitrotoluene (2-am-dnt)		
9507	2-Nitrotoluene		
6150	3,5-Dinitroaniline		
9510	3-Nitrotoluene		
9306	4-Amino-2,6-dinitrotoluene (4-am-dnt)		
9513	4-Nitrotoluene		
6415	Methyl-2,4,6-trinitrophenylnitramine (tetryl)		
5015	Nitrobenzene		
6485	Nitroglycerin		
9522	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)		

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EPA 8330B	9558	Pentaerythritoltetranitrate (PETN)		
	9432	RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine)		
EPA 9012B			10243206	Total and Amenable Cyanide (automated colorimetric with off-line distillation)
	1510	Amenable cyanide		
	1645	Total cyanide		
EPA 9020B			10194408	Total Organic Halides
	2045	Total organic halides (TOX)		
EPA 9040C			10244403	pH Electrometric Measurement
	1900	pH		
EPA 9060A			10244801	Total Organic Carbon
	2040	Total organic carbon		
NCASI 94.03 0			60031507	Methanol in Process Liquids and Wastewaters
	4930	Methanol		
NWTPH-Dx			90018409	Oregon DEQ TPH Diesel Range
	9369	Diesel range organics (DRO)		
	9506	Residual Range Organics (RRO)		
NWTPH-Gx			90018603	Oregon DEQ TPH Gasoline Range Organics by GC/FID-PID Purge & Trap
	9408	Gasoline range organics (GRO)		
NWTPH-HCID			90013200	Oregon DEQ Total Petroleum Hydrocarbon ID
	2050	Total Petroleum Hydrocarbons (TPH)		
SM 2120 B 20th ED			20224004	Color by Visual Comparison
	1605	Color		
SM 2310 B 20th ED			20044206	Acidity by Titration
	1500	Acidity, as CaCO3		
SM 2320 B 20th ED			20045209	Alkalinity by Titration
	1505	Alkalinity as CaCO3		
SM 2340 B 20th ED			20046202	Hardness by calculation
	1750	Hardness		
SM 2340 C 20th ED			20047205	Hardness by EDTA Titration
	1750	Hardness		
SM 2510 B-97 1997			20048606	Conductivity by Probe
	1610	Conductivity		
SM 2540 B 20th ED			20049007	Total Solids
	1950	Residue-total		

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SM 2540 C 20th ED	1955	Residue-filterable (TDS)	20050004	Total Dissolved Solids
SM 2540 D 20th ED	1960	Residue-nonfilterable (TSS)	20050800	Total Suspended Solids
SM 2540 D-2011	1960	Residue-nonfilterable (TSS)	20051212	Total Suspended Solids Dried at 103 - 105 C
SM 2540 D-97 1997	1960	Residue-nonfilterable (TSS)	20051201	Total Suspended Solids Dried at 103 - 105C
SM 2540 F 20th ED	1965	Residue-settleable	20051803	Settleable Solids
SM 4500-Cl C 20th ED	1575	Chloride	20078802	Chloride by Iodometric Method II
SM 4500-Cl F 20th ED	1945	Residual free chlorine	20080506	Residual Chlorine by DPD Ferrous Titration
SM 4500-CN E 20th ED	1635 1645	Cyanide Total cyanide	20092404	Cyanide by Colorimetric Determination
SM 4500-CN G 20th ED	1510	Amenable cyanide	20093203	Cyanide Amenable to Chlorination after Distillation
SM 4500-CN⁻ E-97 online	1635	Cyanide	20096406	Cyanide by Colorimetric Method
SM 4500-F⁻ C 20th ED	1730	Fluoride	20102005	Fluoride by Ion Selective Electrode
SM 4500-H+ B 20th ED	1900	pH	20104807	pH by Probe
SM 4500-NH3 E 20th ED	1515	Ammonia as N	20109802	Ammonia by Selective Ion Probe
SM 4500-NH3 G 20th ED	1515	Ammonia as N	20111006	Ammonia by Automated Phenate
SM 4500-O G 20th ED	1880	Oxygen, dissolved	20121204	Dissolved Oxygen by Membrane Electrode Method
SM 4500-S2 F-2011	2005	Sulfide	20126663	Sulfide by Iodometric Method
SM 4500-S2⁻ D 20th ED	2005	Sulfide	20125400	Sulfide by Methylene Blue Method

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SM 4500-S2¯ D-97 online	2005	Sulfide	20125808	Sulfide by Methylene Blue Method
SM 4500-S2¯ F 20th ED	2005	Sulfide	20126209	Sulfide by Iodometric Titration
SM 4500-SO3¯ B 20th ED	2015	Sulfite-SO3	20130205	Sulfite by Iodometric Method
SM 5210 B 20th ED	1530	Biochemical oxygen demand	20134809	Biochemical Oxygen Demand, 5-Day (BOD5)
SM 5220 C 20th ED	1565	Chemical oxygen demand	20135608	Chemical Oxygen Demand by Closed Reflux and Titration
SM 5310 C 20th ED	2040	Total organic carbon	20138403	Total Organic Carbon by Persulfate-Ultraviolet Oxidation Method
SM 5540 C 20th ED	2025	Surfactants - MBAS	20144609	Surfactants as MBAS
SM 5550 B 20th ED	9597	Tannin & Lignin	20145306	Tannin and Lignin
SM 9215 B (PCA) 20th ED	2555	Heterotrophic plate count	20181208	Heterotrophic Plate Count Pour Plate (plate count agar): Heterotrophic Bacteria
SM 9221 B (LTB) + C MPN 20th ED	2500	Total coliforms	20186805	Multiple Tube Fermentation Quantitative (LTB): Total Coliform
SM 9221 E (EC) 20th ED	2530	Fecal coliforms	20226806	Multiple Tube Fermentation Quantitative (EC): Fecal Coliform
SM 9222 D (m-FC) 20th ED	2530	Fecal coliforms	20209603	Membrane Filtration Quantitative (m-FC): Fecal Coliform
SM 9223 B (Colilert®) 20th ED	2525 2500	Escherichia coli Total coliforms	20212208	Chromogenic/Fluorogenic Qualitative (Colilert®): Total Coliform and E. coli
SM 9223 B (Colilert®-18 Quanti-Tray®) 20th ED	2525 2500	Escherichia coli Total coliforms	20213201	Chromogenic/Fluorogenic Quantitative (Colilert®-18): Total Coliform and E. coli
SM 9223 B (Colilert®-18) 20th ED	2525 2500	Escherichia coli Total coliforms	20214204	Chromogenic/Fluorogenic Qualitative (Colilert®-18): Total Coliform and E. coli

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Non-Potable Water	SM 9223 B (Colilert®-18) 21st ED			20214408	Chromogenic/Fluorogenic Qualitative (Colilert®-18): Total Coliform and E. coli
		2525	Escherichia coli		
		2500	Total coliforms		
	WI(95) DRO			90019457	Wisconsin DNR - Modified Method for Determination of Diesel Range Organics by GC-FID
		9369	Diesel range organics (DRO)		
Solids					
	AK101 GRO			90015002	Determination of Gasoline Range Organics - Alaska Department of Environmental Conservation
		9408	Gasoline range organics (GRO)		
	AK102 DRO			90015206	Determination of Diesel Range Organics - Alaska Department of Environmental Conservation
		9369	Diesel range organics (DRO)		
	AK103 RRO			90015400	Determination of Residual Range Organics - Alaska Department of Environmental Conservation
		9499	Motor Oil		
	ALS Kelso LCP-Acryl 1			60001712	ALS Kelso - Acrylamide by HPLC/MS/MS
		4330	Acrylamide		
	ALS Kelso LCP-PFC 4			60001505	ALS Kelso - Perfluorinated Compounds by HPLC-MS-MS
		199	10:2 Fluorotelomer sulfonate (10:2FTS)		
		4846	2-(N-Ethyl-perfluorooctane sufonamido) acetic acid (EtFOSAA)		
		4847	2-(N-Methyl-perfluorooctane sulfonamido) acetic acid (MeFOSAA)		
		198	2,3,3,3-Tetrafluoro-2-(1,1,2,2,3,3,3-heptafluoropropoxy)propanoic acid (HFPO-DA)		
		9437	4:2 Fluorotelomer sulfonate (4:2FTS)		
		6457	6:2 Fluorotelomersulfonate (6:2FTS)		
		6461	8:2 Fluorotelomersulfonate (8:2FTS)		
		9395	N-Ethylperfluorooctanesulfonamide (EtFOSA)		
		9431	N-Ethylperfluorooctanesulfonamidoethanol (EtFOSE)		
		9433	N-Methylperfluorooctanesulfonamide (MeFOSA)		
		9434	N-Methylperfluorooctanesulfonamidoethanol (MeFOSA)		
		6911	Perfluorobutane Sulfonate (PFBS)		
		6915	Perfluorobutyric acid (PFBA)		

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ALS Kelso LCP-PFC 4	9562	Perfluorodecane Sulfonate (PFDS)		
	6905	Perfluorodecanoic acid (PFDA)		
	6903	Perfluorododecanoic (PFDDA)		
	9470	Perfluoroheptanesulfonic acid (PFHpS)		
	6908	Perfluoroheptanoic acid (PFHpA)		
	6910	Perfluorohexane Sulfonate (PFHS)		
	6913	Perfluorohexanoic acid (PFHXA)		
	6906	Perfluorononanoic acid (PFNA)		
	6917	Perfluorooctane Sulfonamide (PFOSA)		
	6912	Perfluorooctanoic acid		
	6909	Perfluorooctanoic Sulfonate (PFOS)		
	6914	Perfluoropentanoic acid (PFPEA)		
	6902	Perfluorotetradecanoic acid (PFTDA)		
	9563	Perfluorotridecanoic (PFTRIA)		
	6904	Perfluoroundecanoic acid (PFUDA)		
ALS Kelso SOC-8151M 11			60001754	ALS Kelso - Chlorinated Pesticides by GC/ECD
	6730	2,3,4,5-Tetrachlorophenol		
	6740	2,3,5,6-Tetrachlorophenol		
	6835	2,4,5-Trichlorophenol		
	6840	2,4,6-Trichlorophenol		
	6818	3,4,5-Trichlorophenol		
	5997	3,4-Dichlorophenol		
	6397	3,5-Dichlorophenol		
	6605	Pentachlorophenol		
ASTM D1426-08B			30007397	Ammonia by Titration
	1515	Ammonia as N		
ASTM D3590-02(06)A			30016819	Total Kjeldahl Nitrogen in Water
	1795	Kjeldahl nitrogen - total		
ASTM D4129 05			30018907	Total and Organic Carbon in Water by High Temperature Oxidation and by Coulometric Detection
	2040	Total organic carbon		
ASTM D422-63			30030854	Partical Size Distribution (Grain sizing)
	6118	Distribution of particle sizes		
CAS PestMS2 (1699 modified) 2			60035101	Chlorinated Pesticides by GC/MS/MS
	8580	2,4'-DDD		
	8585	2,4'-DDE		
	8590	2,4'-DDT		
	7355	4,4'-DDD		
	7360	4,4'-DDE		
	7365	4,4'-DDT		
	7025	Aldrin		

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Solids

CAS PestMS2 (1699 modified) 2				
	7110	alpha-BHC (alpha-Hexachlorocyclohexane)		
	7115	beta-BHC (beta-Hexachlorocyclohexane)		
	7300	Chlorpyrifos		
	7240	cis-chlordane (alpha-Chlordane)		
	7925	cis-Nonachlor		
	7105	delta-BHC		
	7470	Dieldrin		
	7510	Endosulfan I		
	7515	Endosulfan II		
	7520	Endosulfan sulfate		
	7540	Endrin		
	7530	Endrin aldehyde		
	7535	Endrin ketone		
	7120	gamma-BHC (Lindane, gamma-HexachlorocyclohexanE)		
	7685	Heptachlor		
	7690	Heptachlor epoxide		
	6275	Hexachlorobenzene		
	7725	Isodrin		
	7810	Methoxychlor		
	7870	Mirex		
	5553	Octachlorostyrene		
	3890	Oxychlordane		
	7245	trans-chlordane (gamma-Chlordane)		
	7910	trans-Nonachlor		
CAS SOC-Butyl 10			60035009	Butyltin by GC/Flame Photometric Detector
	1201	Butyltin trichloride		
	1202	Dibutyltin dichloride		
	1209	Tetrabutyltin		
	1203	Tributyltin chloride		
EPA 1020A			10117007	Ignitability Setaflash Closed-cup Method
	1780	Ignitability		
EPA 1110A			10235208	Corrosivity Toward Steel
	1615	Corrosivity		
EPA 1311			10118806	Toxicity Characteristic Leaching Procedure
	8031	Extraction/Preparation		
EPA 1312			10119003	Synthetic Precipitation Leaching Procedure
	8031	Extraction/Preparation		

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EPA 1340 1			808	In Vitro Bioaccessibility for Lead in Soil
	8031	Extraction/Preparation		
EPA 160.3			10009800	Total Solids, dried @ 103-105 C.
	1950	Residue-total		
EPA 1630			10122608	Methyl Mercury by Purge & Trap Cold Vapor Atomic Fluorescence Spectrometry
	1205	Methyl Mercury		
EPA 1631E			10237204	Mercury in Water by Oxidation, Purge & Trap, and Cold Vapor Atomic Fluorescence
	1095	Mercury		
EPA 1664A (HEM)			10127807	N-Hexane Extractable Material (Oil and Grease) by Extraction and Gravimetry
	1803	n-Hexane Extractable Material (O&G)		
	1860	Oil & Grease		
EPA 300.0 2.1			10053200	Methods for the Determination of Inorganic Substances in Environmental Samples
	1575	Chloride		
	1730	Fluoride		
	2000	Sulfate		
EPA 3050B			10135601	Acid Digestion of Sediments, Sludges, and soils
	8031	Extraction/Preparation		
EPA 314.0			10055400	Perchlorate in Drinking Water by Ion Chromatography
	1895	Perchlorate		
EPA 350.1 2			10063602	Ammonia Nitrogen - Colorimetric, Auto Phenate
	1515	Ammonia as N		
EPA 353.2 2			10067604	Nitrate/Nitrite Nitrogen - Automated, Cadmium
	1810	Nitrate as N		
	1823	Nitrate plus Nitrite as N		
	1840	Nitrite as N		
EPA 3540C			10140202	Soxhlet Extraction
	8031	Extraction/Preparation		
EPA 3541			10140406	Automated Soxhlet Extraction
	8031	Extraction/Preparation		
EPA 3546			10141205	Microwave Extraction
	8031	Extraction/Preparation		
EPA 3550C			10142004	Ultrasonic Extraction
	8031	Extraction/Preparation		

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EPA 3580A			10143007	Waste Dilution
	8031	Extraction/Preparation		
EPA 3620C			10146006	Florisil Cleanup
	8031	Extraction/Preparation		
EPA 3630C			10146802	Silica gel cleanup
	8031	Extraction/Preparation		
EPA 3640A			10147203	Gel Preparation Cleanup
	8031	Extraction/Preparation		
EPA 365.3			10070607	Phosphorous - Colorimetric, two reagent.
	1870	Orthophosphate as P		
	1908	Total Phosphate		
EPA 3660B			10148400	Sulfur cleanup
	8031	Extraction/Preparation		
EPA 3665A			10148808	Sulfuric Acid / permanganate Cleanup
	8031	Extraction/Preparation		
EPA 5030B			10153409	Purge and trap for aqueous samples
	8031	Extraction/Preparation		
EPA 5035A			10284807	Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples
	8031	Extraction/Preparation		
EPA 6010C			10155803	ICP - AES
	1000	Aluminum		
	1005	Antimony		
	1010	Arsenic		
	1015	Barium		
	1020	Beryllium		
	1025	Boron		
	1030	Cadmium		
	1035	Calcium		
	1040	Chromium		
	1050	Cobalt		
	1055	Copper		
	1070	Iron		
	1075	Lead		
	1085	Magnesium		
	1090	Manganese		
	1100	Molybdenum		
	1105	Nickel		
	1125	Potassium		

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EPA 6010C				
	1140	Selenium		
	1150	Silver		
	1155	Sodium		
	1160	Strontium		
	1165	Thallium		
	1175	Tin		
	1180	Titanium		
	1185	Vanadium		
	1190	Zinc		
EPA 6020A			10156408	Inductively Coupled Plasma-Mass Spectrometry
	1000	Aluminum		
	1005	Antimony		
	1010	Arsenic		
	1015	Barium		
	1020	Beryllium		
	1030	Cadmium		
	1040	Chromium		
	1050	Cobalt		
	1055	Copper		
	1070	Iron		
	1075	Lead		
	1090	Manganese		
	1100	Molybdenum		
	1105	Nickel		
	1140	Selenium		
	1150	Silver		
	1160	Strontium		
	1165	Thallium		
	1185	Vanadium		
	1190	Zinc		
EPA 6850			10304606	Perchlorate in Water, Soils and Solid Wastes Using High Performance Liquid Chromatography/Electrospray Ionization/Mass Spectrometry
	1895	Perchlorate		
EPA 7062			10159407	Antimony and Arsenic by Borohydride Reduction and Atomic Absorption
	1010	Arsenic		
EPA 7196A			10162400	Chromium Hexavalent colorimetric
	1045	Chromium VI		
EPA 7471B			10166402	Mercury by Cold Vapor Atomic Absorption
	1095	Mercury		

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EPA 7742			10169207	Selenium by Borohydride Reduction and Atomic Absorption
	1140	Selenium		
EPA 8015C			10173805	Non-halogenated organics using GC/FID
	9369	Diesel range organics (DRO)		
	4785	Ethylene glycol		
	9408	Gasoline range organics (GRO)		
EPA 8081B			10178800	Organochlorine Pesticides by GC/ECD
	8580	2,4'-DDD		
	8585	2,4'-DDE		
	8590	2,4'-DDT		
	7355	4,4'-DDD		
	7360	4,4'-DDE		
	7365	4,4'-DDT		
	7005	Alachlor		
	7025	Aldrin		
	7110	alpha-BHC (alpha-Hexachlorocyclohexane)		
	7115	beta-BHC (beta-Hexachlorocyclohexane)		
	7250	Chlordane (tech.)		
	7300	Chlorpyrifos		
	7240	cis-chlordane (alpha-Chlordane)		
	7925	cis-Nonachlor		
	7105	delta-BHC		
	7470	Dieldrin		
	7510	Endosulfan I		
	7515	Endosulfan II		
	7520	Endosulfan sulfate		
	7540	Endrin		
	7530	Endrin aldehyde		
	7535	Endrin ketone		
	7120	gamma-BHC (Lindane, gamma-HexachlorocyclohexanE)		
	7685	Heptachlor		
	7690	Heptachlor epoxide		
	6275	Hexachlorobenzene		
	4835	Hexachlorobutadiene		
	4840	Hexachloroethane		
	7725	Isodrin		
	7810	Methoxychlor		
	7870	Mirex		
	3890	Oxychlordane		
	8250	Toxaphene (Chlorinated camphene)		

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EPA 8081B	7245	trans-chlordane (gamma-Chlordane)		
	7910	trans-Nonachlor		
EPA 8082A			10179201	Polychlorinated Biphenyls (PCBs) by GC/ECD
	9095	2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ-206)		
	9090	2,2',3,3',4,4',5,5'-Octachlorobiphenyl (BZ-194)		
	9103	2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ-195)		
	9065	2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ-170)		
	9020	2,2',3,3',4,4'-Hexachlorobiphenyl (BZ-128)		
	9112	2,2',3,3',4,5',6,6'-Octachlorobiphenyl (BZ-201)		
	9116	2,2',3,3',4,5,6'-Heptachlorobiphenyl (BZ-174)		
	9114	2,2',3,3',4,5',6'-Heptachlorobiphenyl (BZ-177)		
	9120	2,2',3,3',4,6'-Hexachlorobiphenyl (BZ-132)		
	9133	2,2',3,4,4',5,5',6-Octachlorobiphenyl (BZ-203)		
	9134	2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ-180)		
	9075	2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ-183)		
	9025	2,2',3,4,4',5'-Hexachlorobiphenyl (BZ-138)		
	9139	2,2',3,4,4',6,6'-Heptachlorobiphenyl (BZ-184)		
	9080	2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ-187)		
	9030	2,2',3,4,5,5'-Hexachlorobiphenyl (BZ-141)		
	9151	2,2',3,4',5',6-Hexachlorobiphenyl (BZ-149)		
	8975	2,2',3,4,5'-Pentachlorobiphenyl (BZ-87)		
	9155	2,2',3,4',5-Pentachlorobiphenyl (BZ-90)		
	9154	2,2',3,4',5'-Pentachlorobiphenyl (BZ-97)		
	9035	2,2',3,5,5',6-Hexachlorobiphenyl (BZ-151)		
	9166	2,2',3,5',6-Pentachlorobiphenyl (BZ-95)		
	8945	2,2',3,5'-Tetrachlorobiphenyl (BZ-44)		
	9040	2,2',4,4',5,5'-Hexachlorobiphenyl (BZ-153)		
	9174	2,2',4,4',5,6'-Hexachlorobiphenyl (BZ-154)		

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		8980	2,2',4,5,5'-Pentachlorobiphenyl (BZ-101)
		8950	2,2',4,5'-Tetrachlorobiphenyl (BZ-49)
		8955	2,2',5,5'-Tetrachlorobiphenyl (BZ-52)
		8930	2,2',5-Trichlorobiphenyl (BZ-18)
		9085	2,3,3',4,4',5,5'-Heptachlorobiphenyl (BZ-189)
		9050	2,3,3',4,4',5-Hexachlorobiphenyl (BZ-156)
		9193	2,3,3',4,4',6-Hexachlorobiphenyl (BZ-158)
		8985	2,3,3',4,4'-Pentachlorobiphenyl (BZ-105)
		8990	2,3,3',4',6-Pentachlorobiphenyl (BZ-110)
		9207	2,3,3',4'-Tetrachlorobiphenyl (BZ-56)
		9055	2,3',4,4',5,5'-Hexachlorobiphenyl (BZ-167)
		9218	2,3',4,4',5',6-Hexachlorobiphenyl (BZ-168)
		9005	2,3,4,4',5-Pentachlorobiphenyl (BZ-114)
		8995	2,3',4,4',5-Pentachlorobiphenyl (BZ-118)
		9000	2,3',4,4',5'-Pentachlorobiphenyl (BZ-123)
		9220	2,3',4,4',6-Pentachlorobiphenyl (BZ-119)
		9221	2,3,4,4'-Tetrachlorobiphenyl (BZ-60)
		8960	2,3',4,4'-Tetrachlorobiphenyl (BZ-66)
		9230	2,3',4',5-Tetrachlorobiphenyl (BZ-70)
		9239	2,3',4'-Trichlorobiphenyl (BZ-33)
		8920	2,3-Dichlorobiphenyl (BZ-5)
		9250	2,4,4',5-Tetrachlorobiphenyl (BZ-74)
		9252	2,4,4'-Trichlorobiphenyl (BZ-28)
		8940	2,4',5-Trichlorobiphenyl (BZ-31)
		9256	2,4'-Dichlorobiphenyl (BZ-8)
		8915	2-Chlorobiphenyl (BZ-1)
		9060	3,3',4,4',5,5'-Hexachlorobiphenyl (BZ-169)
		9015	3,3',4,4',5-Pentachlorobiphenyl (BZ-126)
		8965	3,3',4,4'-Tetrachlorobiphenyl (BZ-77)
		8970	3,4,4',5-Tetrachlorobiphenyl (BZ-81)
		9266	3,4,4'-Trichlorobiphenyl (BZ-37)
		8880	Aroclor-1016 (PCB-1016)
		8885	Aroclor-1221 (PCB-1221)

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EPA 8082A				
	8890	Aroclor-1232 (PCB-1232)		
	8895	Aroclor-1242 (PCB-1242)		
	8900	Aroclor-1248 (PCB-1248)		
	8905	Aroclor-1254 (PCB-1254)		
	8910	Aroclor-1260 (PCB-1260)		
	8912	Aroclor-1262 (PCB-1262)		
	8913	Aroclor-1268 (PCB-1268)		
	9105	Decachlorobiphenyl (BZ-209)		
EPA 8141B			10182204	Organophosphorous Pesticides by GC/NPD
	7075	Azinphos-methyl (Guthion)		
	7125	Bolstar (Sulprofos)		
	7300	Chlorpyrifos		
	7315	Coumaphos		
	7395	Demeton-o		
	7385	Demeton-s		
	7410	Diazinon		
	8610	Dichlorovos (DDVP, Dichlorvos)		
	7475	Dimethoate		
	8625	Disulfoton		
	7550	EPN		
	7570	Ethoprop		
	7600	Fensulfothion		
	7605	Fenthion		
	7770	Malathion		
	7785	Merphos		
	7825	Methyl parathion (Parathion, methyl)		
	7850	Mevinphos		
	7955	Parathion, ethyl		
	7985	Phorate		
	8110	Ronnel		
	8155	Sulfotepp		
	8200	Tetrachlorvinphos (Stirophos, Gardona) Z-isomer		
	8245	Tokuthion (Prothiophos)		
	8275	Trichloronate		
EPA 8151A			10183207	Chlorinated Herbicides by GC/ECD
	8655	2,4,5-T		
	8545	2,4-D		
	8560	2,4-DB		
	8555	Dalapon		
	8595	Dicamba		
	8605	Dichloroprop (Dichlorprop)		

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EPA 8151A	8620	Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)		
	7775	MCPA		
	7780	MCPP		
	8650	Silvex (2,4,5-TP)		
EPA 8260C			10307003	Volatile Organics: GC/MS (capillary column)
	5105	1,1,1,2-Tetrachloroethane		
	5185	1,1,1-Trichloro-2,2,2-trifluoroethane		
	5160	1,1,1-Trichloroethane		
	5110	1,1,2,2-Tetrachloroethane		
	5195	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)		
	5165	1,1,2-Trichloroethane		
	5167	1,1,2-Trichlorofluoroethane		
	4630	1,1-Dichloroethane		
	4640	1,1-Dichloroethylene		
	4670	1,1-Dichloropropene		
	5150	1,2,3-Trichlorobenzene		
	5180	1,2,3-Trichloropropane		
	5155	1,2,4-Trichlorobenzene		
	5210	1,2,4-Trimethylbenzene		
	4570	1,2-Dibromo-3-chloropropane (DBCP)		
	4585	1,2-Dibromoethane (EDB, Ethylene dibromide)		
	4610	1,2-Dichlorobenzene		
	4635	1,2-Dichloroethane (Ethylene dichloride)		
	4655	1,2-Dichloropropane		
	6800	1,3,5-Trichlorobenzene		
	5215	1,3,5-Trimethylbenzene		
	4615	1,3-Dichlorobenzene		
	4660	1,3-Dichloropropane		
	4620	1,4-Dichlorobenzene		
	4735	1,4-Dioxane (1,4- Diethyleneoxide)		
	4510	1-Chlorohexane		
	4665	2,2-Dichloropropane		
	4410	2-Butanone (Methyl ethyl ketone, MEK)		
	4500	2-Chloroethyl vinyl ether		
	4535	2-Chlorotoluene		
	4860	2-Hexanone (MBK)		
	5020	2-Nitropropane		
	4536	4-Bromofluorobenzene		
	4540	4-Chlorotoluene		
	4910	4-Isopropyltoluene (p-Cymene)		
	4995	4-Methyl-2-pentanone (MIBK)		

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Solids EPA 8260C

4305	Acetamide
4315	Acetone
4320	Acetonitrile
4325	Acrolein (Propenal)
4330	Acrylamide
4340	Acrylonitrile
4355	Allyl chloride (3-Chloropropene)
4375	Benzene
4385	Bromobenzene
4390	Bromochloromethane
4395	Bromodichloromethane
4400	Bromoform
4450	Carbon disulfide
4455	Carbon tetrachloride
4475	Chlorobenzene
4575	Chlorodibromomethane
4485	Chloroethane (Ethyl chloride)
4505	Chloroform
4525	Chloroprene (2-Chloro-1,3-butadiene)
4705	cis & trans-1,2-Dichloroethene
4645	cis-1,2-Dichloroethylene
4680	cis-1,3-Dichloropropene
4595	Dibromomethane (Methylene bromide)
4625	Dichlorodifluoromethane (Freon-12)
4725	Diethyl ether
4755	Ethyl acetate
4810	Ethyl methacrylate
4765	Ethylbenzene
4835	Hexachlorobutadiene
4870	Iodomethane (Methyl iodide)
4875	Isobutyl alcohol (2-Methyl-1-propanol)
4900	Isopropylbenzene (Cumene)
5240	m+p-xylene
4925	Methacrylonitrile
4950	Methyl bromide (Bromomethane)
4960	Methyl chloride (Chloromethane)
5000	Methyl tert-butyl ether (MTBE)
4975	Methylene chloride (Dichloromethane)
5245	m-Xylene
5005	Naphthalene
4435	n-Butylbenzene
5090	n-Propylbenzene
5250	o-Xylene

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EPA 8260C	4440	sec-Butylbenzene	
	5100	Styrene	
	4370	T-amylmethylether (TAME)	
	4445	tert-Butylbenzene	
	5115	Tetrachloroethylene (Perchloroethylene)	
	5140	Toluene	
	4700	trans-1,2-Dichloroethylene	
	4685	trans-1,3-Dichloropropylene	
	4605	trans-1,4-Dichloro-2-butene	
	5170	Trichloroethene (Trichloroethylene)	
	5175	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	
	5225	Vinyl acetate	
	5235	Vinyl chloride	
	5260	Xylene (total)	
EPA 8270D			10186002 Semivolatile Organic compounds by GC/MS
	6715	1,2,4,5-Tetrachlorobenzene	
	5155	1,2,4-Trichlorobenzene	
	4610	1,2-Dichlorobenzene	
	6221	1,2-Diphenylhydrazine	
	4615	1,3-Dichlorobenzene	
	4620	1,4-Dichlorobenzene	
	4659	2,2-Oxybis(1-chloropropane)	
	6735	2,3,4,6-Tetrachlorophenol	
	6835	2,4,5-Trichlorophenol	
	6840	2,4,6-Trichlorophenol	
	6000	2,4-Dichlorophenol	
	6130	2,4-Dimethylphenol	
	6175	2,4-Dinitrophenol	
	6185	2,4-Dinitrotoluene (2,4-DNT)	
	6190	2,6-Dinitrotoluene (2,6-DNT)	
	5735	2-Chloroaniline	
	5795	2-Chloronaphthalene	
	5800	2-Chlorophenol	
	6360	2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	
	6385	2-Methylnaphthalene	
	6400	2-Methylphenol (o-Cresol)	
	6460	2-Nitroaniline	
	6490	2-Nitrophenol	
	6412	3 & 4 Methylphenol	
	5945	3,3'-Dichlorobenzidine	
	6405	3-Methylphenol (m-Cresol)	

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		5660	4-Bromophenyl phenyl ether (BDE-3)
		5700	4-Chloro-3-methylphenol
		5745	4-Chloroaniline
		5825	4-Chlorophenyl phenylether
		6410	4-Methylphenol (p-Cresol)
		6470	4-Nitroaniline
		6500	4-Nitrophenol
		5500	Acenaphthene
		5505	Acenaphthylene
		5510	Acetophenone
		5545	Aniline
		5555	Anthracene
		7065	Atrazine
		5562	Azobenzene
		5570	Benzaldehyde
		5575	Benzo(a)anthracene
		5580	Benzo(a)pyrene
		5590	Benzo(g,h,i)perylene
		9309	Benzo(j)fluoranthene
		5600	Benzo(k)fluoranthene
		5585	Benzo[b]fluoranthene
		5610	Benzoic acid
		5630	Benzyl alcohol
		5640	Biphenyl
		5760	bis(2-Chloroethoxy)methane
		5765	bis(2-Chloroethyl) ether
		5780	bis(2-Chloroisopropyl) ether
		5670	Butyl benzyl phthalate
		7180	Caprolactam
		5680	Carbazole
		5855	Chrysene
		6065	Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate, DEHP)
		5895	Dibenz(a,h) anthracene
		5905	Dibenzofuran
		6070	Diethyl phthalate
		6135	Dimethyl phthalate
		5925	Di-n-butyl phthalate
		6200	Di-n-octyl phthalate
		6265	Fluoranthene
		6270	Fluorene
		6275	Hexachlorobenzene
		4835	Hexachlorobutadiene

Solids

EPA 8270D	6285	Hexachlorocyclopentadiene		
	4840	Hexachloroethane		
	6315	Indeno(1,2,3-cd) pyrene		
	6320	Isophorone		
	5005	Naphthalene		
	5015	Nitrobenzene		
	6530	n-Nitrosodimethylamine		
	6545	n-Nitrosodi-n-propylamine		
	6535	n-Nitrosodiphenylamine		
	6590	Pentachlorobenzene		
	6605	Pentachlorophenol		
	6615	Phenanthrene		
	6625	Phenol		
	6665	Pyrene		
	5095	Pyridine		
EPA 8270D SIM			10242509	Semivolatile Organic compounds by GC/MS Selective Ion Monitoring
	4735	1,4-Dioxane (1,4- Diethyleneoxide)		
	6380	1-Methylnaphthalene		
	9501	1-Methylphenanthrene		
	6852	2,3,5-Trimethylnaphthalene		
	6188	2,6-Dimethylnaphthalene		
	6385	2-Methylnaphthalene		
	5500	Acenaphthene		
	5505	Acenaphthylene		
	5555	Anthracene		
	5575	Benzo(a)anthracene		
	5580	Benzo(a)pyrene		
	5605	Benzo(e)pyrene		
	5590	Benzo(g,h,i)perylene		
	9309	Benzo(j)fluoranthene		
	5600	Benzo(k)fluoranthene		
	5585	Benzo[b]fluoranthene		
	5640	Biphenyl		
	5680	Carbazole		
	5855	Chrysene		
	5895	Dibenz(a,h) anthracene		
	5905	Dibenzofuran		
	5910	Dibenzothiophene		
	6265	Fluoranthene		
	6270	Fluorene		
	6315	Indeno(1,2,3-cd) pyrene		
	5005	Naphthalene		
	6605	Pentachlorophenol		

Solids

EPA 8270D SIM	6608	Perylene		
	6615	Phenanthrene		
	6665	Pyrene		
EPA 8321B			10189205	Solvent Extractable non-volatile compounds by HPLC/TS/MS
	7710	3-Hydroxycarbofuran		
	7010	Aldicarb (Temik)		
	7015	Aldicarb sulfone		
	7020	Aldicarb sulfoxide		
	7195	Carbaryl (Sevin)		
	7205	Carbofuran (Furaden)		
	7800	Methiocarb (Mesurol)		
	7805	Methomyl (Lannate)		
	7940	Oxamyl		
	8080	Propoxur (Baygon)		
EPA 8330B			10308006	Nitroaromatics, Nitramines and Nitrate Esters by High Performance Liquid Chromatography (HPLC)
	6885	1,3,5-Trinitrobenzene (1,3,5-TNB)		
	6160	1,3-Dinitrobenzene (1,3-DNB)		
	9651	2,4,6-Trinitrotoluene (2,4,6-TNT)		
	6185	2,4-Dinitrotoluene (2,4-DNT)		
	6190	2,6-Dinitrotoluene (2,6-DNT)		
	9303	2-Amino-4,6-dinitrotoluene (2-am-dnt)		
	9507	2-Nitrotoluene		
	6150	3,5-Dinitroaniline		
	9510	3-Nitrotoluene		
	9306	4-Amino-2,6-dinitrotoluene (4-am-dnt)		
	9513	4-Nitrotoluene		
	6415	Methyl-2,4,6-trinitrophenylnitramine (tetryl)		
	5015	Nitrobenzene		
	6485	Nitroglycerin		
	9522	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)		
	9558	Pentaerythritoltetranitrate (PETN)		
	9432	RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine)		
EPA 9012B			10243206	Total and Amenable Cyanide (automated colorimetric with off-line distillation)
	1510	Amenable cyanide		
	1645	Total cyanide		
EPA 9013A			10308802	Cyanide Extraction Procedure for Solids and Oils
	8031	Extraction/Preparation		

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EPA 9020B			10194408	Total Organic Halides
	2045	Total organic halides (TOX)		
EPA 9030B			10195605	Acid-Soluble and Acid-Insoluble sulfides: Distillation
	2005	Sulfide		
EPA 9034			10196006	Titrimetric Procedure for Acid-Soluble and Acid-Insoluble Sulfides
	2005	Sulfide		
EPA 9045D			10244607	Soil and Waste pH
	1900	pH		
EPA 9056A			10199607	Determination of Inorganic Anions by Ion Chromatography
	1575	Chloride		
	1730	Fluoride		
	1805	Nitrate		
	1835	Nitrite		
	2000	Sulfate		
EPA 9071A			10201408	Oil and Grease Extraction Method for sludge and sediment samples
	1860	Oil & Grease		
NWTPH-Dx			90018409	Oregon DEQ TPH Diesel Range
	9369	Diesel range organics (DRO)		
	9506	Residual Range Organics (RRO)		
NWTPH-Gx			90018603	Oregon DEQ TPH Gasoline Range Organics by GC/FID-PID Purge & Trap
	9408	Gasoline range organics (GRO)		
NWTPH-HCID			90013200	Oregon DEQ Total Petroleum Hydrocarbon ID
	2050	Total Petroleum Hydrocarbons (TPH)		
PLUMB 1981			60006259	Extraction/Preparation
	6118	Distribution of particle sizes		
	8031	Extraction/Preparation		
WI(95) DRO			90019457	Wisconsin DNR - Modified Method for Determination of Diesel Range Organics by GC-FID
	9369	Diesel range organics (DRO)		

QUALITY ASSURANCE MANUAL

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QUALITY ASSURANCE MANUAL

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Current Data Quality Objectives (DQOs) may be requested from the laboratory for specified methods or projects.

QA MANUAL CROSS REFERENCE TABLE

ALS QA Manual	ISO 17025:2005 Section	TNI Standard 2009 Volume 1, Module 2 Section
2	4.1	4.1
3	4.2	4.2
4	4.3	4.3
5	4.4	4.4
6	4.5	4.5
7	4.6	4.6
8	4.7	4.7
9	4.8	4.8
15	4.9	4.9
16	4.10	4.10
16	4.11	4.11
16	4.12	4.12
17	4.13	4.13
18	4.14	4.14
19	4.15	4.15
2, 12, 13, 14	5.1	5.1
20	5.2	5.2
10	5.3	5.3
12, 13, 14	5.4	5.4
10	5.5	5.5
13	5.6	5.6
11	5.7	5.7
11, 12, 13	5.8	5.8
14	5.9	5.9
21	5.10	5.10

1) Introduction and Scope

ALS Environmental, Kelso is a professional analytical services laboratory which performs chemical and microbiological analyses on a wide variety of sample matrices, including drinking water, groundwater, surface water, wastewater, soil, sludge, sediment, tissue, industrial and hazardous waste, air, and other material.

We recognize that quality assurance requires a commitment to quality by everyone in the organization – individually, within each operating unit, and throughout the entire laboratory. Laboratory management is committed to ensuring the effectiveness of its quality systems and to ensure that all tests are carried out in accordance to customer requirements. Key elements of this commitment are set forth in the SOP *Laboratory Ethics and Data Integrity* (CE-GEN001) and in this Quality Assurance Manual. ALS – Kelso is committed to operate in accordance with these requirements and those of regulatory agencies, accrediting authorities, and certifying organizations. The laboratory also strives for improvement through varying continuous improvement initiatives and projects.

Quality Management Systems are established, implemented and maintained by management. Policies and procedures are established in order to meet requirements of accreditation bodies and applicable programs, such as the Department of Defense (DOD) Environmental Laboratory Accreditation Program, as well as client's quality objectives. Systems are designed so that there will be sufficient Quality Assurance (QA) activities conducted in the laboratory to ensure that all analytical data generated and processed will be scientifically sound, legally defensible, of known and documented quality, and will accurately reflect the material being tested. Quality Systems are applicable to all fields of testing in which the laboratory in involved.

Quality Control (QC) procedures are used to continually assess performance of the laboratory and quality systems. The laboratory maintains control of analytical results by adhering to written standard operating procedures (SOPs), using analytical control parameters with all analyses, and by observing sample custody requirements. All analytical results are calculated and reported in units consistent with project specifications to allow comparability of data.

This QAM is applicable to the facility listed on the title page. The information in this manual has been organized according to requirements found in the National Environmental Laboratory Accreditation Program (NELAP) Quality Systems Standards (2003 and 2009), the EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5, USEPA, 2001; and General Requirements for the Competence of Testing and Calibration Laboratories, ISO/IEC 17025:2005. A glossary of pertinent terms and acronyms is included in Appendix A.

2) Organization

The ALS Environmental, Kelso staff, consisting of approximately 110 employees, includes chemists, technicians and support personnel. They represent diverse educational backgrounds and experience, and provide the comprehensive skills that the laboratory requires. During seasonal workload increases, additional temporary employees may be hired to perform specific tasks. All employees share the responsibility for maintaining and improving the quality of our analytical services.

ALS – Kelso is legally identifiable as ALS Group USA, Corp., dba ALS Environmental. ALS Group USA, Corp. is a component of ALS Limited, a publicly held Australian company. The ALS global website may be referred to for corporate ownership information (www.alsglobal.com/Our-Company). The laboratory is divided into operational and managerial units based upon specific disciplines. Each department is responsible for establishing, maintaining and documenting QA and QC practices meeting laboratory needs. Organizational charts of the laboratory, as well as the resumes of these key personnel, can be found in Appendix B. This laboratory organization is designed so that potential conflict of interest is avoided, and such

that an adequate amount of supervisory personnel are in place to provide oversight and supervision of day to day operations.

3) Management

The purpose of the QA program at ALS Environmental, Kelso is to ensure that our clients are provided with analytical data that is scientifically sound, legally defensible, and of known and documented quality. The concept of Quality Assurance can be extended, and is expressed in the mission statement:

> "The mission of ALS Environmental, Kelso is to provide high quality, cost-effective, and timely professional testing services to our customers. We recognize that our success as a company is based on our ability to maintain customer satisfaction. To do this requires constant attention to customer needs, maintenance of state-of-the-art testing capabilities and successful management of our most important asset - our people - in a way that encourages professional growth, personal development and company commitment."

3.1 Quality Management Systems

In support of this mission, the laboratory has developed a Quality Management System to ensure all products and services meet our client's needs. The system is implemented and maintained by the Quality Assurance Manager with corporate oversight by the Manager of Quality Assurance, USA. These systems are based upon ISO 17025:2005 standards, upon which fundamental programs (NELAC 2003, 2009 and DoD QSM) are based. Implementation and documentation against these standards are communicated in corporate policy statements, this QAM, and SOPs. Actual procedures, actions and documentation are defined in both administrative and technical SOPs. Quality systems include:

- Accreditation and certification program compliance
- Standard Operating Procedures
- Sample management and Chain of Custody procedures
- Document control
- Demonstration of Capability
- Analytical traceability
- Ethics training and data integrity processes
- Corrective action procedures
- Statistical control charting
- Management reviews

The effectiveness of the quality system is assessed in several ways, including:

- Internal and external audits
- Periodic reports to management
- Analysis of customer feedback
- Proficiency testing

The responsibilities of key positions within the laboratory are described below. Table 3-1 lists the ALS - Kelso personnel assigned to these key positions. Managerial staff members are

provided the authority and resources needed to perform their duties. In the event that work is stopped in response to quality problems, as described below, only the Laboratory Director or Quality Assurance Manager has the authority to resume work.

Laboratory Director – The role of the Laboratory Director is to provide technical, operational, and administrative leadership through planning, allocation and management of personnel and equipment resources. The Laboratory Director provides leadership and support for the QA program and is responsible for overall laboratory efficiency and financial performance. The Laboratory Director has the authority to stop work in response to quality problems. The Laboratory Director also provides resources for implementation of the QA program, reviews and approves this QA Manual, reviews and approves standard operating procedures (SOPs), and provides support for business development by identifying and developing new markets through continuing support of the management of existing client activities.

Quality Assurance Manager (QAM) – The Quality Assurance Manager has the authority and responsibility for implementing, maintaining, and improving the quality system. This includes coordination of QA activities in the laboratory, ensuring that personnel understand the quality system, ensuring communication takes place in the laboratory regarding implementation of the quality system, ensuring adequate staff training, and monitoring overall quality system compliance. The QAM continually evaluates potential improvements in the quality system. Audit and surveillance results, control charts, proficiency testing results, data analysis, corrective and preventive actions, customer feedback, and management reviews are used to support quality system implementation. The QAM is responsible for ensuring compliance with all applicable regulatory compliance quality standards (i.e. NELAP/TNI, ISO, DoD QSM, etc.). The QAM works with laboratory staff to establish effective quality control and assessment processes and has the authority to stop work in response to quality problems. The QAM is responsible for maintaining the laboratory's certifications and approvals, for maintaining the QA Manual and performing an annual review of it, reviewing and approving SOPs and ensuring the annual review of technical SOPs, maintaining QA records (metrological records, archived logbooks, PT results, etc.), document control, conducting proficiency testing studies, approving nonconformity and corrective action reports, and performing internal QA audits.

The QAM reports directly to the Laboratory Director and reports indirectly to the ALS Manager of Quality Assurance, USA. It is important to note that when evaluating data, the QAM does so in an objective manner and free of outside, or managerial, influence.

The Manager of Quality Assurance, USA is responsible for the overall QA program at all the ALS Environmental Group laboratories. The Manager of Quality Assurance, USA is responsible for oversight of QAM's regulatory compliance efforts (NELAP, ISO, DOD, etc.) and may perform internal audits to evaluate compliance. The Manager of Quality Assurance, USA approves company-wide SOPs and provides assistance to the laboratory QA staff and laboratory managers as necessary.

Deputy Laboratory Director and QA Manager – In the case of absence of the Laboratory Director or QAM, deputies are assigned to act in that role. Default deputies for these positions are the Client Services Manager or Metals Department Manager (for the Laboratory Director) and the Laboratory Director (for the QAM).

Environmental Health and Safety (EH&S) Officer – The EH&S officer is responsible for the administration of the laboratory health and safety policies. This includes the formulation and implementation of safety policies, the supervision of new-employee safety training, the review of accidents, incidents and prevention plans, the monitoring of hazardous waste disposal and the conducting of departmental safety inspections.

The EH&S officer is also designated as the Chemical Hygiene Officer. The EH&S Officer has a dotted-line reporting responsibility to the ALS North America EH&S Manager.

Client Services Manager (CSM) – The CSM is responsible for the Client Services Department defined for the laboratory. This includes management and oversight of Project Managers, electronic deliverables, and support functions. The Client Services Department provides a complete interface with clients from initial project specification to final deliverables. The Client Services Manager has the responsibility and authority to stop work in response to accreditation/certification or quality problems, or in response to similar subcontractor quality problems.

Department Managers and Supervisors – Each manager or supervisor has the responsibility to ensure that QA and QC functions are carried out as specified when executing the analyses and related tasks and to ensure the production of high quality data. Managers and bench-level supervisors monitor the day-to-day operations to ensure that productivity and data quality objectives are met. A department manager has the authority to stop work in response to quality problems in their area. Managers and supervisors are responsible for ensuring that analysts perform testing according to applied methods, SOPs, and QC guidelines particular to the laboratory department.

Sample Management Office (SMO) – The Sample Management Office plays a key role in the laboratory QA program by handling all activities associated with receiving, storage, and disposal of samples, and maintaining documentation for all samples received. SMO staff is also responsible for the proper disposal of samples after analysis. The Support Services Manager oversees SMO and bottle preparation functions.

Information Technology (IT) – IT staff is responsible for the administration of the Laboratory Information Management System (LIMS) and other necessary support services. Other functions of the IT staff include laboratory network maintenance, IT systems development and implementation, education of analytical staff in the use of scientific software, Electronic Data Deliverable (EDD) support, and data back-up, archival and integrity operations.

3.2 Ethics, Professional Conduct and Data Integrity

One of the most important aspects of the success of ALS – Kelso is the emphasis placed on the integrity of the data provided and the services rendered. This success is reliant on both the professional conduct of all employees within ALS – Kelso as well as established laboratory practices. All personnel involved with environmental testing and calibration activities must familiarize themselves with the quality documentation and implement the policies and procedures in their work.

All employees are required to sign and adhere to the requirements set forth in the *ALS Code of Conduct Policy* and agree to the *Confidentiality Agreement (*Appendix C).

3.2.1 Professional Conduct

To promote quality ALS – Kelso requires certain standards of conduct and ethical performance among employees. The following examples of documented ALS policy are representative of these standards, and are not intended to be limiting or all-inclusive:

- Under no circumstances is the willful act of fraudulent manipulation of analytical data condoned. Such acts are to be reported immediately to senior management for appropriate corrective action.
- Unless specifically required in writing by a client, alteration, deviation or omission of written contractual requirements is not permitted. Such changes must be in writing and approved by senior management.

- Falsification of data in any form will not be tolerated. While much analytical data is subject to professional judgment and interpretation, outright falsification, whenever observed or discovered, will be documented, and appropriate remedies and punitive measures will be taken toward those individuals responsible.

3.2.2 Confidentiality

It is the responsibility of all laboratory employees to safeguard sensitive company information, client data, records, and information; and matters of national security concern should they arise. The nature of our business and the well-being of our company and of our clients is dependent upon protecting and maintaining confidential and/or proprietary company and client information. All information, data, and reports (except that in the public domain) collected or assembled on behalf of a client is treated as confidential.

Information may not be given to third parties without the consent of the client. Unauthorized release of confidential information about the company or its clients is taken seriously and is subject to formal disciplinary action. All employees sign a confidentiality agreement upon hire to protect the company and client's confidentiality and proprietary rights.

3.2.3 Prevention and Detection of Improper, Unethical or Illegal Actions

It is the intention of ALS - Kelso to proactively prevent and/or detect any improper, unethical or illegal action conducted within the laboratory. This is performed by the implementation of a program designed for not only the detection but also prevention. Prevention consists of educating all laboratory personnel in their roles and duties as employees, company policies, inappropriate practices, and their corresponding implications as described here.

In addition to education, appropriate and inappropriate practices are included in SOPs such as manual integration, data review and specific method procedures. Electronic and hardcopy data audits are performed regularly, including periodic audits of chromatographic electronic data. Requirements for internal QA audits are described in the SOP *Internal Audits* (CE-QA001). All aspects of this program are documented and retained on file according to the company policy on record retention.

The ALS Employee Handbook also contains information on the ALS ethics and data integrity program, including mechanisms for reporting and seeking advice on ethical decisions.

3.2.4 Laboratory Data Integrity, Ethics, and Computer Security Training

Each employee receives data integrity and ethics training on an annual basis. The topics covered and training participation are documented. It is the responsibility of the QAM to ensure that the training is conducted as described. Additionally, new employees are given a QA and data integrity/ethics orientation within the first month of hire, followed by the routine annual training.

Key topics covered are the organizational mission and its relationship to the critical need for honesty and full disclosure in all analytical reporting, record keeping, and reporting data integrity issues. Training includes discussion regarding all data integrity procedures, data integrity training documentation, in-depth data monitoring and data integrity procedures. Training topics also cover examples of improper actions, legal and liability implications (company

and personal), causes, prevention, awareness, and reporting options. Computer security is also included, covering ALS computing security awareness, passwords and access, and related topics.

Trainees are required to understand that any infraction of the laboratory data integrity procedures will result in an investigation that could lead to serious consequences including immediate termination, or civil/criminal prosecution.

3.2.5 Management and Employee Commitment

ALS – Kelso makes every attempt to ensure that employees are free from any commercial, financial, or other undue pressures that might affect their quality of work. Related policies are described in the ALS Employee Handbook. This includes:

- ALS Open Door Policy (ALS Employee Handbook) – Employees are encouraged to bring any work related problems or concerns to the attention of local management or their Human Resources representative. However, depending on the extent or sensitivity of the concern, employees are encouraged to directly contact any member of upper management.
- ALS Integrity Hotline – An anonymous and confidential reporting system available to all employees that is used to communicate misconduct and other concerns. The program shall help minimize negative morale, promote a positive work place, and encourage reporting suspected misconduct without retribution. Associated upper management is notified and the investigations are documented.
- Use of flexible work hours. Within reason and as approved by supervisors, employees are allowed flexible work hours in order to help ease schedule pressures which could impact decision-making and work quality.
- Operational and project scheduling assessments are continually made to ensure that project planning is performed and that adequate resources are available during anticipated periods of increased workloads. Procedures for subcontracting work are established, and within the ALS Environmental laboratory network additional capacity is typically available for subcontracting, if necessary.
- Gifts and Favors (ALS Employee Handbook) – To avoid possible conflict of interest implications, employees do not give unusual gifts or favors to, nor accept such gifts or favors from, persons outside the Company who are, or may be, in any way concerned with the projects on which the Company is professionally engaged.

Table 3-1
Summary of Technical Experience and Qualifications – Key Personnel

Personnel	Years of Experience	Project Role
Jeff Grindstaff, B.S.	26	Laboratory Director
Carl Degner, M.S.	31	Quality Assurance Manager
Kurt Clarkson	8	Client Services Manager
Jeff Coronado, B.S.	25	Metals Department Manager
Harvey Jacky, B.S.	26	General Chemistry Department Manager
Loren Portwood, B.S.	26	Organics Department Manager
Les Kennedy, B.A.	24	Support Services Manager
Eileen Arnold, B.A.	33	Environmental Health and Safety Officer
Joe Caulfield	16	Information Technology

4) Document Control

Procedures for control and maintenance of documents are described in SOP *Document Control* (CE-GEN005). The requirements of the SOP apply to all laboratory logbooks (standards, maintenance, run logbooks, etc.), certificates of analysis, SOPs, QAMs, quality assurance project plans (QAPPs), Environmental Health & Safety (EHS) manuals, and other controlled ALS Environmental documents.

Each controlled copy of a controlled document is released after a document control number is assigned and the recipient is recorded on a document distribution list. Filing and distribution is performed by the QAM, or designee, and ensure that only the most current version of the document is distributed and in use. A document control number is assigned to logbooks. Completed logbooks that are no longer in use are archived in a master logbook file. Logbook entries are standardized following SOP *Making Entries onto Analytical Records* (CE-QA007). The logbook entries are reviewed and approved at a regular interval (quarterly).

A records system is used which ensures all laboratory records (including raw data, reports, and supporting records) are retained and available. The archiving system is described in SOP *Data Archiving* (ADM-ARCH).

External documents relative to the management system are managed by the QAM. To prevent the use of invalid and/or outdated external documents, the laboratory maintains a master list of current documents and their availability. The list is reviewed before making the documents available. External documents are not issued to personnel.

5) Review of Requests, Tenders and Contracts

Requests for new work are reviewed prior to signing any contracts or otherwise agreeing to perform the work. The specific methods to be used are agreed upon between the laboratory and the client. A capability review is performed to determine if the laboratory has or needs to obtain certification to perform the work, to determine if the laboratory has the resources (personnel, equipment, materials, capacity, skills, expertise) to perform the work, and if the laboratory is able to meet the client's required reporting and QC limits. The results of this review are communicated to the client and any potential conflict, deficiency, lack of appropriate accreditation status, or concerns of the ability to complete the client's work are resolved. Any differences between the request or tender and the contract shall be resolved before any work commences. The client should be notified at this time if work is expected to be subcontracted. Each contract shall be acceptable both to the laboratory and the client. Records are maintained of pertinent discussions with a client relating to the client's requirements or the results of the work. If a contract needs to be amended after work has commenced, the contract review process is repeated and any amendments are communicated to all affected personnel. Changes in accreditation status affecting ongoing projects must be reported to the client.

6) Subcontracting of Tests

Analytical services are subcontracted when the laboratory needs to balance workload or when the requested analyses are not performed by the laboratory. Subcontracting is only done with the knowledge and approval of the client and to qualified laboratories. Subcontracting to another ALS Environmental Group laboratory is preferred over external-laboratory subcontracting. Further, subcontracting is done using capable and qualified laboratories. Established procedures are used to qualify external subcontract laboratories. These procedures are described in SOP *Qualification of Subcontract Laboratories* (CE-QA004). The Quality Assurance staff is responsible for maintaining a list of qualified subcontract laboratories.

7) Purchasing Services and Supplies

The quality level of reagents and materials (grade, traceability, etc.) required is specified in analytical SOPs. Department supervisors ensure that the proper materials are purchased. Inspection and verification of material ordered is performed at the time of receipt by receiving personnel. The receiving staff labels the material with the date received. Expiration dates are assigned as appropriate for the material. Storage conditions and expiration dates are specified in the analytical SOP. *Quality of Reagents and Standards* (CE-QA012) and Reagent and *Standards Login and Tracking* (ADM-RLT) provides default expiration requirements. Supplies and services that are critical in maintaining the quality of laboratory testing are procured from pre-approved vendors. The policy and procedure for purchasing and procurement are described in SOP *Procurement and Control of Laboratory Services and Supplies* (CE-GEN007).

Receipt procedures include technical review of the purchase order/request to verify that what was received is identical to the item ordered. The laboratory checks new lots of reagents for unacceptable levels of contamination prior to use in sample preservation, sample preparation, and sample analysis by following SOP *Reagent and Standards Login and Tracking* (ADM-RLT).

8) Service to the Client

ALS - Kelso utilizes a number of processes to ensure that adequate resources exist to meet service demands. Senior staff meetings, tracking of outstanding proposals, and a current synopsis of incoming work all assist the senior staff in properly allocating sufficient resources. Status/production meetings are conducted regularly with the laboratory and Project Managers to inform the staff of the status of incoming work, future projects, or project requirements.

The Project Manager is a scientist assigned to each client to act as a technical liaison between the client and the laboratory. The Project Manager is responsible for ensuring that the analyses performed by the laboratory meet all project and contract requirements. This entails coordinating with the laboratory staff to ensure that client-specific needs are understood and that the services provided are properly executed and satisfy the requirements of the client.

Laboratory management also monitors a number of other indicators to assess the overall ability of the laboratory to successfully perform analyses for its clients. This includes on-time performance, customer complaints, training reports and non-conformity reports. A frequent assessment is made of the laboratory's facilities and resources in anticipation of accepting an additional or increased workload.

All Requests for Proposal (RFP) documents are reviewed by the Project Manager and appropriate managerial staff to identify any project specific requirements that differ from the standard practices of the laboratory. Any requirements that potentially cannot be met are noted and communicated to the client, as well as requesting the client to provide any applicable project specific Quality Assurance Project Plans (QAPPs).

When a client requests a modification to an SOP, policy, or standard specification the Project Manager will discuss the proposed deviation with the Client Services Manager, Laboratory Director, and department manager to obtain approval for the deviation. The QAM may also be involved. All project-specific requirements must be on-file and with the service request upon logging in the samples. The modification or deviation must be documented. A Project-Specific Communication Form, Form V, or similar, may be used to document such deviations.

The laboratory affords clients cooperation to clarify the client's request and to monitor the laboratory's performance in relation to the work performed, provided that the laboratory ensures confidentiality to other clients. The laboratory maintains and documents timely communication with the client for the purposes of seeking feedback and clarifying customer requests. Feedback is used and analyzed to improve the quality of services. The SOP *Handling Customer Feedback* (CE-GEN010) is in place for these events.

9) Complaints

In addition to project communication and internal communication of data issues, the laboratory also maintains a system for dealing with customer complaints. The procedure is described in SOP *Handling Customer Feedback* (CE-GEN010). The person who initially receives feedback in the form of a complaint (typically the Project Manager) is responsible for documenting the complaint. If the Project Manager is unable to satisfy the customer, the complaint is brought to the attention of the Client Services Manager, Laboratory Director, or QAM for final resolution. The complaint and resolution are documented.

10) Facilities and Equipment

The ALS Environmental Kelso laboratory features over 45,000 square feet of laboratory and administrative workspace. The laboratory has been designed and constructed to provide safeguards against cross-contamination of samples and is arranged according to work function, which enhances the efficiency of analytical operations. The ventilation system has been specially designed to meet the needs of the analyses performed in each work space. Also, ALS - Kelso minimizes laboratory contamination sources by employing janitorial and maintenance staff to ensure that good housekeeping and facilities maintenance are performed. In addition, the segregated laboratory areas are designed for safe and efficient handling of a variety of sample types. These specialized areas (and access restrictions) include:

- Shipping and Receiving/Purchasing
- Sample Management Office, including controlled-access sample storage areas
- Inorganic/Metals Sample Preparation Laboratories (2)
- Inorganic/Metals "clean room" sample preparation laboratory
- ICP-AES Laboratory
- ICP-MS Laboratory
- Low-level Mercury Laboratory
- Water Chemistry & General Chemistry Laboratories (3)
- Semi-volatile Organics Sample Preparation Laboratory
- Gas Chromatography and High Performance Liquid Chromatography Laboratories
- Gas Chromatography/Mass Spectrometry Laboratories (2)
- Semi-volatile Organics Drinking Water Laboratory
- Volatile Organics Laboratory
    - Separate sample preparation laboratory
    - Access by semi-volatile sample preparation staff only after removing lab coat and solvent-contaminated gloves, etc.
- Microbiology Laboratory
- Laboratory Deionized Water Systems (2)
- Laboratory Management, Client Service, Report Generation and Administration
- Data Archival, Data Review and support functions areas

In addition, the designated areas for sample receiving, refrigerated sample storage and dedicated sample container preparation and shipping areas provide for the efficient and safe

handling of a variety of sample types. The laboratory is equipped with state-of-the-art analytical and administrative support equipment. The equipment and instrumentation are appropriate for the procedures in use. Refer to Appendix D for a Laboratory Floor Plan and Appendix E for a list of major equipment, illustrating the laboratory's overall capabilities and depth.

11) Sample Management

11.1 Sampling and Sample Preservation

The quality of analytical results is highly dependent upon the quality of the procedures used to collect, preserve and store samples. ALS - Kelso recommends that clients follow sampling guidelines described in 40 CFR 136, 40 CFR 141, USEPA SW 846, and state-specific sampling guidelines, if applicable. Sampling factors that must be taken into account to insure accurate, defensible analytical results include:

- Amount of sample taken
- Type of container used
- Type of sample preservation
- Sample storage time
- Proper custodial documentation

The laboratory uses the sample preservation, container, and holding-time recommendations published in a number of documents. The primary documents of reference are: USEPA SW-846, Third Edition and Updates I, II, IIA, IIB, III, IV for hazardous waste samples; USEPA 600/4-79-020, 600/4-91-010, 600/4-82-057, 600/R-93/100, 600/4-88-039, 600/R-94-111, and Supplements; EPA 40CFR parts 136 and 141 and associated Method Update Rules; and Standard Methods for the Examination of Water and Wastewater for water and wastewater samples (see Section 23 for complete references). The container, preservation and holding time information for these references is summarized in Appendix F for soil, water, and drinking water. The current EPA CLP Statement of Work should be referred to for CLP procedures. Where allowed by project sampling and analysis protocols (such as Puget Sound Protocols) the holding time for sediment, soil, and tissue samples may be extended for a defined period when stored frozen at -20°C.

ALS - Kelso provides clients with sample containers with applicable preservatives. Containers are purchased as pre-cleaned to a level 1 status, and conform to the requirements for samples established by the USEPA. Certificates of analysis for sample containers are available upon request. Reagent water used for sampling blanks (trip blanks, etc.) and chemical preservation reagents are tested by the laboratory to ensure that they are free of interferences and documented. Our sample kits typically consist of pre-cleaned, rinsed, and air-dried shipping coolers with foam liners, specially prepared and labeled sample containers individually wrapped in protective material (VOC vials are placed in a specially made foam holder), chain-of-custody (COC) forms, and custody seals. Container labels and custody seals are provided for each container. Figure 11-1 shows the chain-of-custody form routinely used at ALS - Kelso and included with sample kits. Dry ice or gel ice is the only temperature preservative used. For large sample container shipments the containers may be shipped in their original boxes. Such shipments will consist of labeled and preserved sample containers and sufficient materials (bubble wrap, COC forms, custody seals, shipping coolers, etc.) for return to ALS, unless otherwise instructed by the client.

ALS - Kelso also provides courier service that makes regularly scheduled trips on the I-5 corridor between the Greater Portland, Oregon area and the Great Seattle/Tacoma area, and nearby communities and facilities.

Returning shipping coolers are cleaned and decontaminated. If any such cooler exhibits an odor or other abnormality after receipt and cleaning, a more vigorous decontamination process is employed. Containers which cannot be decontaminated are discarded. ALS - Kelso keeps client-specific shipping requirements on file and utilizes major transportation carriers to necessary to meet sample shipping requirements (same-day, overnight, etc.).

When ALS - Kelso ships samples to other laboratories for analysis, similar sample integrity processes are used to ensure preservation and proper sample handling, and to avoid any possible breakage, cross-contamination of samples, or identification problems. Alternatively, the receiving laboratory's procedures may be specified. Chain of custody is maintained during the process.

11.2 Sample Receipt and Handling

Standard procedures are established for the receiving of samples into the laboratory and are found in SOP SMO-GEN, *Sample Receiving*. These procedures ensure that samples are received and properly logged into the laboratory, and that all associated documentation, including chain of custody forms, is complete and consistent with the samples received.

Once samples are received or delivered to the laboratory the sample management office uses a Cooler Receipt and Preservation Check Form (CRF - Figure 11-2) is used to assess the shipping cooler and its contents as received by the laboratory. Any anomalies or discrepancies observed during the initial assessment are recorded on the CRF and COC documents. Verification of sample integrity includes the following activities:

- Assessment of custody seal presence/absence, location and signature;
- Temperature of sample containers upon receipt;
- Chain of custody documents properly used (entries in ink, signature present, etc.);
- Sample containers checked for integrity (broken, leaking, etc.);
- Sample is clearly marked and dated (bottle labels complete with required information);
- Appropriate containers (size, type) are received for the requested analyses;
- The minimum amount of sample material is provided for the analysis.
- Sample container labels and/or tags agree with chain of custody entries (identification, required analyses, etc.);
- Assessment of proper sample preservation (if inadequate, corrective action is employed); and
- VOC containers are inspected for the presence/absence of bubbles. (Assessment of proper preservation of VOC containers is performed by lab personnel).

Samples are logged into a Laboratory Information Management System (LIMS). Potential problems with a sample shipment are addressed by contacting the client and discussing the pertinent issues. When the Project Manager and client have reached a satisfactory resolution, the login process may continue and analysis may begin. During

the login process each sample container is given a unique laboratory code and a Service Request form is generated which contains client information, sample descriptions, sample matrix information, required analyses, sample collection dates, analysis due dates and other pertinent information. The service request is reviewed by the applicable Project Manager for accuracy and completeness.

Samples are stored as per method requirements until analysis, unless otherwise specified, using various refrigerators, freezers, or designated secure areas. ALS - Kelso has multiple walk-in and refrigerator cold storage units which house the majority of samples, including dedicated refrigerated storage of VOC samples. The VOC storage units are monitored using storage blanks as described in SOP VOC-BLAN, *VOA Storage Blanks*. ALS - Kelso also has multiple sub-zero freezers capable of storing samples at -10 to -30°C primarily used for tissue and sediment samples. The temperature of each sample storage unit is monitored real time with an electronic temperature monitoring system.

ALS - Kelso adheres to the method-prescribed or project-specified holding times for all analyses. Analysts monitor holding times by obtaining analysis-specific reports from the LIMS. These reports provide holding time information on all samples for the analysis, calculated from the sampling date and the holding time requirement. To document holding time compliance, the date and time analyzed is printed or written on the analytical raw data. Unless other arrangements have been made in advance, upon completion of all analyses and submittal of the final report, aqueous samples are retained at ambient temperature for 30 days, soil samples are retained at ambient temperature for 60 days, and tissue samples are retained frozen for 3 months. Upon expiration of these time limits, the samples are either returned to the client or disposed of according to approved disposal practices. Sample extracts are retained as specified in analytical SOPs. All samples are characterized according to hazardous/non-hazardous waste criteria and are segregated accordingly. All hazardous waste samples are disposed of according to formal procedures outlined in the ALS Environmental Health and Safety Manual and in accordance with applicable laws. Documentation is maintained for each sample from initial receipt through final disposal to ensure that an accurate history of the sample from "cradle to grave" is available.

11.3 Sample Custody

Sample custody transfer at the time of sample receipt is documented using chain-of-custody (COC) forms accompanying the samples. During sample receipt, it is also noted if custody seals were present.

Facility security and access is important in maintaining the integrity of samples received at ALS - Kelso. Access to the laboratory facility is limited by use of locked exterior doors with a coded/card entry, except for the reception area and sample receiving doors, which are staffed during business hours and locked at all other times. In addition, the sample storage area within the laboratory is a controlled access area with locked doors with a coded entry. The facility is equipped with an alarm system and the laboratory employs a private security firm to provide nighttime and weekend security.

A barcoding system is used to document internal sample custody. Each person removing or returning samples from/to sample storage is required to document this custody transfer (via custodian or directly). The system uniquely identifies sample containers and provides an electronic record of the sample custody. Procedures are also defined for sample extracts, digestates, and leachates. The procedures are described in the SOP SMO-SCOC, *Sample Tracking and Internal Chain of Custody*.

11.4 Project Setup

The analytical method(s) used for sample analysis are chosen based on the client's requirements. LIMS codes are chosen to identify the analysis method used for analysis. The Project Manager ensures that the correct methods are selected for analysis, deliverable requirements are identified, and due dates are specified on the Service Request. For SW-846 methods, some projects may require the most recent promulgated version, and some projects may require the most recent published version. The Project Manager will ensure that the correct method version is used. Functionality incorporated in the LIMS is used to communicate and specify project-specific requirements and demographics, including the use of attachments to LIMS delivery group (SDG or SR) such as specification forms, analyte lists, deliverable requirements, and other pertinent information.

Figure 11-1

ALS Environmental Standard Chain of Custody Form

ALS Environmental

1317 South 13th Ave., Kelso, WA 98626 | 360.577.7222 | 800.695.7222 | 360.636.1068 (fax)

CHAIN OF CUSTODY

SR# _____ PAGE _____ OF _____ COC# _____

PROJECT NAME
PROJECT NUMBER
PROJECT MANAGER
COMPANY NAME
ADDRESS
CITY/STATE/ZIP
E-MAIL ADDRESS
PHONE # FAX #
SAMPLER'S SIGNATURE

SAMPLE I.D.	DATE	TIME	LAB I.D.	MATRIX	NUMBER OF CONTAINERS	Semivolatile Organics by GC/MS 625 ☐ 8270 ☐ 8270LL ☐ SIM PAH ☐ Volatile Organics 624 ☐ 8260 ☐ 8021 ☐ BTEX ☐ Hydrocarbons (*see below) Gas ☐ Diesel ☐ Oil ☐ Oil & Grease/TRPH 1664 HEM ☐ 1664 SGT ☐ PCBs Aroclors ☐ Congeners ☐ Pesticides/Herbicides 608 ☐ 8081 ☐ 8141 ☐ 8151 ☐ Chlorophenolics - 8151M TH ☐ Terra ☐ PCP ☐ Metals, Total or Dissolved (See List below) Cyanide ☐ Hex-Chrom ☐ (circle) pH, Cond., Cl, SO4, PO4, F, NO2, NO3, BOD, TSS, TDS, Turb. (circle) NH3-N, COD, TKN, TOC, DOC, NO2+NO3, T-Phos TOX 9020 ☐ AOX 1650 ☐ 506 ☐ Alkalinity ☐ CO3 ☐ HCO3 ☐ Dioxins/Furans 1613 ☐ 8290 ☐ Dissolved Gases RSK 175 ☐ Methane ☐ Ethane ☐ Ethene ☐ CO2 ☐	REMARKS

REPORT REQUIREMENTS

___ I. Routine Report: Method Blank, Surrogate, as required
___ II. Report Dup., MS, MSD as required
___ III. CLP Like Summary (no raw data)
___ IV. Data Validation Report
___ V. EDD

INVOICE INFORMATION

P.O. # _____
Bill To: _____

Circle which metals are to be analyzed:

Total Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg
Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

TURNAROUND REQUIREMENTS

___24 hr. ___48 hr.
___5 day
___Standard (15 working days)
___Provide FAX Results
___Requested Report Date _____

***INDICATE STATE HYDROCARBON PROCEDURE: AK CA WI NORTHWEST OTHER: _____ (CIRCLE ONE)**

SPECIAL INSTRUCTIONS/COMMENTS:

☐ Sample Shipment contains USDA regulated soil samples (check box if applicable)

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Signature _____ Date/Time _____	Signature _____ Date/Time _____	Signature _____ Date/Time _____	Signature _____ Date/Time _____
Printed Name _____ Firm _____	Printed Name _____ Firm _____	Printed Name _____ Firm _____	Printed Name _____ Firm _____

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Cooler Receipt and Preservation Form

Client _____ Service Request *K16* _____

Thermometer ID	Corr. Factor	@20 min, Raw Blank	@20 min, Corr. Blank	@40 min. Raw Blank	@40 min. Corr. Blank	@60 min. Raw Blank	@60 min Corr. Blank

Sample ID on Bottle	Sample ID on COC	Identified by:

Sample ID	Bottle Count Bottle Type	Out of Temp	Head-space	Broke	pH	Reagent	Volume added	Reagent Lot Number	Initials	Time

Notes, Discrepancies & Resolutions:

_____

_____

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7/25/16 *Page*_____*of*_____

Cooler Receipt and Preservation Form

Client _____ Service Request *K16* _____

Notes, Discrepancies & Resolutions:

7/25/16

*Page*_____*of*_____

12) Analytical Procedures

ALS - Kelso employs methods and analytical procedures from a variety of external sources. The primary method references are: USEPA SW-846, Third Edition and Updates I, II, IIA, IIB, III, IVA, IVB, and online updates for hazardous waste samples, and USEPA 600/4-79-020, 600/4-91-010, 600/4-82-057, 600/R-93/100, 600/4-88-039, 600/R-94-111, EPA 40CFR parts 136 and 141 and associated Method Update Rules and Supplements; Standard Methods for the Examination of Water and Wastewater for water and wastewater samples, and American Society for Testing and Materials (ASTM). Complete citations for these references can be found in Section 23. Other published procedures, such as state-specific methods, program-specific methods (such as Puget Sound Protocols), or in-house methods may be used. Several factors are involved with the selection of analytical methods to be used in the laboratory. These include the method detection/reporting limit, the expected concentration of the analyte(s) being measured, method selectivity, accuracy and precision of the method, the type of sample being analyzed, and the regulatory compliance objectives. The implementation of methods by ALS - Kelso is described in SOPs specific to each method. A list of NELAP-accredited methods is given in Appendix J.

12.1 Standard Operating Procedures (SOPs) and Laboratory Notebooks.

ALS Environmental, Kelso maintains SOPs for use in both technical and administrative functions. SOPs are written following standardized format and content requirements as described in SOP *Preparation of Standard Operating Procedures* (CE-GEN009). Each SOP is reviewed and approved by a minimum of two managers (the Laboratory Director and/or Department Manager and the Quality Assurance Manager). All SOPs undergo a documented review to make sure current practices are described. The QAM maintains a comprehensive list of current SOPs. The document control process ensures that only the most currently approved version of an SOP is being used. The procedures for document control are described in SOP *Document Control* (CE-GEN005). In addition to SOPs, each laboratory department maintains the current methods used to perform analyses accessible to all laboratory staff. Laboratory notebook entries are standardized using the procedure in SOP *Making Entries onto Analytical Records* (CE-QA007). Laboratory notebook entries are reviewed and approved by the appropriate supervisor at a regular interval. A list of current SOPs is given in Appendix G.

12.2 Deviation from Standard Operating Procedures

When a client requests a modification to an SOP (such as a change in reporting limit, addition or deletion of target analyte(s), etc.), the Project Manager handling that project must discuss the proposed deviation with the department manager in charge of the analysis and obtain their approval to accept the project. The Project Manager is responsible for documenting the approved or allowed deviation from the SOP by placing a description of the deviation attached with the project documents and also providing an instructional comment with the Service Request.

For circumstances when a deviation or departure from company policies or procedures involving any non-technical function is found necessary, approval must be obtained from the appropriate supervisor, manager, the Laboratory Director, or other level of authority. Frequent departure from policy is not encouraged. However, if frequent departure from any policy is noted, the laboratory director will address the possible need for a change in policy.

12.3 Modified Procedures

ALS - Kelso strives to perform published methods as described in the referenced documents. If there is a material deviation from the published method, the method is cited as a "Modified" method in the analytical report. Modifications to the published methods are listed in the standard operating procedure. Standard operating

procedures are available to analysts and are also available to our clients for review. Client approval is obtained for the use of "Modified" methods prior to the performance of the analysis.

12.4 Analytical Batch

The basic unit for analytical quality control is the analytical batch. The definition that ALS - Kelso has adopted for the analytical batch is listed below. The overriding principle for describing an analytical batch is that all the samples in a batch, both field samples and quality control samples are to be handled exactly the same way, and all of the data from each analysis is to be manipulated in exactly the same manner. The minimum requirements of an analytical batch are:

1) The number of (field) samples in a batch is not to exceed 20.

2) All (field) samples in a batch are of the same matrix.

3) The QC samples to be processed with the (field) samples include:

- Method Blank (a.k.a. Laboratory Reagent Blank)
- Laboratory Control Sample
- Matrix Spiked (field) Sample (a.k.a. Laboratory Fortified Sample Matrix)*
- Duplicate Matrix Spiked (field) Sample or Duplicate (field) Sample (a.k.a. Laboratory Duplicate)*

* A sample identified as a field blank, an equipment blank, or a trip blank is not to be matrix spiked or duplicated.

4) A single lot of reagents is used to process the batch of samples.

5) Each operation within the analysis is performed by a single analyst, technician, chemist, or by a team of analysts/technicians/chemists.

6) Samples are analyzed in a continuous manner over a timeframe not to exceed 24-hours between the start of processing of the first and last sample of the batch.

7) Samples are analyzed in a continuous manner over a timeframe not to exceed 24-hours.

8) Field samples are assigned to batches commencing at the time that sample processing begins.

9) The QC samples are to be analyzed in conjunction with the associated field samples prepared with them. However, for tests which have a separate sample preparation step that defines a batch (digestion, extraction, etc.), the QC samples in the batch do not require analysis each time a field sample within the preparation batch is analyzed (multiple instrument sequences to analyze all field samples in the batch need not include re-analyses of the QC samples).

10) The batch is to be assigned a unique identification number that can be used to correlate the QC samples with the field samples.

11) Batch QC refers to the QC samples that are analyzed in a batch of (field) samples.

12) Project-specific requirements may be exceptions. If project, program, or method requirements are more stringent than these laboratory minimum requirements, then the project, program, or method requirements will take precedence. However, if the project, program, or method requirements are less

stringent than these laboratory minimum requirements, these laboratory minimum requirements will take precedence.

12.5 Specialized Procedures

ALS – Kelso not only strives to provide results that are scientifically sound, legally defensible, and of known and documented quality; but also strives to provide the best solution to analytical challenges. Procedures using specialized instrumentation and methodology have been developed to improve sensitivity (provide lower detection limits), selectivity (minimize interferences while maintaining sensitivity), and overall data quality for low concentration applications. Examples are trace-level Mercury and Methyl Mercury analyses, reductive precipitation metals analysis, leaching procedures, incremental sampling protocols, specialized GC/MS analyses, LC/MS analyses, and ultra-low level organics analyses (including PAHs, pesticides and PCBs); including those for emerging contaminants of concern.

12.6 Sample Cleanup

The laboratory commonly employs several cleanup procedures to minimize known common interferences prior to analysis. EPA methods (3620, 3630, 3640, 3660, and 3665) for cleanup of sample extracts for organics analysis are routinely used to minimize or eliminate interferences that may adversely affect sample results and data usability.

13) Measurement Traceability and Calibration

All equipment and instruments used at ALS – Kelso are operated, maintained and calibrated according to the manufacturer's recommendations and criteria set forth in the analytical methods. All analytical measurements generated are performed using materials that are traceable to a reference material, unless unavailable. Documentation of calibration information is maintained in appropriate reference files. Brief descriptions of the calibration procedures for our major laboratory equipment are described below. Calibration verification is performed according to the analytical methods and SOPs, and criteria are listed in the SOPs. Documentation of calibration verification is maintained in appropriate reference files. Records are maintained to provide traceability of reference materials and reference equipment.

Laboratory support equipment (thermometers, balances, and weights) are routinely verified on an annual basis by a vendor accredited to ISO/IEC 17025:2005, or more frequently if program-specified. Metrology equipment (analytical balances, thermometers, etc.) is calibrated using reference materials traceable to the National Institute of Standards and Technology (NIST). These primary reference materials are themselves recertified on an annual basis. Vendors used for metrology support are required to verify compliance to International Standards by supplying the laboratory with a copy of their scope of accreditation.

Equipment shown by verification to be malfunctioning or defective is taken out of service until it is repaired. When an instrument is taken out of service, an Out of Service sign is placed by the laboratory on the instrument. The equipment is placed back in service only after verifying, by calibration, that the equipment performs satisfactorily.

13.1 Temperature Control Devices

Temperatures are monitored and recorded each day for all of the temperature-regulating support equipment such as sample refrigerators, freezers, and standards refrigerators/freezers. Temperatures are recorded in either laboratory logbook or through Check Point® Wireless Monitoring System. During weekends and holidays a min/max thermometer may be used.

Laboratory records contain the recorded temperature, identification and location of equipment, acceptance criteria and the initials of the technician who performed the

checks. The procedure for performing these measurements is provided in the SOP *Support Equipment Monitoring and Calibration* (ADM-SEMC).

Where the operating temperature is specified as a test condition (such as ovens, incubators, evaporators) the temperature is recorded on the raw data. All thermometers are identified according to serial number, and the calibration is checked annually against a National Institute of Standards and Technology (NIST) certified thermometer. The NIST thermometer is recertified by a vendor accredited to ISO/IEC 17025:2005 on an annual basis.

13.2 Analytical Balances

The calibration of each analytical balance is checked by the user each day of use with three Class S or S-1 weights, which assess the accuracy of the balance at low, mid-level and high levels bracketing the working range. Records are kept which contain the recorded measurements, identification of the balance, acceptance criteria, and the initials of user who performed the check. The procedure for performing these measurements and use of acceptance criteria is described in the SOP *Support Equipment Monitoring and Calibration* (ADM-SEMC). The weights are recertified using NIST traceable standards by an accredited metrology organization on an annual basis. As needed, the balances are recalibrated using the manufacturers recommended operating procedures. Analytical balances are serviced on a semi-annual basis by an accredited metrology organization.

13.3 Water Purification Systems

ALS - Kelso uses two independent water purification systems is designed to produce deionized water meeting method specifications. One system consists of a series of pumps, filters, and resin beds designed to yield deionized water meeting the specifications of ASTM Type II water, and Standard Methods for the Examination of Water and Wastewater (SM1080, 20th Ed.) High Quality water. Activated carbon filters are also in series with the demineralizers to produce "organic-free" water. A second system consists of pumps, filters, and treatment components designed to yield deionized water meeting the specifications of ASTM Type I water, and Standard Methods for the Examination of Water and Wastewater (SM1080, 20th Ed.) High Quality water. The status of each system is monitored continuously for conductivity and resistivity with an on-line meter and indicator light, and readings recorded daily. The meter accuracy is verified annually. Deionizers are rotated and replaced on a regular schedule. Microbiology water is checked on a daily basis at a point downstream of the purification system at a tap in the laboratory.

13.4 Standards and Reference Materials

Consumable reference materials routinely purchased by the laboratories (e.g., analytical standards) are purchased from nationally recognized, reputable vendors. All vendors where possible have fulfilled the requirements for 9001 certification and/or are ISO 17025 accredited. ALS - Kelso relies on a primary vendor for the majority of its analytical supplies. Consumable primary stock standards are obtained from certified commercial sources or from sources referenced in a specific method. Supelco, Ultra Scientific, AccuStandard, Chem Services, Inc., Aldrich Chemical Co., Baker, Spex, etc. are examples of the vendors used. Reference material information is recorded in the appropriate logbook(s) and materials are stored under conditions that provide maximum protection against deterioration and contamination. The logbook entry includes such information as an assigned logbook identification code, the source of the material (i.e. vendor identification), solvent (if applicable) and concentration of analyte(s), reference to the certificate of analysis and an assigned expiration date. The date that the standard is received in the laboratory is marked on the container. When

the reference material is used for the first time, the date of usage and the initials of the analyst are also recorded on the container.

Stock solutions and calibration standard solutions are prepared fresh as often as necessary according to their stability. All standard solutions are properly labeled as to analyte concentration, solvent, date, preparer, and expiration date; these entries are also recorded in the appropriate notebook(s) following the SOP for *Reagent Login and Tracking* (ADM-RTL). Prior to sample analysis, all calibration reference materials are verified with a second, independent source of the material.

13.5 Inductively Coupled Plasma-Atomic Emission Spectrograph (ICP-AES)

Each emission line on the ICP is calibrated daily against a blank and against standards whose concentrations fall within the instruments linear range. Analyses of calibration standards, initial and continuing calibration verification standards, and inter-element interference check samples are carried out as specified in the applicable method SOP and analytical method (i.e. EPA 200.7, 6010B, 6010C, CLP SOW, etc.).

13.6 Inductively Coupled Plasma-Mass Spectrometer (ICP-MS)

Each element of interest is calibrated for using a blank and a single standard. Prior to calibration, a short-term stability check is performed on the system. Following calibration, an independent check standard is analyzed, and a continuing calibration verification standard (CCV) is analyzed with every ten samples.

13.7 Atomic Absorption Spectrophotometers (AAS)

These instruments are calibrated daily using a minimum of four standards and a blank. Calibration is validated using reference standards, and is verified at a minimum frequency of once every ten samples. Initial calibration points cannot be “dropped” from the resulting calibration curve.

13.8 GC/MS Systems

All GC/MS instruments are calibrated at multiple concentration levels for the analytes of interest (unless specified otherwise) using procedures outlined in Standard Operating Procedures and/or appropriate USEPA method citations. All reference materials used for this function are vendor-certified standards. Calibration verification is performed at method-specified intervals following the procedures in the SOP. For internal standard and isotope dilution procedures, the internal standard response and/or labeled compound recovery must meet method criteria. Method-specific instrument tuning is regularly checked the method-specified compounds. Mass spectra for the tuning compounds must meet method/SOP criteria before analyses can proceed. Calibration policies for organics chromatographic analyses are described in the SOP *Calibration of Instruments for Organics Chromatographic Analyses* (SOC-CAL).

13.9 Gas Chromatographs and High Performance Liquid Chromatographs

Calibration and standardization follow SOP guidelines and/or appropriate USEPA method citations. All GC and HPLC instruments are calibrated at a minimum of five different concentration levels for the analytes of interest (unless specified otherwise). The lowest standard is equivalent to the method reporting limit; additional standards define the working range of the GC or LC detector. Results are used to establish response factors (or calibration curves) and retention-time windows for each analyte. Calibration is verified at a minimum frequency of once every ten samples, unless otherwise specified by the reference method. Calibration policies for organics chromatographic analyses are described in the SOP *Calibration of Instruments for Organics Chromatographic Analyses* (SOC-CAL).

LC/MS Systems:

Calibration and tuning procedures are included in analytical SOPs written specifically for these tests. In general, multiple concentration levels for the analytes of interest are used to generate calibration curves. All reference materials used for this function are vendor-certified standards. Calibration and tuning verification is performed at SOP-defined intervals. Any other system performance checks are described in the applicable SOP. Calibration policies for organics chromatographic analyses are described in the SOP *Calibration of Instruments for Organics Chromatographic Analyses* (SOC-CAL).

13.10 UV-Visible Spectrophotometer (manual colorimetric analyses)

Routine calibrations for colorimetric and turbidimetric analyses involve generating a 5 point calibration curve including a blank. Initial calibration points cannot be "dropped" from the resulting calibration curve. Correlation coefficients must meet method or SOP specifications before analysis can proceed. Independent calibration verification standards (ICVs) are analyzed with each batch of samples. Continuing calibration is verified at a minimum frequency of once every ten samples. Typical UV-Visible spectrophotometric methods at ALS Environmental, Kelso include total phenolics, phosphates, surfactants and tannin-lignin.

13.11 Flow Injection Analyzer (automated colorimetric analysis)

A minimum of six standards and a blank are used to calibrate the instrument for cyanide analysis. A blank and (minimum of) five standards are used to calibrate the instrument for all other automated chemistries. Initial calibration points cannot be "dropped" from the resulting calibration curve. Standard ALS Environmental, Kelso acceptance limits are used to evaluate the calibration curve prior to sample analysis.

13.12 Discrete Auto-Analyzer (automated absorbance analysis)

A minimum of five standards and a blank are used to calibrate the instrument. Initial calibration points cannot be "dropped" from the resulting calibration curve. Method specific acceptance limits are used to evaluate the calibration curve prior to sample analysis.

13.13 Ion Chromatographs

Calibration of the ion chromatograph (IC) involves generating a calibration curve with the method-specified number of points (or more). Initial calibration points cannot be "dropped" from the resulting calibration curve. A correlation coefficient of > 0.995 for the curve is required before analysis can proceed. Quality Control (QC) samples that are routinely analyzed include blanks and laboratory control samples. The target analytes typically determined by the IC include nitrate, nitrite, chloride, fluoride, sulfate and drinking water inorganic disinfection byproducts. Calibration verification is performed at method-specified intervals following the procedures in the SOP and reference method.

13.14 Turbidimeter

Calibration of the turbidimeter requires analysis of three Nephelometric Turbidity Unit (NTU) formazin standards. Quality Control samples that are routinely analyzed include blanks, Environmental Resource Associates QC samples (or equivalent) and duplicates.

13.15 Ion-selective electrode

The method-prescribed numbers of standards are used to calibrate the electrodes before analysis. The slope of the curve must be within acceptance limits before analysis can proceed. Quality Control samples that are routinely analyzed include blanks, LCSs and duplicates.

13.16 Pipets

The calibration of pipets and autopipettors used to make critical-volume measurements is verified following SOP *Checking Volumetric Labware* (ADM-VOLWARE). Both accuracy and precision verifications are performed, at intervals applicable to the pipet and use. The results of all calibration verifications are recorded in bound logbooks.

13.17 Other Instruments

Calibration for the total organic carbon (TOC), total organic halogen (TOX), and other instruments is performed following manufacturer's recommendations and applicable SOPs.

14) Assuring the Quality of Results

A primary focus of ALS - Kelso's QA Program is to ensure the accuracy, precision and comparability of all analytical results. Prior to using a procedure for the analysis on field samples, acceptable method performance is established by performing demonstration of capability analyses. Performance characteristics are established by performing method detection limit studies and assessing accuracy and precision according to the reference method. ALS - Kelso has established Quality Control (QC) objectives for precision and accuracy that are used to determine the acceptability of the data that is generated. These QC limits are either specified in the test methodology or are statistically derived based on the laboratory's historical data. Quality Control objectives are defined below.

14.1 Quality Control Objectives

14.1.1 Demonstration of Capability - A demonstration of capability (DOC) is made prior to using any new test method or when a technician is new to the method. This demonstration is made following regulatory, accreditation, or method specified procedures. In general, this demonstration does not test the performance of the method in real world samples, but in the applicable clean matrix free of target analytes and interferences.

A quality control sample material may be obtained from an outside source or may be prepared in the laboratory. The analyte(s) is (are) diluted in a volume of clean matrix (for analytes which do not lend themselves to spiking, e.g., TSS, the demonstration of capability may be performed using quality control samples). Where specified, the method-required concentration levels are used. Four aliquots are prepared and analyzed according to the test procedure. The mean recovery and standard deviations are calculated and compared to the corresponding acceptance criteria for precision and accuracy in the test method or laboratory-generated acceptance criteria (if there are not established mandatory criteria). All parameters must meet the acceptance criteria. Where spike levels are not specified, actual Laboratory Control Sample results may be used to meet this requirement, provided acceptance criteria is met.

14.1.2 Accuracy - A measure of the closeness of an individual measurement (or an average of multiple measurements) to a true or expected value and expressed as percent recovery (% REC.) of the measured value, relative to the true or expected value. If a measurement process produces results whose mean is not the true or expected value, the process is said to be biased. Bias is the systematic error either inherent in a method of analysis or caused by an artifact of the measurement system (e.g., contamination). Ongoing accuracy is determined by calculating the mean value of results from ongoing analyses of laboratory control sample, standard reference materials, or standard

solutions. In addition, matrix-spiked samples are also measured and recovery indicates the accuracy or bias in the actual sample matrix.

ALS - Kelso utilizes several quality control measures to eliminate analytical bias, including systematic analysis of method blanks, laboratory control samples and independent calibration verification standards. Because bias can be positive or negative, and because several types of bias can occur simultaneously, only the net, or total, bias can be evaluated in a measurement.

14.1.3 Precision - Precision is the ability of an analytical method or instrument to reproduce its own measurement. It is a measure of the variability, or random error, in sampling, sample handling and in laboratory analysis. The American Society of Testing and Materials (ASTM) recognizes two levels of precision: repeatability - the random error associated with measurements made by a single test operator on identical aliquots of test material in a given laboratory, with the same apparatus, under constant operating conditions, and reproducibility - the random error associated with measurements made by different test operators, in different laboratories, using the same method but different equipment to analyze identical samples of test material.

"Within-batch" precision is measured using replicate sample or QC analyses and is expressed as the relative percent difference (RPD) between the measurements. The "batch-to-batch" precision is determined from the variance observed in the analysis of standard solutions or laboratory control samples from multiple analytical batches.

14.1.4 Control Limits - The control limits for accuracy and precision originate from two different sources. For analyses having enough QC data, control limits are calculated at the 99% confidence limits. For analyses not having enough QC data, or where the method is prescriptive, control limits are taken from the method on which the procedure is based. If the method does not have stated control limits, then control limits are assigned method-default or reasonable values based on similar methods. Control limits are reviewed each year and may be updated if new statistical limits are generated for the appropriate surrogate, laboratory control sample, and matrix spike compounds (typically once a year) or when method prescribed limits change. The updated limits are reviewed by the QAM. The new control limits replace the previous limits and data is assessed using the new values. Current *Data Quality Objectives*, including acceptance limits for accuracy and precision are available from the laboratory. For inorganics, the precision limit values listed are for laboratory duplicates. For organics, the precision limit values listed are for duplicate laboratory control samples or duplicate matrix spike analyses. Procedures for establishing control limits are found in SOP *Control Limits* (CE-QA009).

14.1.5 Representativeness - The degree to which the field sample, being properly preserved, free of contamination, and properly analyzed, represents the overall sample site or material. This can be extended to the sample itself, in that representativeness is the degree to which the subsample that is analyzed represents the entire field sample submitted for analysis. ALS - Kelso has sample handling procedures to ensure that the sample used for analysis is representative of the entire sample. These include the SOP for *Subsampling and Compositing of Samples* (GEN-SUBS) and the SOP for *Tissue Sample Preparation* (MET-TISP). Further, analytical SOPs specify sample handling and sample sizes to further ensure the sample aliquot that is analyzed is representative in entire sample.

14.1.6 Comparability – Comparability expresses the confidence with which one data set can be compared to another and is directly affected by data quality (accuracy and precision) and sample handling (sampling, preservation, etc.). Only data of known quality can be compared. The objective is to generate data of known quality with the highest level of comparability, completeness, and usability. This is achieved by employing the quality controls listed below and standard operating procedures for the handling and analysis of all samples. Data is reported in units specified by the client and using ALS Environmental, Kelso or project-specified data qualifiers.

14.2 Method Detection Limits, Method Reporting Limits, Limits of Detection, and Limits of Quantitation

Method Detection Limits (MDL) for methods performed at ALS – Kelso are determined during initial method set up and when significant changes are made. If an MDL study is not performed annually, the established MDL is verified by performing a Limit of Detection (LOD) verification on every instrument used in the analysis. The MDLs are determined by following the SOP *Performing Method Detection Limit Studies and Establishing Limits of Detection and Quantitation* (CE-QA011), which is based on the procedure in 40 CFR Part 136, Appendix B. As required by NELAP and DoD protocols, the validity of MDLs is verified using LOD verification samples.

The Method Reporting Limit (MRL) is the lowest amount of an analyte in a sample that can be quantitatively determined with stated, acceptable precision and accuracy under stated analytical conditions (i.e. Limit of Quantitation- LOQ). LOQ are analyzed at the frequency specified in the SOP *Performing Method Detection Limit Studies and Establishing Limits of Detection and Quantitation* (CE-QA011) and at specified concentrations (not lower than the lowest calibration standard). Current MDL/LOD and MRL/LOQ values are available from the laboratory.

14.3 Quality Control Procedures

The specific types, frequencies, and processes for quality control sample analysis are described in detail in method-specific standard operating procedures and listed below. These sample types and frequencies have been adopted for each method and a definition of each type of QC sample is provided below. Unique test-specific requirements may also exist and are found in the laboratory SOP.

14.3.1 Method Blank (a.k.a. Laboratory Reagent Blank)

The method blank is an analyte-free matrix (water, soil, etc.) subjected to the entire analytical process. When analyte-free soil is not available, anhydrous sodium sulfate, organic-free sand, or an acceptable substitute is used. The method blank is analyzed to demonstrate that the analytical system itself does not introduce contamination. The method blank results should be below the Method Reporting Limit (MRL) or, if required for DoD projects, < ½ MRL for the analyte(s) being tested. Otherwise, corrective action must be taken. A method blank is included with the analysis of every sample preparation batch, every 20 samples, or as stated in the method, whichever is more frequent.

14.3.2 Calibration Blank

For some methods, calibration blanks are prepared along with calibration standards in order to create a calibration curve. Calibration blanks are free of the analyte of interest and, where applicable, provide the zero point of the calibration curve. Additional project-specific requirements may also apply to calibration blanks.

14.3.3 Continuing Calibration Blank

Continuing calibration blanks (CCBs) are solutions of analyte-free water, reagent, or solvent that are analyzed in order to verify the system is contamination-free when CCV standards are analyzed. The frequency of CCB analysis is either once every ten samples or as indicated in the method, whichever is greater. Additional project-specific requirements may also apply to continuing calibration blanks.

14.3.4 Calibration Standards

Calibration standards are solutions of known concentration prepared from primary standard or stock standard materials. Calibration standards are used to calibrate the instrument response with respect to analyte concentration. Standards are analyzed in accordance with the requirements stated in the particular method being used.

14.3.5 Initial (or Independent) Calibration Verification Standard (ICV)

The ICV standard is prepared from materials obtained from a source independent of that used for preparing the calibration standards ("second-source"). The ICV is analyzed after calibration but prior to sample analysis in order to verify the validity and accuracy of the standards used in calibration. Once it is determined that there is no defect or error in the calibration standard(s), the standards are considered valid and may be used for subsequent calibrations and quantitative determinations (as expiration dates and methods allow). ICVs are also analyzed in accordance with method-specific requirements.

14.3.6 Continuing Calibration Verification Standard

Continuing calibration verification (CCV) standards are midrange standards that are analyzed in order to verify that the calibration of the analytical system is still acceptable. The frequency of CCV analysis is either once every ten samples, or as indicated in the method.

14.3.7 Internal Standards

Internal standards are known amounts of specific compounds that are added to each sample prior to instrument analysis. Internal standards are generally used for GC/MS and ICP/MS procedures to correct sample results that have been affected by changes in instrument conditions or changes caused by matrix effects. The requirements for evaluation of internal standards are specified in each method and SOP.

14.3.8 Surrogates

Surrogates are organic compounds which are similar in chemical composition and analytical behavior to the analytes of interest, but which are not normally found in environmental samples. Depending on the analytical method, one or more of these compounds is added to method blanks, calibration and check standards, and samples (including duplicates, matrix spike samples, duplicate matrix spike samples and laboratory control samples) prior to extraction and analysis in order to monitor the method performance on each sample. The percent recovery is calculated for each surrogate, and the recovery is a measurement of the overall method performance.

$$\text{Recovery (\%)} = (M/T) \times 100$$

Where: M = The measured concentration of analyte,
T = The known concentration of analyte added.

14.3.9 Laboratory Control Samples (a.k.a Laboratory Fortified Blank – LFB)

The laboratory control sample (LCS) is an aliquot of analyte-free water or analyte-free solid (or anhydrous sodium sulfate or equivalent) to which known amounts of the method analyte(s) is (are) added. A reference material of known matrix type, containing certified amounts of target analytes, may also be used as an LCS. An LCS is prepared and analyzed at a minimum frequency of one LCS per 20 samples, with every analytical batch or as stated in the method, whichever is more frequent. The LCS sample is prepared and analyzed in exactly the same manner as the field samples.

The percent recovery of the target analytes in the LCS is compared to established control limits and assists in determining whether the methodology is in control and whether the laboratory is capable of making accurate and precise measurements at the required reporting limit. Comparison of batch-to-batch LCS analyses enables the laboratory to evaluate batch-to-batch precision and accuracy.

$$\text{Recovery (\%)} = (M/T) \times 100$$

Where: M = The measured analyte concentration,
T = The known analyte concentration added.

14.3.10 Laboratory Fortified Blank – MRL Level

A laboratory blank fortified at the MRL used to verify that the method reporting limit can be achieved. This LFB is carried through the entire extraction and analytical procedure. A MRL LFB is required with every batch of drinking water samples.

14.3.11 Matrix Spikes (MS)

Matrix spiked samples are aliquots of samples to which a known amount of the target analyte (or analytes) is (are) added. The samples are then prepared and analyzed in the same analytical batch, and in exactly the same manner as are routine samples. For the appropriate methods, matrix spiked samples are prepared and analyzed and at a minimum frequency of one spiked sample (and one duplicate spiked sample, if appropriate) per twenty samples. The spike recovery measures the effects of interferences caused by the sample matrix and reflects the accuracy of the method for the particular matrix in question. Spike recoveries are calculated as follows:

$$\text{Recovery (\%)} = (S - A)/T \times 100$$

Where: S = The measured analyte concentration in the spiked sample,
A = The measured analyte concentration in the parent sample,
T = The known analyte concentration added to the spiked sample.

14.3.12 Laboratory Duplicates and Duplicate Matrix Spikes

Duplicates are additional replicates of samples that are subjected to the same preparation and analytical scheme as the original sample. Depending on the method of analysis, either a duplicate analysis (and/or a matrix spiked sample) or a matrix spiked sample and duplicate matrix spiked sample (MS/DMS) are analyzed. The relative percent difference between duplicate

analyses or between an MS and DMS is a measure of the precision for a given method and analytical batch. The relative percent difference (RPD) for these analyses is calculated as follows:

Relative Percent Difference (RPD) = (S1 – S2) x 100 ÷ S_{ave}

Where:

S1 and S2 = The analyte concentrations in the sample and its duplicate, or in the matrix spike and its duplicate matrix spike, and,

S_{ave} = The average of analyte concentrations in the sample and its duplicate, or in the matrix spike and its duplicate matrix spike.

Depending on the method of analysis, either duplicates (and/or matrix spikes) or MS/DMS analyses are performed at a minimum frequency of one set per 20 samples. If an insufficient quantity of sample is available to perform a laboratory duplicate or duplicate matrix spikes, duplicate LCSs will be prepared and analyzed.

14.3.13 Interference Check Samples (ICS)

An ICS is a solution containing both interfering and analyte elements of known concentration that can be analyzed to verify background and interelement correction factors in metals analyses. The ICS is prepared to contain known concentrations (method or program specific) of elements that will provide an adequate test of the correction factors. The ICS is analyzed at the beginning and end of an analytical run or at a method-specified frequency. Results must meet method criteria and any project-specific criteria.

14.3.14 Post Digestion Spikes

Post digestion spikes are samples prepared for metals analyses that have an analyte spike added to determine if matrix effects may be a factor in the results. The spike addition should produce a method-specified minimum concentration above the method reporting limit. A post digestion spike is analyzed with each batch of samples and recovery criteria are specified for each method.

14.3.15 Control Charting

The generation of control charts is routinely performed at ALS. Surrogate, Matrix Spike and LCS recoveries are all monitored and charted. In addition, the laboratory also monitors the Relative Percent Difference (RPD) measurement of precision. Control charts are available to each individual laboratory unit to monitor the data generated in its facility using control charts that have been programmed to identify various trends in the analytical results. If trends in the data are perceived, various means of corrective action may then be employed in order to prevent future problems with the analytical system(s). Finally, data quality reports using control charts are generated for specific clients and projects pursuant to contract requirements. The control charting procedure is described in SOP *Control Limits* (CE-QA009).

14.3.16 Glassware Washing

Glassware washing and maintenance play a crucial role in the daily operation of a laboratory. The glassware used at ALS - Kelso undergoes a rigorous

cleansing procedure prior to every usage. A number of SOPs have been generated that outline the various procedures used at ALS; each is specific to the end-use of the equipment as well as to the overall analytical requirements of the project. In addition, other equipment that may be routinely used at the laboratory is also cleaned following instructions in the appropriate SOP.

14.3.17 Uncertainty

Measurement uncertainty is associated with most of the results obtained in laboratory testing. It may be meaningful to estimate the extent of the uncertainty associated with each result generated by the laboratory. It is also useful to recognize that this measurement uncertainty is likely to be much less than that associated with sample collection activities. The uncertainty associated with the analytical measurement processes can be estimated from quality control data. When requested, the laboratory provides uncertainty information as described in the SOP *Estimate of Uncertainty of Analytical Measurements* (CE-QA010). The estimation of uncertainty relates only to measurements conducted in the laboratory.

14.4 When data quality objectives or quality control measures are not met, due to the sample matrix or anomalies, incompatibility of the methodology and sample type, statistical outliers, random error, or other factors, it may be necessary to apply data qualifiers to reported data. A list of standard data qualifiers is given in Appendix H.

15) Control of Non-Conforming Environmental Testing Work

The laboratory takes all appropriate steps necessary to ensure all sample results are reported with acceptable quality control results. When sample results do not conform to established quality control procedures, responsible management will evaluate the significance of the nonconforming work and take corrective action to address the nonconformance.

Nonconforming events such as errors, deficiencies, deviations from SOP, proficiency (PT) failure or results that fall outside of established QC limits are documented using the NCAR database. The procedure and responsibilities for addressing nonconforming work is defined in SOP *Nonconformance and Corrective Action* (CE-QA008). Nonconformances are reported to the client using various means (voice, email, narrative, etc.). When a nonconformance occurs that casts doubt on the validity of the test results or additional client instructions are needed, the Project Manager notifies the client the same business day that the nonconformance is confirmed and reported. The QAM reviews each problem, ensuring that appropriate corrective action has been taken by the appropriate personnel. The QAM periodically reviews all NCARs looking for chronic, systematic problems that need more in-depth investigation and alternative corrective action consideration. In addition, the appropriate Project Manager is promptly notified of any problems in order to inform the client and proceed with any action the client may want to initiate.

Results from non-conforming environmental testing work generally require the need for qualified data on analytical reports. A list of standard data qualifiers is given in Appendix H. Additionally, the report narrative will provide an explanation of the nonconformance and potential impact on results.

16) Corrective Action, Preventive Action, and Improvement

If a quality control measure is found to be out of control, and the data is to be reported, all samples associated with the failed quality control measure shall be reported with the appropriate data qualifier(s). Failure to meet established analytical controls, such as the quality control objectives, prompts corrective action. Corrective action may take several forms and may involve a review of the calculations, a check of the instrument maintenance and

operation, a review of analytical technique and methodology, and reanalysis of quality control and field samples. If a potential problem develops that cannot be solved directly by the responsible analyst, the supervisor, team leader, the department manager, and/or the QAM may examine and pursue alternative solutions. In addition, the appropriate Project Manager is notified in order to ascertain if the client needs to be notified.

Part of the corrective action process involves determining the root cause. Identifying the root cause of a nonconformance can be difficult, but important for implementing effective corrective action. Root cause principles are used to determine assignable causes, which leads to corrective action taken to prevent recurrence. Various preventive action processes are used for eliminating a potential problem or averting a problem before it occurs. This is explained in SOP *Nonconformance and Corrective Action* (CE-QA008).

Preventive action is focused on using existing information or experiences to anticipate potential problems and eliminating the likely causes of them. Preventive action is a pro-active process and tied to results from corrective action as well as opportunities for improvement. ALS - Kelso used preventive action processes to avoid errors and implement improvements. The SOP *Preventive Action* (CE-GEN004) describes procedures used. Examples of preventive action are given in the SOP. The laboratory also uses ideas from staff, client feedback, and other input mechanisms to identify potential improvements. The monthly lab-wide meeting regularly includes reports on improvements made or underway.

16.1 Preventive maintenance

Preventive maintenance is a crucial element of the QA program. Equipment and instruments at ALS - Kelso are regularly maintained by qualified laboratory staff or under commercial service contracts. All instruments are operated and maintained according to the instrument operating manuals. All routine and special maintenance activities pertaining to the instruments are recorded in instrument maintenance logbooks. The maintenance logbooks used at ALS Environmental, Kelso contain extensive information about the instruments used at the laboratory, including:

- The equipment's serial number;
- Date the equipment was received;
- Date the equipment was placed into service;
- Condition of equipment when received (new, used, reconditioned, etc.); and
- Prior history of damage, malfunction, modification or repair (if known).

Preventive maintenance procedures, frequencies, etc. are available for each instrument used at ALS. They may be found in the various SOPs for routine methods performed on an instrument and may also be found in the operating or maintenance manuals provided with the equipment at the time of purchase.

Responsibility for ensuring that routine maintenance is performed lies with the section supervisor. In the case of non-routine repair of capital equipment, the section supervisor is responsible for providing the repair, either by performing the repair themselves with manufacturer guidance or by acquiring on-site manufacturer repair. Each laboratory section maintains a critical parts inventory. This inventory or "parts list" also includes the items needed to perform any other routine maintenance and certain in-house non-routine repairs such as gas chromatography/mass spectrometry jet separators and electron multipliers and ICP/MS nebulizer. When performing maintenance on an instrument (whether preventive or corrective), additional information about the problem, attempted repairs, etc. is also recorded in the notebook. Typical logbook entries include the following information:

- Details and symptoms of the problem;

- Repairs and/or maintenance performed;
- Description and/or part number of replaced parts;
- Source(s) of the replaced parts;
- Analyst's signature and date; and
- Demonstration of return to analytical control.

See the Appendix E for a list of equipment and whether primarily maintained by laboratory of service providers.

17) Control of Records

ALS - Kelso maintains a records system which ensures that all laboratory records of analysis data retained and available. Analysis data is retained for 5 years from the report date unless contractual terms or regulations specify a longer retention time. The archiving system is described in the SOP for *Data Archiving* (ADM-ARCH).

17.1 Documentation and Archiving of Sample Analysis Data

The archiving system includes the following items for each set of analyses performed:

- Benchsheets describing sample preparation (if appropriate) and analysis;
- Instrument parameters (or reference to the data acquisition method);
- Sample analysis sequence;
- Instrument printouts, including chromatograms and peak integration reports for all samples, standards, blanks, spikes and reruns;
- Logbook ID number for the appropriate standards;
- Copies of report sheets submitted to the work request file; and
- Copies of Nonconformity and Corrective Action Reports, if necessary.

Individual sets of analyses are identified by analysis date and service request number. Since many analyses are performed with computer-based data systems, the final sample concentrations can be automatically calculated. If additional calculations are needed, they are written on the integration report or securely stapled to the chromatogram, if done on a separate sheet.

For organics analysis, data applicable to all analyses within the batch, such as GCMS tunes, CCVs, batch QC, and analysis sequences; are kept using a separate documentation system. This system is used to archive data on a batch-specific basis and is segregated according to the date of analysis. This system also includes results for the most recent calibration curves, as well as method validation results.

18) Audits

Quality audits are an essential part of the Quality Assurance program. There are two types of audits used at the facility: System Audits are conducted to qualitatively evaluate the operational details of the QA program, while Performance Audits are conducted by analyzing proficiency testing samples in order to quantitatively evaluate the outputs of the various measurement systems.

18.1 System Audits

The system audit examines the presence and appropriateness of laboratory systems. External system audits of ALS/Kelso are conducted regularly by various regulatory

agencies and clients. Appendix J lists the certification and accreditation programs in which ALS/Kelso participates. Programs and certifications are added as required.

Internal system audits of ALS/Kelso are conducted regularly under the direction of the Quality Assurance Manager. The internal audit procedures are described in SOP *Internal Audits* (CE-QA001). The internal audits are performed as follows:

- System audit – this is an annual audit of the implementation of the quality system in the laboratory.
- Process audit – this is an audit of all operational areas in the laboratory to evaluate compliance with operational and technical procedures. Focus is on sample handling, preparation and analysis and technically sound practices. Three primary concepts are 1) is the procedure in use the same as that described in the SOP, 2) the use of sound analytical techniques and practices, and 3) sample handling/preparation. Topics as calibration, sample/analytical batching, standards traceability, QC criteria, instrument operation and maintenance, data interpretation, and reporting results are included. Hardcopy data and/or report audits may be included.

  Process audits may be one larger audit event or a series of audits such that all areas of the laboratory are audited over a one year period. Audits conducted over the four calendar quarters will follow the schedules listed in an audit plan.
- Electronic data audits focus on organic chromatographic data and include an examination of audit trails, peak integrations, calibration practices, GCMS tuning data, use of appropriate files, and other components of the analysis. Each applicable instrument is periodically audited using audit software and randomly selected data files.

All audit findings and corrective actions are documented. The results of each audit are reported to the Laboratory Director and Department Managers for review. Any deficiencies identified are summarized in the audit report. Managers must respond with corrective actions correcting the deficiency within a defined timeframe. Should problems impacting data quality be found during an internal audit, any client whose data is adversely impacted will be given written notification within the corrective action period (if not already provided).

Additional internal audits or data evaluations may be performed as needed to address any potential data integrity issues that may arise.

18.2 Performance Audits

ALS – Kelso participates in the analysis of interlaboratory proficiency testing (PT) samples. Participation in PT studies is performed on a regular basis and is designed to evaluate all analytical areas of the laboratory. General procedures for these analyses are described in SOP *Proficiency Sample Testing Analysis* (CE-QA006). ALS – Kelso routinely participates in the following studies:

- Water Pollution (WP) and additional water parameters, 2 per year.
- Water Supply (WS) PT studies, 2 per year.
- Hazardous Waste/Soil/UST PT studies, 2 per year.
- Microbiology (WS and WP) PT studies, 2 per year.
- State-specific Underground Storage Tank PT studies, 1 per year, or as specified for accreditation.
- Other studies as required for certifications, accreditations, or validations.

PT samples are processed by entering them into the LIMS system as samples and are processed the same as field samples (following the PT provider instructions). The laboratory sections handle samples the same as field samples, performing the analyses following method requirements and performing data review. The laboratory sections submit results to the QA Manager for subsequent reporting to the appropriate agencies or study provider. Results of the performance evaluation samples and audits are received by the QAM and distributed to Laboratory Director and department managers for review. For any results outside acceptance criteria, the analysis data is reviewed to identify a root cause for the deficiency, and corrective action is taken and documented through nonconformance (NCAR) procedures.

19) Management Review

An annual Review of the laboratory's quality system and testing activities is conducted by the laboratory's management team to ensure the continuing suitability and effectiveness of the quality system and testing activities and to introduce any necessary changes or improvements. The review ensures that the quality system of the laboratory continues to conform to the requirements of the ISO 17025:2005 and various accrediting authorities, including NELAP/TNI.

General procedures for the Review are described in *Laboratory Management Review* (SOP CE-QA005). When conducting the review a standard list of items and categories is evaluated. The quality policies and their relation to testing activities are reviewed and any changes that are necessary are identified. The review also notes significant changes that have taken place or need to take place in the quality system; and the organization, facilities, equipment, procedures, and activities of the laboratory.

The Review is documented by the laboratory QA Manager. Action items, including preventive actions and improvements, should be identified. Results should feed into the laboratory's planning process planning.

20) Personnel

20.1 Personnel Training

Job descriptions, including technical position descriptions, are used for all employees, regardless of position or level of seniority. These documents are maintained by the Human Resources personnel and are available for review. In order to assess the technical capabilities and qualifications of a potential employee, all candidates for employment are evaluated, in part, against the appropriate technical description.

Training begins the first day of employment at ALS – Kelso when the company policies are presented and discussed. Safety and Quality System requirements are integral parts of initial and ongoing training processes at the laboratory. Safety training begins with the reading of the ALS Environmental Health and Safety Manual. Employees are also required to attend periodic safety meetings where additional safety training may be performed by the Environmental, Health and Safety Officer.

Quality Systems training begins with QA orientation for new employees which includes reading the Quality Assurance Manual and ethics/data integrity introductory training. Additional training on laboratory quality systems as they relate to job functions is incorporated into training plans. Employees are responsible for complying with the requirements of the QA Manual and QA/QC requirements associated with their function(s).

ALS – Kelso also encourages its personnel to continue to learn and develop new skills that will enhance their performance and value to the company. Ongoing training occurs for all employees through a variety of mechanisms. The corporate, company-wide training and development program, external and internal technical seminars and

training courses, and laboratory-specific training exercises are all used to provide employees with professional growth opportunities.

All technical training is documented and records are maintained in the QA department. Training requirements and its documentation are described in SOP *ALS-Kelso Training Procedure* (ADM-TRAIN). A training plan is developed whenever an employee starts a new procedure to new position. The training plan includes a description of the step-by-step process for training an employee and for initial demonstration of capability. Where the analyst performs the entire procedure, a generic training plan may be used.

20.2 Initial Demonstration of Capability (IDOC)

Training in analytical procedures typically begins with the reading of the SOP for the method. Hands-on training begins with the observation of an experienced analyst performing the method, followed by the trainee performing the method under close supervision, and culminating with independent performance of the method on quality control samples. Successful completion of the applicable Demonstration of Capability analysis qualifies the analyst to perform the method independently. Demonstration of Capability is performed by one of the following:

- Successful completion of an Initial Precision and Recovery (IPR) study (required where mandated by the method).
- Analysis of 4 consecutive Laboratory Control Samples, with acceptable accuracy and precision.
- Where spiking is not possible but QC standards are used ("non-spiked" LCS), analysis of 4 consecutive LCS analyses with acceptable accuracy and precision.
- Where one of the three above is not possible, special requirements are as follows:
    - Total Settleable Solids: Successful single-blind PT sample analysis and duplicate results with RPD<10%.
    - Color: Four consecutive prepared LCSs with acceptable accuracy and precision of <10% RSD.
    - Physical Tests (Grain size, Corrosivity to Steel, etc.): Supervisor acknowledgement of training and approval.

A flowchart identifying the Demonstration of Proficiency requirements is given in Figure 20-1. The flowchart identifies allowed approaches to assessing Demonstration of Capability when a 4-replicate study is not mandated by the method, when spiking is not an option, or when QC samples are not readily available.

20.3 Continuing Demonstration of Proficiency

A periodic demonstration of proficiency is required to maintain continuing qualification. Continuing Demonstration of Proficiency is required each year, and may be performed one of the following ways:

- Successful performance on external (independent) single-blind sample analyses using the test method, or a similar test method using the same technology. I.e. PT sample or QC sample blind to the analyst.
- Performing Initial Demonstration of Capability as described above, with acceptable levels of precision and accuracy.
- Analysis of at least 4 consecutive LCSs with acceptable levels of accuracy and precision from in-control analytical batches.

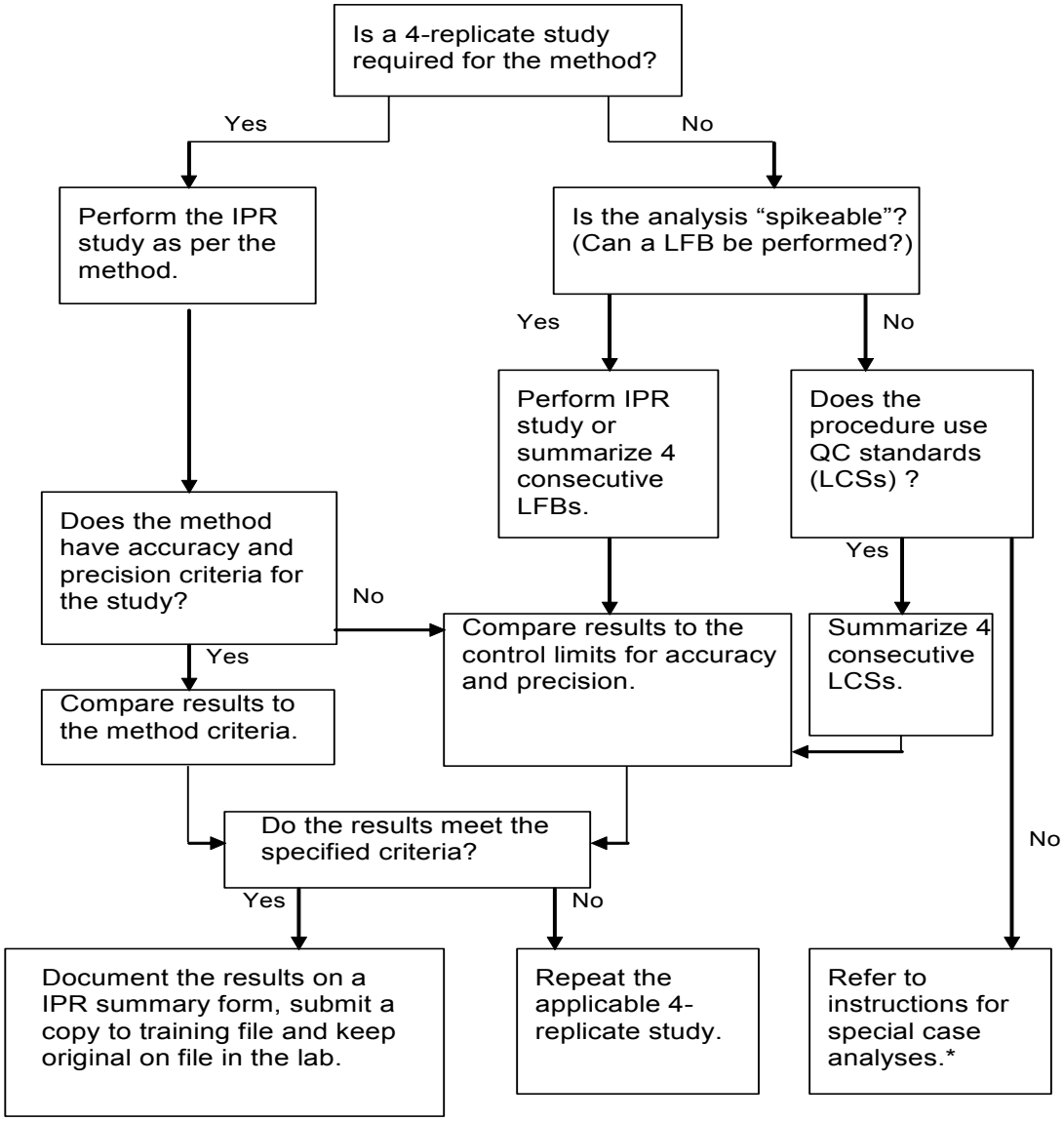
- If the above cannot be performed, analysis of authentic samples with results statistically indistinguishable from those obtained by another trained analyst.
- For methods for which PT samples are not available and a spiked analysis (LFB, MDL, etc.) is not possible, analysis of field samples that have been analyzed by another analyst with statistically indistinguishable results.

20.4 Documentation of Training

Records are maintained to indicate the employee has the necessary training, education, and experience to perform their functions. Information of previously acquired skills and abilities for a new employee is maintained in Human Resources personnel files and internal resumes. The QA department maintains a record of the various technical skills and training acquired while employed by ALS. Information includes the employee's name, a description of the skill including the appropriate method and SOP reference, the mechanism used to document proficiency, and the date the training was completed. General procedures for documenting technical training are described in SOP *ALS-Kelso Training Procedure* (ADM-TRAIN).

Figure 20-1

Demonstration of Proficiency Flowchart



21) Reporting of Results

ALS - Kelso reports the analytical data produced in its laboratories to the client via the Analytical Report. This report includes a transmittal letter, a case narrative, client project information, sample receipt and chain of custody information, specific test results, quality control data (as requested), and any other project-specific support documentation. The following procedures describe the procedures used for data reduction, validation and reporting.

21.1 Data Reduction and Review

Results are generated by the analyst who performs the analysis and works up the raw data. All data is initially reviewed and processed by analysts using appropriate methods (e.g., chromatographic software, instrument printouts, hand calculation, etc.). Equations used for calculation of results are found in the applicable analytical SOPs. Policies and procedures for manual editing of data are established. The analyst making the change must initial and date the edited data entry, without obliteration of the original entry. The policies and procedures are described in the SOP *Making Entries onto Analytical Records* (CE-QA007).

The resulting data set is either manually entered (e.g., titrimetric or microbiological data) into an electronic report form or is electronically transferred into the report. Once the complete data set has been transferred into the proper electronic report form(s), it is then printed. The resulting hardcopy version of the electronic report is then reviewed by the analyst for accuracy. Once the primary analyst has checked the data for accuracy and acceptability, the data and report hardcopy is forwarded to the supervisor or second qualified analyst who reviews the data. Where calculations are not performed using a validated software system, the reviewer rechecks a minimum of 10% of the calculations. Analysts performing routine testing are responsible for generating a data quality narrative or data review document with every analytical batch processed. This report also allows the analyst to provide appropriate notes and/or a narrative if problems were encountered with the analyses. A Nonconformance and Corrective Action Report (NCAR) may also be attached to the data prior to review. Supervisors or qualified analysts review all of the completed analytical batches to ensure that all QC criteria have been examined and any deficiencies noted and addressed. Data review procedures are described in the SOP for *Laboratory Data Review Process* (ADM-DREV).

Policies and procedures for electronic manual integration of chromatographic data are established. The analyst performing the integration must document the integration change by printing both the “before” and “after” integrations and including them in the raw data records. The policies and procedures are described in SOP *Manual Integration Policy* (CE-QA002) and SOP *Manual Integration of Chromatographic Peaks* (ADM-MI).

21.1.1 Validation of Results

The validity of the data generated is assessed through the evaluation of the sample results, calibrations, and QC samples (method blanks, laboratory control samples, sample duplicates, matrix spikes, trip blanks, etc.). A brief description of the evaluation of these analyses is described below, with details listed in applicable SOPs. The criteria for evaluation of QC samples are listed within each method-specific SOP. Other data evaluation measures may include (as necessary) a check of the accuracy check of the QC standards and a check of the system sensitivity. Data transcriptions and calculations are also reviewed.

Note: Within the scope of this document, all possible data assessment requirements for various project protocols cannot be included in the listing below. This listing gives a general description of data evaluation practices used in the laboratory in compliance with NELAP Quality Systems requirements. Additional requirements exist for certain programs, such as projects under the DoD QSM protocols, and project-specific QAPPs.

- Initial Calibration – Following the analysis of calibration standards according to the applicable SOP the data is fit to an applicable and allowed calibration model (correlation coefficient, linear, average response factor, quadratic, etc.) and the resulting calibration is compared to specified criteria. If the calibration meets criteria analysis may continue. If the calibration fails, any problems are isolated and corrected and the calibration standards reanalyzed. Following calibration and analysis of the independent calibration verification standard(s) the percent difference for the ICV is calculated. If the percent difference is within the specified limits the calibration is complete. If not, the problem associated with the calibration and/or ICV are isolated and corrected and verification and/or calibration is repeated.
- Continuing Calibration Verification (CCV) – Following the analysis of the CCV standard the percent difference is calculated and compared to specified criteria. If the CCV meets the criteria analysis may continue. If the CCV fails, routine corrective action is performed and documented and a 2nd CCV is analyzed. If this CCV meets criteria, analysis may continue, including any reanalysis of samples that were associated with a failing CCV. If the routine corrective action failed to produce an immediate CCV within criteria, then either acceptable performance is demonstrated (after additional corrective action) with two consecutive calibration verifications or a new initial calibration is performed.
- Method Blank – Results for the method blank are calculated as performed for samples. If results are less than the MRL (<½ MRL for DoD projects), the blank may be reported. If not, associated sample results are evaluated to determine the impact of the blank result. If possible, the source of the contamination is determined. If the contamination has affected sample results the blank and samples are reanalyzed. If positive blank results are reported, the blank (and sample) results are flagged with an appropriate flag, qualifier, or footnote.
- Sample Results (Inorganic) – Following sample analysis and calculations (including any dilutions made due to the sample matrix) the result is verified to fall within the calibration range. If not, the sample is diluted and analyzed to bring the result into calibration range. When sample and sample duplicates are analyzed for precision, the calculated RPD is compared to the specified limits. The sample and duplicate are reanalyzed if the criteria are exceeded. The samples may require re-preparation and reanalysis. For metals, additional measures as described in the applicable SOP may be taken to further evaluate results (dilution tests and/or post-digestion spikes). Results are reported when within the calibration range, or as estimates when outside the calibration range. When dilutions are performed the MRL is elevated accordingly and qualified. Efforts are made to meet the project MRL's including alternative analysis.

- Sample Results (Organic) – For GC/MS analyses, it is verified that the analysis was within the prescribed tune window. If not, the sample is reanalyzed. Following sample analysis and calculations (including any dilutions made due to the sample matrix) peak integrations, retention times, and spectra are evaluated to confirm qualitative identification. Internal standard responses and surrogate recoveries are evaluated against specified criteria. If internal standard response does not meet criteria, the sample is diluted and reanalyzed. Results outside of the calibration range are diluted to within the calibration range. For GC and HPLC tests, results from confirmation analysis are evaluated to confirm positive results and to determine the reported value. The procedure to determine which result to report is described in the SOP for *Confirmation Procedure for GC and HPLC Analysis* (SOC-CONF). If obvious matrix interferences are present, additional cleanup of the sample using appropriate procedures may be necessary and the sample is reanalyzed. When dilutions are performed the MRL is elevated accordingly and qualified. Efforts are made to meet the project MRL's including additional cleanup.
- Surrogate Results (Organic) – The percent recovery of each surrogate is compared to specified control limits. If recoveries are acceptable, the results are reported. If recoveries do not fall within control limits, the sample matrix is evaluated. When matrix interferences are present or documented, the results are reported with a qualifier that matrix interferences are present. If no matrix interferences are present and there is no cause for the outlier, the sample is reprepared and reanalyzed. However, if the recovery is above the upper control limit with non-detected target analytes, the sample may be reported. All surrogate recovery outliers are appropriately qualified on the report.
- Duplicate Sample and/or Duplicate Matrix Spike Results – The RPD is calculated and compared to the specified control limits. If the RPD is within the control limits the result is reported. If not, an evaluation of the sample is made to verify that a homogenous sample was used. Despite the use of homogenizing procedures prior to sample preparation or analysis, the sample may not be homogenous or duplicate sample containers may not have been sample consistently. If non-homogenous, the result is reported with a qualifier about the homogeneity of the sample. Also, the results are compared to the MRL. If the results are less than five times the MRL, the results are reported with a qualifier that the high RPD is due to the results being near the MRL. If the sample is homogenous and results above five times the MRL, the samples and duplicates are reanalyzed. If re-analysis also produces out-of-control results, the results are reported with an appropriate qualifier.
- Laboratory Control Sample Results – The LCS percent recovery is calculated and compared to specified control limits. If the recovery is within control limits, the analysis is in control and results may be reported. If not, this indicates that the analysis is not in control. Samples associated with the 'out of control' LCS, shall be considered suspect and the samples re-extracted or re-analyzed or the data reported with the appropriate qualifiers. For analysis where a large number of analytes are in the LCS, it becomes more likely that some analytes (marginal exceedences) will be outside the control limits. The procedure described in the 2009 NELAC standards, V1M4 Section

1.7.4.2 are used to determine if the LCS is effective in validating the analytical system and the associated samples.

- Matrix Spike Results – The MS percent recovery is calculated and compared to specified control limits. If the recovery is within control limits the results are reported. If not, and the LCS is within control limits, this indicates that the matrix potentially biases analyte recovery. It is verified that the spike level is at least five times the background level. If not, the results are reported with a qualifier that the background level is too high for accurate recovery determination. If matrix interferences are present or results indicate a potential problem with sample preparation, steps may be taken to improve results; such as performing any additional cleanups, dilution and reanalysis, or re-preparation and reanalysis. Results that do not meet acceptance limits are reported with an appropriate qualifier.

21.1.2 Qualitative Data Evaluation

All sample results and QC results are reviewed to ensure correct identification of target analytes, when not inherent to the test method. Details particular to each analysis are given in the analytical SOP.

Identification criteria for GC, LC or GC/MS methods are summarized below:

- GC and LC Methods
  - The analyte must fall within the retention time window specified in the applicable SOP. The retention time window is established prior to analysis and documented.
  - For analyses all positive results are confirmed by a second column, a second detector, a second wavelength (HPLC/UV), or by GC/MS analysis. Details for confirmation analysis are described in the SOP *Confirmation Procedures for GC and HPLC Analyses* (SOC-CONF). Confirmation data will be provided as specified in the method.
  - When sample results are confirmed by two dissimilar columns or detectors, the agreement between quantitative results must be evaluated. The relative percent difference between the two results is calculated and evaluated against SOP and/or method criteria.
- GC/MS and LC/MS Methods – Two criteria are used to verify identification:
  - Elution of the analyte is at the same relative retention time (as defined by the method) as demonstrated in the standard.
  - The mass spectrum of the analyte in the sample must, in the opinion of a qualified analyst or the department manager, correspond to the spectrum of the analyte in the standard or the current GC/MS reference library.
  - When Tentatively Identified Compounds are to be reported for GC/MS, the spectrum for non-target peaks is compared to the current GC/MS reference library.

21.2 Data Reporting

It is the responsibility of each laboratory unit to provide the Project Manager with a final report of the data for each analysis, accompanied by signature approval. When the entire data set has been found to be acceptable, a final copy of the report is generated and approved by the laboratory supervisor, departmental manager or designated laboratory staff. The entire data package for the analysis is then placed into the service request file, and an electronic copy of the final data package is forwarded to the appropriate personnel for archival. Footnotes and/or narrative notes must accompany any data package if problems were encountered that require further explanation to the client. Each data package is submitted to the appropriate Project Manager.

When all analyses and departmental reports are completed the Project Manager reviews the entire collection of analytical data for completeness and to ensure that any and all client-specified objectives were successfully achieved. A report narrative is written by the Project Manager to explain any unusual problems with a specific analysis or sample, etc. Prior to release of the report to the client, the Project Manager reviews and approves the entire report for completeness and to ensure that any and all client-specified objectives were successfully achieved. The original raw data, along with a copy of the final report, is scanned and archived by service request number.

To the extent possible, samples shall be reported only if all QC measures are acceptable. If a QC measure is found to be out of control, and the data is to be reported, all samples associated with the failed quality control measure shall be reported with the appropriate data qualifier(s). The SOP for *Data Reporting and Report Generation* (ADM-RG) addresses the flagging and qualification of data. The ALS-defined data qualifiers, state-specific data qualifiers, or project-defined data qualifiers are used depending on project requirements. A case narrative may be written by the Project Manager to explain problems with a specific analysis or sample, etc.

When requested by the client or relevant to the validity of reported results, the estimation of measurement uncertainty will be provided to a client or regulatory agency. How the uncertainty will be reported may be dictated by the client's reporting specifications. Procedures for determining and reporting uncertainty are given in SOP *Estimation of Uncertainty of Analytical Measurements* (CE-QA010).

For subcontracted analyses, the Project Manager verifies that the report received from the subcontractor is complete. This includes checking that the correct analyses were performed, the analyses were performed for each sample as requested, a report is provided for each analysis, and the report is signed. The Project Manager accepts the report if all verification items are complete. Acceptance is demonstrated by forwarding the report to the client.

21.3 Deliverables

In order to meet individual project needs, ALS - Kelso provides several levels of analytical reports. Standard specifications for each level of deliverable are described in Table 21-1. Variations may be provided based on client or project specifications. This includes (but is not limited to) deliverables for DoD QSM projects and state-specific drinking water formats.

When requested, ALS - Kelso provides Electronic Data Deliverables (EDDs) in the format specified by client need or project specification. ALS - Kelso is capable of generating EDDs with many different formats and specifications. The EDD is prepared by report production staff using the electronic version of the laboratory report to minimize transcription errors. User guides and EDD specification outlines are used in

preparing the EDD. The EDD is reviewed and compared to the hard-copy report for accuracy.

Table 21-1
Descriptions of ALS Environmental – Kelso Standard Data Deliverables*
Tier I. Routine Analytical Report includes the following:
• Transmittal letter
• Chain of custody documents and sample/cooler receipt documentation
• Sample analytical results
• Method blank results
• Surrogate recovery results and acceptance criteria for applicable organic methods
• Dates of sample preparation and analysis for all tests
• Case narrative – optional
Tier II. In addition to the Tier I Deliverables, this Analytical Report includes the following:
• Laboratory Control Sample results with calculated recovery and associated acceptance criteria
• Matrix spike results with calculated recovery and associated acceptance criteria
• Duplicate or duplicate matrix spike result(s) (as appropriate to method), with calculated relative percent difference
• Case narrative – optional
Tier III. Data Validation Package. In addition to the Tier II Deliverables, this CAR includes the following:
• Case narrative – required
• Summary forms for all associated QC and Calibration parameters, with associated control criteria/acceptance limits
• Other summary forms specified in QAPPs or project/program protocols, or those related to specialized analyses such as HRGC/MS are included.
Tier IV. Full Data Validation Package.
• All raw data associated with the sample analysis, including but not limited to: • Preparation and analysis bench sheets and instrument printouts, • For organics analyses, all applicable chromatograms, spectral, confirmation, and manual integration raw data. For GC/MS this includes tuning results, mass spectra of all positive results, and the results and spectra of TIC compounds when requested.
• QC data
• Calibration data (initial, verification, continuing, etc.),
• Calibration blanks or instrument blanks (as appropriate to method).

* If a project QAPP or program reporting protocol applies the report will be presented as required for the project.

22) Summary of Changes and Document History

Revision Number	Effective Date	Document Editor	Description of Changes
25	11/12/2016	C. Degner	Minor changes and updates to text sections 1-23, updated key personnel, organization charts, and equipment. Updated appendices.

23) References for Quality System Standards, External Documents, Manuals, and Test Procedures

The analytical methods used at ALS Environmental, Kelso generally depend upon the end-use of the data. Since most of our work involves the analysis of environmental samples for regulatory purposes, specified federal and/or state testing methodologies are used and followed closely. Typical methods used at ALS Environmental, Kelso are taken from the following references:

- National Environmental Laboratory Accreditation Program (NELAP), 2009 Quality Standards.
- TNI Standard - Environmental Laboratory Sector, Volume 1, *Management and Technical Requirements for Laboratories Performing Environmental Analysis,* EL-V1-2009.
- Quality Standards. American National Standard *General requirements for the competence of testing and calibration laboratories,* ANSI/ISO/IEC 17025:2005(E)
- *DoD Quality Systems Manual for Environmental Laboratories,* Versions 4.2 and 5.0
- *Good Automated Laboratory Practices, Principles and Guidance to Regulations For Ensuring Data Integrity In Automated Laboratory Operations*, EPA 2185 (August 1995).
- *Manual for the Certification of Laboratories Analyzing Drinking Water*, 5th Edition, EPA 815-B-97-001 (January 2005).
- *Procedure Manual for the Environmental Laboratory Accreditation Program,* Washington Department of Ecology, 10-03-048, September 2010.
- *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, SW-846, Third Edition, (September 1986) and Updates I (July 1992), II (September 1994), IIA (August 1993), IIB (January 1995), III (December 1996), Final Update IV (February 2007), and updates posted online at http://www.epa.gov/epaoswer/hazwaste/test/sw846.htm. See Chapters 1, 2, 3, and 4.
- *Methods for Chemical Analysis of Water and Wastes*, EPA-600/4-79-020, (Revised March 1983).
- *Methods for the Determination of Inorganic Substances in Environmental Samples*, EPA/600/R-93/100 (August 1993).
- *Methods for the Determination of Metals in Environmental Samples*, EPA/600/4-91/010 (June 1991) and Supplements.
- *Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater*, EPA 600/4-82-057 (July 1982) and 40 CFR Part 136, Appendix A.
- *Methods for the Determination of Organic Compounds in Drinking Water*, EPA/600/4-88/039 (December 1988) and Supplements.

- Standard Methods for the Examination of Water and Wastewater, 20th Edition (1998) and SM On-Line. See Introduction in Part 1000.
- 40 CFR Part 136, Guidelines for Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act, and EPA Method Update Rule 2007 and 2012.
- 40 CFR Part 141, National Primary Drinking Water Regulations and EPA Method Update Rule 2007.
- Analytical Methods for Petroleum Hydrocarbons, ECY 97-602, Washington State Department of Ecology, June 1997.
- State-specific total petroleum hydrocarbon methods for the analysis of samples for gasoline, diesel, and other petroleum hydrocarbon products (Alaska, Arizona, California, Oregon, Washington, Wisconsin, etc.).
- Annual Book of ASTM Standards, Part 31, Water.
- U. S. EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, EPA-540/R-94/012 (February 1993).
- U. S. EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, EPA-540/R-94/013 (February 1994).
- Recommended Protocols for Measuring Selected Environmental Variables in Puget Sound, for USEPA and USACE (March 1986), with revisions through April 1997.
- WDOE 83-13, Chemical Testing Methods for Complying with the State of Washington Dangerous Waste Regulations (March 1982) and as Revised (July 1983 and April 1991).
- Identification and Listing of Hazardous Waste, California Code of Regulations, Title 22, Division 4.5, Chapter 11.
- Analytical Methods for the Determination of Pollutants in Pulp and Paper Industry Wastewater, EPA 821-R-93-017 (October 1993).
- Analytical Methods for the Determination of Pollutants in Pharmaceutical Manufacturing Industry Wastewaters, EPA 821-B-98-016 (July 1998).
- National Council of the Pulp and Paper Industry for Air and Stream Improvement (NCASI).

Internal program-level QA documents are listed in Appendix I.

APPENDIX A – Glossary

Acceptance Criteria: Specified limits placed on characteristics of an item, process, or service defined in requirement documents.

Accreditation: The process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications or standards, thereby accrediting the laboratory.

Accreditation Body: The territorial, state or federal agency having responsibility and accountability for environmental laboratory accreditation and which grants accreditation.

Accreditation Standard: The document describing the elements of laboratory accreditation that has been developed and established within the consensus principles of standard setting and meets the approval requirements of standard adoption organizations procedures and policies.

Accuracy: The degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components that are due to sampling and analytical operations; a data quality indicator.

Analysis Date: The calendar date of analysis associated with the analytical result reported for an accreditation or experimental field of proficiency testing.

Analyst: The designated individual who performs the "hands-on" analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality.

Analytical Uncertainty: A subset of Measurement Uncertainty that includes all laboratory activities performed as part of the analysis.

Assessment: The evaluation process used to measure or establish the performance, effectiveness, and conformance of an organization and/or its systems to defined criteria (to the standards and requirements of laboratory accreditation).

Audit: A systematic and independent examination of facilities, equipment, personnel, training, procedures, record-keeping, data validation, data management, and reporting aspects of a system to determine whether QA/QC and technical activities are being conducted as planned and whether these activities will effectively achieve quality objectives.

Bias: The systematic distortion of a measurement process, which causes errors in one direction (i.e., the expected sample measurement is different from the sample's true value).

Calibration: A set of operations that establish, under specified conditions, the relationship between values of quantities indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material, and the corresponding values realized by standards.

Calibration Standard: A substance or reference material used for calibration.

Certified Reference Material (CRM): Reference material accompanied by a certificate, having a value, measurement uncertainty, and stated metrological traceability to a national metrology institute.

Chain of Custody: Record that documents the possession of the samples from the time of collection to receipt in the laboratory. This record generally includes: the number and types of containers; the mode of collection; the collector; time of collection; preservation; and requested analyses.

Confirmation: Verification of the identity of a component through the use of an approach with a different scientific principle from the original method. These may include, but are not limited to: second column confirmation, alternate wavelength, derivatization, mass spectral interpretation, alternative detectors, or additional cleanup procedures.

Data Reduction: The process of transforming the number of data items by arithmetic or statistical calculation, standard curves, and concentration factors, and collating them into a more useful form.

Demonstration of Capability: A procedure to establish the ability of the analyst to generate analytical results of acceptable accuracy and precision.

Field of Accreditation: Those matrix, technology/method, and analyte combinations for which the accreditation body offers accreditation.

Field of Proficiency Testing (FoPT): Analytes for which a laboratory is required to successfully analyze a PT sample in order to obtain or maintain accreditation, collectively defined as: matrix, technology/method, analyte.

Finding: An assessment conclusion referenced to a laboratory accreditation standard and supported by objective evidence that identifies a deviation from a laboratory accreditation standard requirement.

Holding Time: The specified maximum time that can elapse between two specified sampling and/or analytical activities.

Internal Standard: A known amount of standard added to a test portion of a sample as a reference for evaluating and controlling the precision and bias of the applied analytical method.

Laboratory Control Sample (however named, such as laboratory fortified blank, spiked blank, or QC check sample): A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes and taken through all sample preparation and analytical steps of the procedure unless otherwise noted in a reference method. It is generally used to establish evaluate accuracy and bias for associated sample analyses.

Legal Chain of Custody Protocols: Procedures employed to record the possession of samples from the time of sampling through the retention time specified by the client or program. These procedures are performed at the special request of the client and include the use of a Chain of Custody Form that documents the collection, transport, and receipt of compliance samples by the laboratory. In addition, these protocols document all handling of the samples within the laboratory.

Limit of Detection (LOD): A laboratory's estimate of the minimum amount of an analyte in a given matrix that an analytical process can reliably detect.

Limit of Quantitation (LOQ): The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence.

Matrix: The substrate of a test sample.

Matrix Duplicate: A replicate matrix prepared in the laboratory and analyzed to obtain a measure of precision.

Matrix Spike (spiked sample or fortified sample): A sample prepared, taken through all sample preparation and analytical steps of the procedure unless otherwise noted in a referenced method, by adding a known amount of target analyte to a specified amount of sample for which an independent test result of target analyte concentration is available. Matrix spikes are used to determine the effect of the matrix on a method's recovery efficiency.

Matrix Spike Duplicate (spiked sample or fortified sample duplicate): A replicate matrix spike prepared in the laboratory and analyzed to obtain a measure of the precision of the recovery for each analyte.

Measurement System: A method, as implemented at a particular laboratory, and which includes the equipment used to perform the test and the operator(s).

Method: A body of procedures and techniques for performing an activity (e.g., sampling, chemical analysis, quantification), systematically presented in the order in which they are to be executed.

National Institute of Standards and Technology (NIST): A federal agency of the US Department of Commerce's Technology Administration that is designed as the United States National Metrology Institute (NMI).

Precision: The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator.

Preservation: Any conditions under which a sample must be kept in order to maintain chemical and/or biological integrity prior to analysis.

Primary Accreditation Body (Primary AB): The TNI-NELAP accreditation body responsible for assessing a laboratory's total quality system, on-site assessment, and PT performance tracking for fields of accreditation.

Procedure: A specified way to carry out an activity or process. Procedures can be documented or not.

Proficiency Testing (PT): A means to evaluate a laboratory's performance under controlled conditions relative to a given set of criteria, through analysis of unknown samples provided by an external source.

Proficiency Testing Provider (PTP): A person or organization accredited by the TNI-approved Proficiency Testing Provider Accreditor to operate a TNI-compliant PT program.

Proficiency Testing Sample (PT Sample): A sample, the composition of which is unknown to the laboratory and is provided to test whether the laboratory can produce analytical results within the specified acceptance criteria.

Proficiency Testing Study (PT Study): A single complete sequence of circulation of proficiency testing samples to all participants in a proficiency test program.

Quality Assurance: An integrated system of management activities involving planning, implementation, assessment, reporting, and quality improvement to ensure that a process, item, or service is of the type and quality needed and expected by the client.

Quality Control: The overall system of technical activities that continually measures the performance of a process, item, or service against defined standards to verify that they meet the stated requirements. Also, the system of activities and checks used to ensure that measurement systems are maintained within prescribed limits, providing protection against "out of control" conditions and ensuring that the results are of acceptable quality.

Quality Control Sample: A sample used to assess the performance of all or a portion of the measurement system.

Quality Manual: A document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users.

Quality System: A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required quality assurance (QA) and quality control (QC) activities.

Quality System Matrix: These matrix definitions be used for purposes of batch and quality control requirements:

Air and Emissions: Whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas or vapor that are collected with a sorbent tube, impinger solution, filter, or other device.

Aqueous: Any aqueous sample excluded from the definition of Drinking Water or Saline/Estuarine. Includes surface water, ground water effluents, and TCLP or other extracts.

Biological Tissue: Any sample of a biological origin such as fish tissue, shellfish, or plant material. Such samples are grouped according to type of tissue (i.e. marine vs. plant).

Chemical Waste: A product or by-product of an industrial process that results in a matrix not otherwise defined.

Drinking Water: Any aqueous sample that has been designated a potable or potential potable water source.

Non-Aqueous Liquid: Any organic liquid, product, or solvent not miscible in water and with <15% settleable solids.

Saline/Estuarine: Any aqueous sample from an ocean or estuary, or other salt water source.

Solids: Includes soils, sediments, sludges and other matrices with >15% settleable solids.

Raw Data: The documentation generated during sampling and analysis that records the original work steps, observations, and measurements, whether performed by an analyst or instrument. This documentation includes, but is not limited to field notes, electronic data, analysis bench sheets, run/injection logs, printouts, chromatograms, instrument outputs, and handwritten records for calibration, sample preparation, and sample analysis for field samples and QC samples.

Reference Material: Material or substance one or more of whose property values are sufficiently homogeneous and well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials.

Reference Standard: Standard used for the calibration of working measurement standards in a given organization or at a given location.

Sampling: Activity related to obtaining a representative sample of the object of conformity assessment, according to a procedure.

Secondary Accreditation Body (Primary AB): A TNI-NELAP accreditation body responsible that accredits the laboratory based on the Primary AB accreditation and procedures.

Selectivity: The ability to analyze, distinguish, and determine a specific analyte or parameter from another component that may be a potential interferent or that may behave similarly to the target analyte or parameter within the measurement system.

Sensitivity: The capability of a method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest.

Standard Operating Procedure (SOP): A written document that details the process for an operation, analysis, or action, with thoroughly prescribed techniques and steps. SOPs are officially approved as the procedures for performing certain routine or repetitive tasks.

Technology: A specific arrangement of analytical instruments, detection systems, and/or preparation techniques.

Traceability: The ability to trace the history, application, or location of an entity by means of recorded identifications. In a calibration sense, traceability relates measuring equipment to national or international standards, primary standards, basic physical constants or properties, or reference materials. In a data collection sense, it relates calculations and data generated throughout the project back to the requirements for the quality of the project.

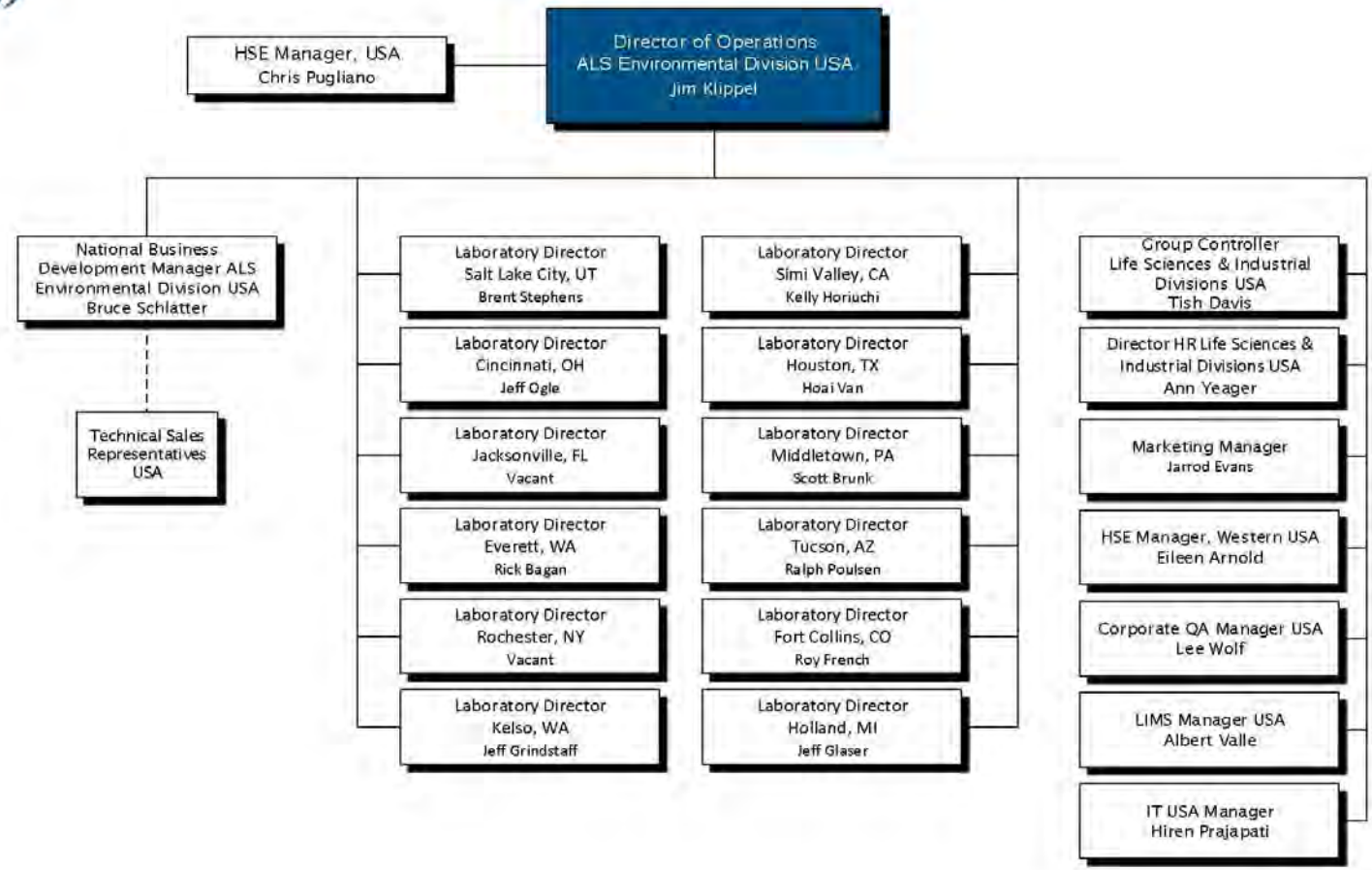
Verification: Confirmation by examination and objective evidence that specified requirements have been met.

Acronyms

ASTM – American Society for Testing and Materials
A2LA – American Association for Laboratory Accreditation
CARB – California Air Resources Board
CAS – Number Chemical Abstract Service registry Number
CFC – Chlorofluorocarbon
CFU – Colony-Forming Unit
DEC – Department of Environmental Conservation
DEQ – Department of Environmental Quality
DHS – Department of Health Services
DOE – Department of Ecology
DOH – Department of Health
EPA – U. S. Environmental Protection Agency
ELAP – Environmental Laboratory Accreditation Program
GC – Gas Chromatography
GC/MS – Gas Chromatography/Mass Spectrometry
LOD – Limit of Detection
LOQ – Limit of Quantitation
LUFT – Leaking Underground Fuel Tank
M – Modified
MCL – Maximum Contaminant Level is the highest permissible concentration of a substance allowed in drinking water as established by the USEPA.
MDL – Method Detection Limit
MPN – Most Probable Number
MRL – Method Reporting Limit
NA – Not Applicable
NC – Not Calculated
NCASI – National Council of the Paper Industry for Air and Stream Improvement
ND Not Detected
NIOSH – National Institute for Occupational Safety and Health
PQL – Practical Quantitation Limit
RCRA – Resource Conservation and Recovery Act
SIM – Selected Ion Monitoring
TNI – The NELAC Institute
TPH – Total Petroleum Hydrocarbons

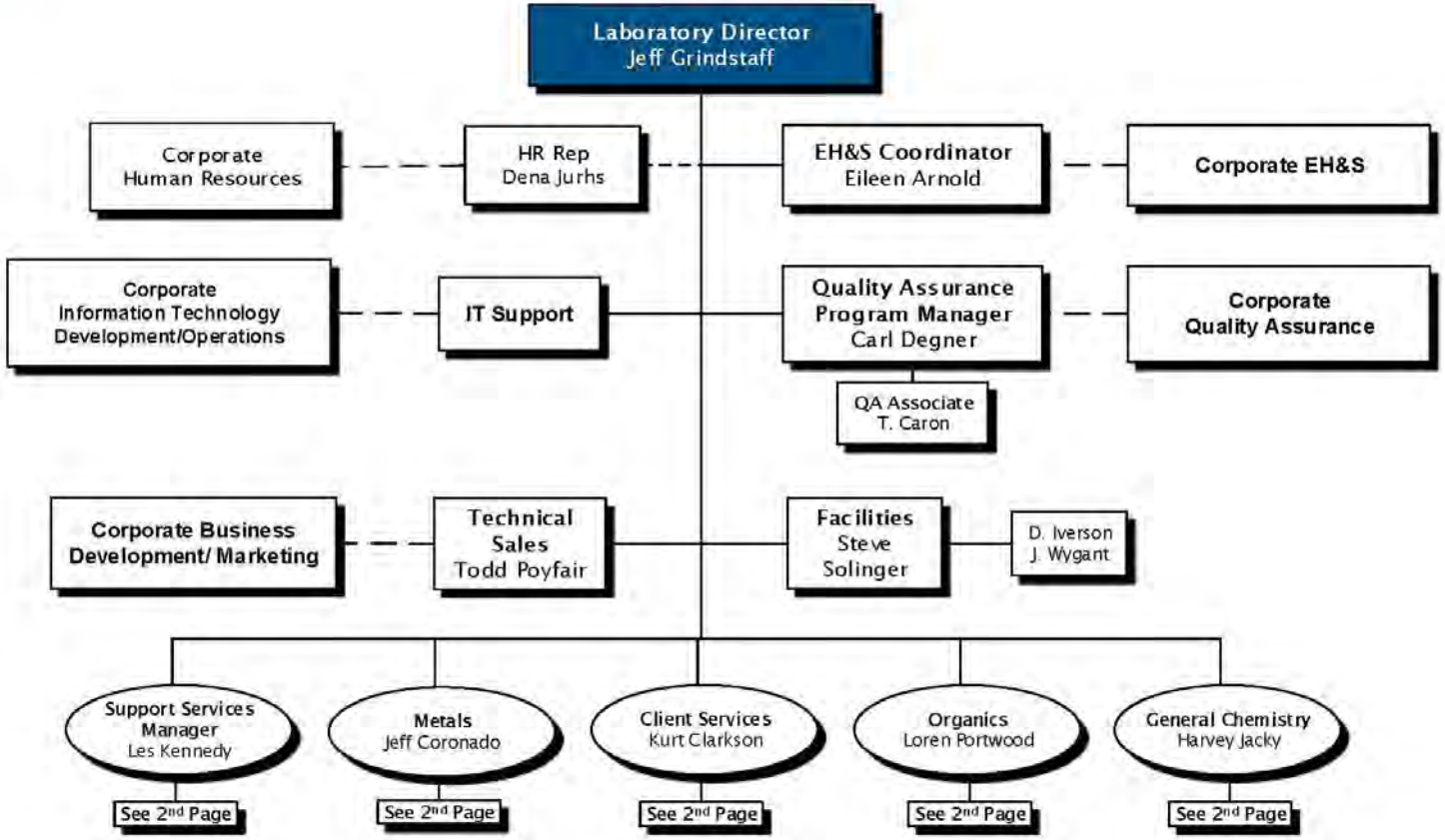
APPENDIX B – Organization Charts, Key Personnel, and Report Signatories

ALS Environmental USA



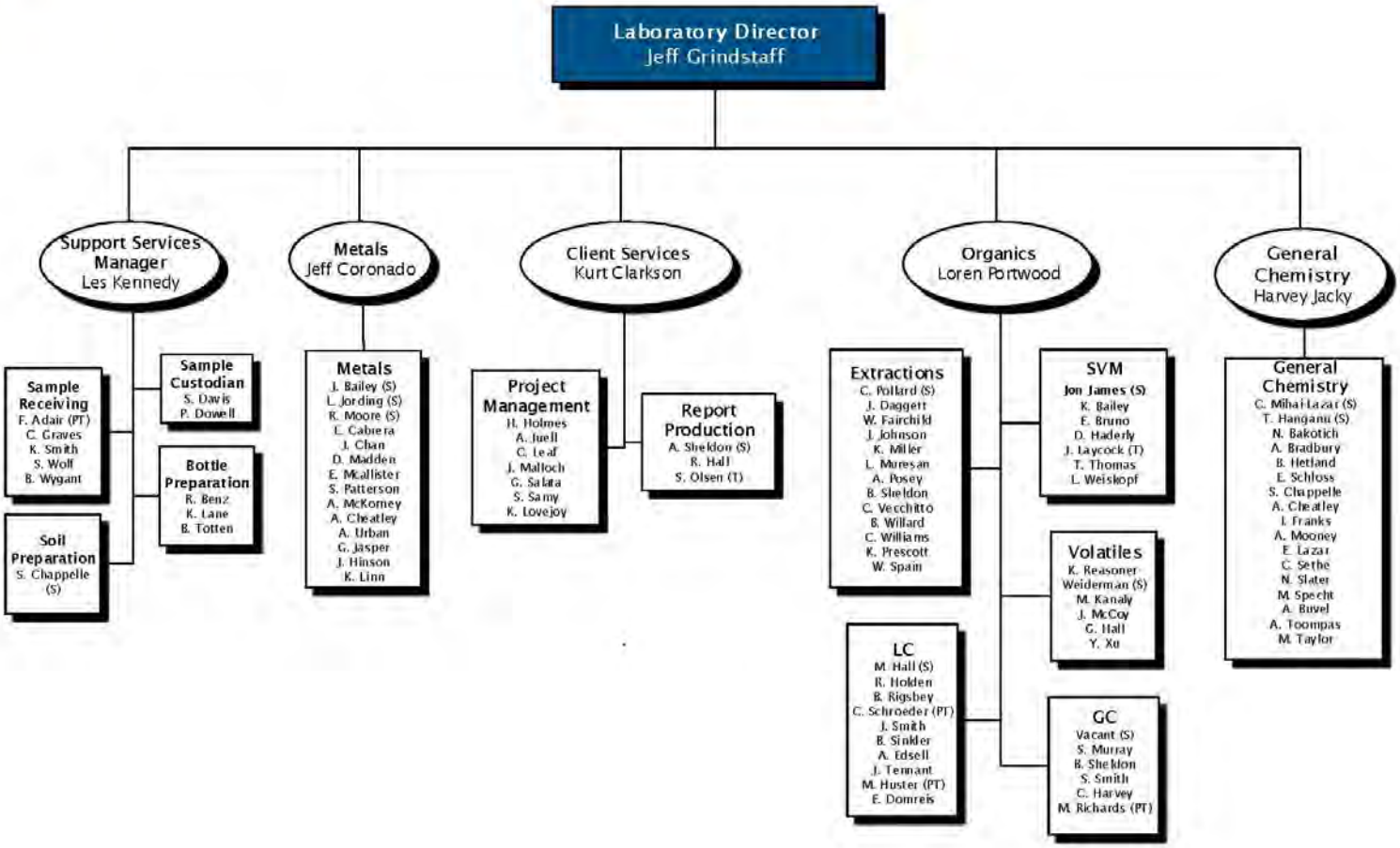
Kelso, Washington Laboratory

October 5, 2016



Kelso, Washington Laboratory

October 5, 2016
Operations



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JEFF GRINDSTAFF

Laboratory Director, 2010 - Present
Kelso Laboratory

Responsible for all phases of laboratory operations at the Kelso Laboratory, including project planning, budgeting and quality assurance. Primary duties include the direct management and operational oversight of the Kelso laboratory and all department managers.

PREVIOUS EXPERIENCE

Technical Manager III, Pharmaceutical GC/MS, VOC and SVOC Laboratories, 1997-2010
Columbia Analytical Services, Inc.
Kelso, WA

Primary responsibilities include leadership of the Pharmaceutical GC/MS, VOC and SVOC staff, management of method development, training, data review, tracking department workload, scheduling analyses. Responsible for ensuring data quality and timeliness. Also responsible for project management and coordination for pharmaceutical clients.

Manager, GC/MS VOA Laboratory, 1994-1997
Columbia Analytical Services, Inc.
Kelso, WA

Responsible for supervision of GC/MS VOA staff development, method development, training, data review, tracking department workload, scheduling analyses, and general maintenance and troubleshooting of GC/MS systems.

Scientist III, GC/MS VOA Laboratory, 1991-1994
Columbia Analytical Services, Inc.
Kelso, WA

Responsible included scheduling workload, data review, instrument maintenance and troubleshooting and personnel training and evaluation.

EDUCATION

Allan Hancock College -
Santa Maria, CA
AA, Liberal Arts
1986

California Polytechnic State University -
San Luis Obispo, CA
BS, Chemistry
1989

Hewlett-Packard Analytical Education Center
Mass Selective Detector Maintenance 1993

Richard Rogers Group
Leadership Training, 1996

PTI International
Sampling and Testing of Raw Materials, 2004

American Chemical Society, 1989

Mr. Grindstaff has a number of publications and presentations. For a complete list, contact ALS.

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KURT CLARKSON

Client Services Manager, 2016 – Present
Kelso Laboratory

Management of the Client Services Departments: Project Management, Electronic Data Deliverables and Report Generation, and Sample Management. Oversee the client services. Personally responsible for project management, technical and regulatory interpretation assistance, as well as project organization of work received by the laboratory.

PREVIOUS EXPERIENCE

Project Manager, 2015-2016
ALS Group USA, Corp.
Kelso, WA

Responsible for technical project management, ensuring overall data quality and compliance with customer requirements, Provide technical support to clients regarding laboratory application to projects. Additionally, acts as a consultant to clients regarding industrial/environmental compliance issues; serving as liaison between clients and regulatory agencies. Responsible for direct technical project management providing technical and regulatory interpretation assistance, as well as project organization of work received and reported by the laboratory.

Client Services Manager, 2013-2015
Western Environmental Testing Laboratory
Sparks, NV

Management of the Client Services Departments: Project Management, direct employees, continuous improvement initiatives, and laboratory revenue. Worked directly with clients to develop strong customer relationships. Met deadlines and quick turnaround times.

Customer Service Department Manager/Sr. Project Manager, 2012-2013
STAT Analysis Corporation
Chicago, IL

Management of the Client Services Departments: Project Management, direct employees, continuous improvement initiatives, and laboratory revenue. Worked directly with clients to develop strong customer relationships. Met deadlines and quick turnaround times.

EDUCATION

University of Alaska, Anchorage - Anchorage, AK
MBA Leadership and Operations Management
2011

University of Reno, Nevada -Reno, NV
BS Biology and Business Management
2007

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CARL DEGNER

Quality Manager, 2015 – Present
Kelso Laboratory

Directing the quality systems and ethics programs for the Kelso, WA laboratory facility. Responsible for ensuring that ALS quality systems and data integrity standards are implemented. Act as liaison with government entities involving quality, technical and operational issues. This includes maintaining accreditations and certifications, and maintaining all necessary documents (QA Manual, SOPs, and QA records). Act as primary point of contact during laboratory audits and provide audit responses and corrective actions. Coordinate performance audits (PE/PT testing) and conduct internal audits.

PREVIOUS EXPERIENCE

Technical Manager, SVM, 2011–2014
ALS Group USA, Corp.
Kelso, WA

Responsible for daily operation of Semi-volatiles GC/MS laboratory. This includes scheduling workloads of 3 analyst, data review, reporting and long-range planning for SVM laboratory. Work with PMs on client specific project requirements.

Technical Manager, SVM, 2001–2011
Columbia Analytical Services, Inc.
Kelso, WA

Same as above.

Scientist IV, SVM, 1998–2001
Columbia Analytical Services, Inc.
Kelso, WA

Responsible for all phases of operation of GC/MS systems, utilizing SIM and 8270C methodologies, including preparation of standards, QC verifications, data review, and reporting.

Project Chemist/Principal Organic Scientist, 1993–1998
Environ Express Laboratory
LaPorte, TX

Responsible for SV Extractions and GC/MS laboratories. Set up, operated, and maintained three HP GC/MS systems and worked with clients on technical issues.

EDUCATION

University of Houston – Houston, TX
MS Environmental Management
1998

University of Houston – Houston, TX
BS Biochemistry/Biophysical Science
1984

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EILEEN ARNOLD

Health, Safety and Environmental Manager, Western USA, 2015 – Present

Responsibilities include development, support and implementation of Environmental, Health and Safety policies for lab locations in the Western US, including national corporate policies for respiratory protection and hazardous waste generation. At the Kelso facility, also responsible for incident reporting and investigation, maintenance of all safety related equipment, review of monthly safety audits, and completion of all Federal and State mandated EH&S reports.

PREVIOUS EXPERIENCE

Scientist IV Metals Laboratory/Kelso Health and Safety Officer, 2012-2015
ALS Group USA, Corp.
Kelso, WA

Supervisor of the Metals reporting group responsible for ensuring timely, accurate reporting of all metals reports. Responsible for updating instrument specific data, such as MDL and control limits. Analyst for the Inductively Coupled Argon Plasma (ICAP) Emission Spectrometer. This involves digestion, instrumental analysis, and report generation for environmental samples using approved EPA techniques. Also, Environmental, Health and Safety Officer.

Scientist IV Metals Laboratory/Kelso Health and Safety Officer, 1994-2012
Columbia Analytical Services, Inc.
Kelso, WA

Same as above.

Project Chemist, 1992-1994
Columbia Analytical Services, Inc.
Kelso, WA

Duties included technical project management and customer service. Responsible for meeting the clients' needs of timely and appropriate analyses, and to act as liaison for all client-related activities within Columbia Analytical Services, Inc.

EDUCATION

Immaculata College –
Immaculata, PA
BS Chemistry
1977

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JEFF CORONADO

Technical Manager IV, Metals Department Manager, 1992 – Present
Kelso Laboratory

Management of the Kelso Metals Department staff and annual revenues approaching $4 million. Responsible for data quality and timeliness, annual budgeting, revenues, expenses, workload coordination, method development efforts, and resource allocation. Participation in multiple LIMS development teams responsible for defining the ALS product. Team leader for defining specifications of the Sample Preparation Module to capture preparation information across all laboratory departments.

PREVIOUS EXPERIENCE

Supervisor, GFAA Laboratory, 1989–1992
Columbia Analytical Services, Inc.
Kelso, WA

Responsibilities included supervision of metals analysis by graphite furnace atomic absorption following SW 846 and EPA CLP methodologies. Duties include workload scheduling, data review, instrument maintenance, personnel training and evaluation.

EDUCATION

Western Washington University – Bellingham, WA
BS Chemistry
1988

Western Washington University – Bellingham, WA
BA Business Administration
1985

Winter Conference on Plasma Spectrochemistry – Tucson, AZ, 2012

LC/ICP-MS Training Course – PerkinElmer, 2008

Field Immunaossay Training Course – EnSys Inc., 1995

Winter Conference on Plasma Spectrochemistry – San Diego, CA, 1994

ICP-MS Training Course – VG-Elemental, 1992

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HARVEY JACKY

General Chemistry Department Manager, 2008 - Present
Kelso Laboratory

Oversee the operation of the General Chemistry and Microbiology groups. Responsible for the quality and timeliness of the inorganic laboratories analytical reports, departmental budgets, workload coordination, method development efforts, cost-effectiveness, and resource allocation.

PREVIOUS EXPERIENCE

Project Manager III, 1999-2008
Columbia Analytical Services, Inc.
Kelso, WA

Responsible for technical project management, ensuring overall data quality and compliance with customer requirements, and providing technical support to clients regarding laboratory application to projects. Additionally, acts as a consultant to clients regarding industrial/environmental compliance issues; serving as liaison between clients and regulatory agencies.

Director of Project Management, 1997-1999
Coffey Laboratories
Portland, OR

Responsible for technical project management. Communicated with clients to determine needs and expectations. Monitored laboratory production and ensured the timely completion of analytical projects. Technical consultant for clients regarding environmental compliance. Supervised and managed other members of the project management team. Served as a member of the senior management team for oversight of general operations, strategic planning, finances, and policy.

Project Manager/Chemist, 1997-1999
Coffey Laboratories
Portland, OR

Responsibilities: Served as primary liaison between Coffey Laboratories and major clients. Ensured that work was completed in a timely manner and done to client specifications. Served as technical consultant regarding environmental chemistry, soil remediation, and waste water industrial compliance.

EDUCATION

Oregon State University - Corvallis, OR
BS Zoology, 1988

Oregon State University - Corvallis, OR
BS General Science, 1988

Linfield College - McMinnville, OR **General Studies**, 1981 - 1982

40-Hour Hazmat Certification, PBS Environmental, 1996

Industrial Emergency Response, SFSP Seminar, 1991

American Chemical Society, Member since 1988

Biochemical and Physical Factors Involved in the Application and Measurement of a Soil Bioremediation System. Biogeochemistry, Portland State University, 1996

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LOREN PORTWOOD

Organics Manager, 2016 - Present
Kelso Laboratory

Oversee the operation of the Volatiles GC/MS, Semi-volatile GC/MS and HPLC laboratories. Responsibilities include organizing and prioritizing workload, training and development of staff, working with PMs on client-specific project requirements, workload coordination, method development efforts and resource allocation. Responsible for the quality and timeliness of analytical reports. Other responsibilities include ensuring compliance with ALS QA protocols, and assisting staff with troubleshooting equipment and procedural problems.

PREVIOUS EXPERIENCE

Technical Manager, Drinking Water Laboratory/SVG Supervisor, 2008-2016
ALS Group USA, Corp.
Kelso, WA

Responsible for management of the Semi-volatile Organics Gas chromatograph and drinking water department. Also responsible for implementation and oversight of UCMR2 analyses. Perform method development. Project management of drinking water accounts. Develop SOPs for Drinking Water methods, EPA 600 methods and SW-846 methods. Operation of Varian GC/MS ion trap, Thermo GC/MS ion trap, Agilent GC/ECD, Agilent GC/FPD, Agilent GC/FID. Responsible for data interpretation, quality control and data reporting. Additional responsibilities include SOP generation; handling routine and advanced maintenance and troubleshooting of instrumentation; and assisting in the training of staff department analysts. Assists the department manager and/or other senior scientists in setting up more complex procedures. Serves as senior technical advisor for teams and projects.

Lead Analyst, 2002-2008
Columbia Analytical Services
Kelso, WA

Primary responsibilities include management of the petroleum hydrocarbon team, initiating new methods and process improvements, and staff development and training. Other duties include department wide compliance with CAS quality assurance guidelines, routine system checks, assist and encourage staff in troubleshooting equipment and procedural problems in a manner consistent with company, state and federal guidelines.

EDUCATION

Whitworth College - Spokane, WA
BS in Chemistry, Emphasis in Biochemistry
1990

HP 5890 GC Maintenance and Troubleshooting, Hewlett Packard, 1993

Capilliary Chromatography Restek, 1993

HP6890 - Fast GC Hewlett Packard, 1996

HP5890-C+GC Advanced Operations Hewlett Packard, 1996

Purge and Trap Theory and Troubleshooting, Full Spectrum Analytics, 2001

Comprehensive HPLC, Restek, 2002

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LES KENNEDY

Sample Custodian/Sample Management Manager, 2010 - Present
Kelso Laboratory

Responsible for the operation of the Sample Management, Sample Control, Bottle preparation departments, including sample receiving, courier service, sample control, storage and disposal, bottle preparation and shipping, and general freight receiving. Responsible for employee supervision, personnel evaluations, workload coordination, and adherence to all standard operating procedures within said departments. Additional duties include oversight of quarantined soil importation for laboratory testing. Is the designated Sample Custodian for the laboratory.

PREVIOUS EXPERIENCE

Project Manager/SMO Supervisor, 1999-2011
Columbia Analytical Services, Inc.
Kelso, WA

Responsible for technical project management, ensuring overall data quality and compliance with customer requirements, and serving as liaison to clients and regulatory agencies. Oversight of the daily activities in sample management department including receipt, login, storage, and proper disposal of all samples received in the laboratory.

Organic Extractions Supervisor, 1997-1999
Columbia Analytical Services, Inc.
Kelso, WA

Responsible for managing work load; directing efficiency; and ensuring that all critical holding times and QC are met each day. This involves GC/MS prep work, including extracting and GPC clean up; and subsequent sample screening of the GC/MS prep work. Additional responsibilities include data processing of GC/MS analytical runs including all steps of the data review and reporting process.

Senior Analyst, GC/MS Laboratory, 1996-1997
Columbia Analytical Services, Inc.
Kelso, WA

Primary duties were performing analyses by EPA Method 8270, SIM TCL. SIM PAH, including all steps in the data review and reporting process.

EDUCATION

Lower Columbia College - Longview, WA
Coursework, General Studies
1988-1990

Portland Bible College
Portland, OR
Bachelor of Theology,
2009

APPROVED SIGNATORIES FOR FINAL ANALYTICAL REPORTS

ALS Environmental, Kelso, WA

CLARKDON, KURT
CORONADO, JEFFREY
DEGNER, CARL
GRINDSTAFF, JEFF
HOLMES, HOWARD
JACKY, HARVEY
JUELL, AMANDA
LEAF, CHRIS
LOVEJOY, KELLEY
MALLOCH, JANET
SALATA, GREGORY
SAMY, SHAR

Update: October, 2016 Approved by: Kurt Clarkson, Client Services Manager

APPENDIX C

ALS Environmental Confidentiality Agreement

Confidentiality Agreement

The Confidentiality Agreement (the "Agreement") is entered into by and between ALS Group (hereinafter referred to as the "Company") and _____ (hereinafter referred to as "Employee").

WHEREAS, employee is presently employed by the Company in a position in which Employee will receive and have access to confidential business information and other secrets of the Company, and shall, to the best of Employee's ability, assist the Company in improving and developing the products and services of the Company; and

WHEREAS, employee is desirous of continuing such employment and receiving such disclosures of confidential business information, and assisting the Company in improving and developing its products and services.

NOW, this Agreement being a condition therefore and ancillary thereto, and in further consideration of the benefits to Employee pursuant to the employment by the Company, the receipt and sufficiency of all such consideration being hereby acknowledged by Employee, it is agreed between the Company and Employee as follows:

1. **Confidential Business Information.** Employee recognizes and agrees that the Company has certain confidential business information, including, but not limited to, compilations of information, customer lists, customer data, records, specifications, and trade secrets, and related business methods and techniques, which confidential business information are used by the Company to obtain a competitive advantage over the Company's competitors who do not know or use this information. Employee further recognizes and agrees that the protection of such confidential business information against unauthorized disclosure and use is of critical importance to the company to maintain its competitive position and Employee therefore agrees that use of, or disclose to any other person or entity, except as authorized by the Company in writing, any of the confidential business information of the Company. Employee also agrees not to disclose to the Company or utilize on the Company's behalf, any of the trade secrets or other confidential information of any of the Employee's former employers.

2. **Return of Confidential Business Information.** Upon termination of his employment for any reason, employee shall promptly deliver to the Company all drawings, manuals, letters, photographs, tapes or video recordings, records of any kind, and all copies thereof, that may be in the possession of, or under the control of, Employee pertaining to the Company's employers.

3. **Assignment of Rights to Company.** Employee agrees to assist the Company in all possible ways in the discovery, perfection, and development of new ideas, inventions, discoveries, devices, and methods in processes, all for the benefit of the Company and as its exclusive property. Employee agrees to and does hereby assign, transfer, and convey to the Company, or at the written direction of the Company and which are made, developed or conceived by Employee, either solely or jointly with others, during Employee's employment with the Company, whether prior or subsequent to the signing of this Agreement, whether made, developed or conceived by Employee during or outside of regular working hours or on or away from the

Company's premises or at Employee's expense, the expense of the Company or some other person or persons. At any time, the Employee shall execute such documents requested by the Company to confirm the rights of the Company in the ideas, inventions, discoveries, and devices, methods and processes referenced in this Section 3.

4. **Reasonableness of Covenants**. Employee specifically acknowledges and agrees as follow: (I) the covenants set forth in this Agreement are reasonable and necessary to protect the goodwill and the operations and business of the Company; (ii) the time duration of the covenants set forth in this Agreement and are reasonable and necessary to protect the goodwill and the operations and business of the Company; (iii) the geographical area limitations of the covenants set forth in this Agreement are reasonable and necessary to protect the goodwill and the operations and business of the Company; (iv) the covenants set forth in this Agreement are not oppressive to Employee and do not impose a greater restraint on Employee than is necessary to protect the goodwill and the operations and business of the Company.

5. **Remedies**. Employee recognizes that irreparable injury or damage will result to the business of the company in the event to the breach of any covenant contained in this Agreement and Employee therefore agrees that in the event of such breach on the part of the Employee, the Company shall be entitled, in addition to any legal or equitable remedies and damages available, to an injunction to restrain the violation thereof by Employee and all other persons action for or on behalf of Employee. Any claim of Employee against the Company shall not prevent the Company from enforcing any provision of this agreement. Further, in the event legal action is necessary to enforce any of Employee's obligations hereunder and the Company prevails in such legal action, the Company shall be entitled to a recovery of its attorney's fees expended in such action.

6. **Reformation**. Whenever possible, each provision of this agreement shall be interpreted in such manner as to be effective and valid under applicable law; provided, however, incase any on or more of the provisions contained in this Agreement shall, for any reason, be held to be invalid, illegal, or unenforceable in any respect, such invalidity, illegality, or unenforceability shall no affect any other provision of this agreement, and this Agreement shall be construed as if such invalid, illegal, or unenforceable provision had never been contained herein. Should a court of competent jurisdiction declare any of the provisions of this Agreement unenforceable due to any restriction of duration, territorial coverage, scene of activity, or otherwise, in lieu of declaring such provisions unenforceable, the parties hereto expressly authorize the court, to the extent permissible by law, to revise or reconstruct such provisions in a manner sufficient to cause them to be enforceable.

7. **Affiliates**. This agreement, and Employee's obligations hereunder, shall apply to any confidential business information, formulas, recipes, patterns, devices, secret inventions, processes, compilations of information, materials, ingredients, customer lists, records, specifications and trade secrets of any affiliate of the Company. For the purpose of this Agreement, the "affiliate" means any person that, directly or indirectly, controls, or controlled by, or is under common control with, another person'; "person" means any individual, corporation, partnership, joint venture, limited liability company, association, joint stock company, trust, unincorporated

organization or any other form of entity; and "control" means the power to direct or cause the direction of the management and policies of a person, directly or indirectly, whether through the ownership of voting securities by contract, or otherwise.

8. **Compelled Disclosure**. In the event that Employee is requested or required (by oral questions, interrogatories, requested for information or documents, subpoenas, civil investigative demand or similar process) to disclose any of the confidential business information of the Company, it is agreed that Employee will provide the Company with immediate notice of such request(s), so that the Company may seek an appropriate protective order or, if appropriate, waive Employee's compliance with this agreement. Employee agreed that, if in the absence of a protective order or the receipt of a waive hereunder, Employee is nonetheless, in the reasonable opinion of Employee's counsel, legally compelled to disclose the confidential business information of the Company or else stand liable for contempt or suffer other censure or penalty, Employee may, after prior notice to the Company, disclose such the confidential business information of the Company to the extent legally required.

9. **Indemnity**. Employee agrees to indemnify and hold harmless the Company, and its directors, officers, employees, agents, and attorneys, from and after the date hereof, against any and all actions, causes of action, claims, suites, proceedings, demands, assessments, demands, settlement, judgment, damages, loses, costs, and legal and other expenses arising out of or resulting from the breach or failure of Employee to Company with any covenant or agreement made herein.

10. **Choice of Law: Waiver of Trial by Jury**. This Agreement shall be construed in accordance with, and governed for all purposes by the laws of the State of Texas and obligations and undertakings of each of the parties to this contract shall be performable at Houston, Harris County. TO THE EXTENT NOT PROHIBITED BY APPLICABLE LAW, THE PARTIES HEREBY KNOWLINGLY, VOLUNTARILY, AND INTENTIONALLY WAIVE ANY RIGHT TO TRIAL BY JURY THAT THE COMPANY OR EMPLOYEE MAY HAVE IN ACTION OR PROCEEDING, IN LAW OR IN EQUITY, IN CONNECTION WITH THIS AGREEMENT, EACH PARTY REPRESENTS AND WARRANTS THAT NEITHER PARTY HAS REPRESENTED, EXPRESSLY, OR OTHERWISE THAT IT WILL NOT, IN THE EVENT OF LITIGATION, SEEK TO ENFORCE THIS RIGHT TO JURY TRIAL WAIVER. EACH PARTY ACKNOWLEDGES THAT THE OTHER PARTY HAS BEEN INCLUDED TO ENTER INTO THIS AGREEMENT BY, AMONG OTHER THINGS, THE PROVISIONS OF THE WAIVER.

11. **Waiver**. No waiver of any provision of this Agreement shall constitute a waiver of any other provision of this agreement, nor such waiver constitute a waiver of any subsequent breach of such provision.

12. **Acknowledgement of Receipt.** Employee acknowledges a receipt of a copy of this Agreement, which has been executed in multiple copies, all executed copies of that shall be deemed originals.

13. **No Promise of Employment.** It is expressly agreed that this Agreement is not a promise of future employment.

14. **Assignment**: **Survival**. This agreement shall not be assignable by Employee. This agreement and the obligations of Employee hereunder, shall survive the termination of Employee's employment with the Company.

15. **Entire Agreement**. This Agreement entered into by the Company and Employee, embodies the entire agreement and understanding between the Company and the Employee relating to the subject matter hereof, and supersedes all prior agreements and understandings relating to the employment and compensation of the Employee and may only be amended by a written agreement signed by all parties hereto.

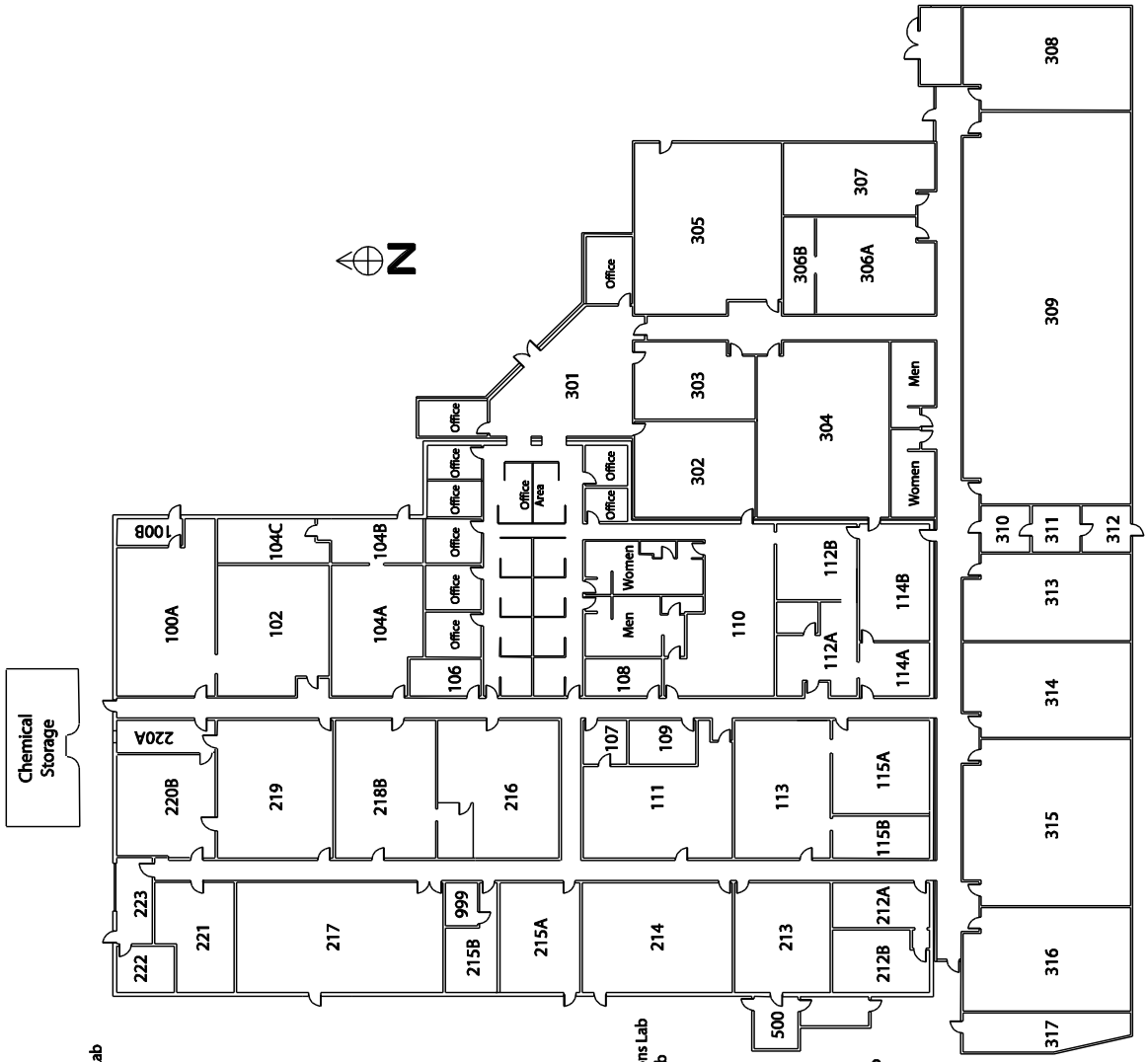
Employee Signature: _____ Date: _____

Employee Printed Name: _____

Witness: _____ Date: _____

Witness Printed Name: _____

APPENDIX D – Laboratory Floor Plan



Room #	
100A	Semivolatile Organics GC Instrument Lab
100B	Electrical Room
102	Semivolatile Organics GC Office
104 A - C	Organics LC Labs and Offices
106	Deionized Water System Room
107	Oven Room
108	Zero Headspace Extraction Lab
109	Storeroom
110	Lunch Room
111	General Chemistry Lab
112A	Microbiology Lab
112B	Copy Center
113	ICP MS Lab
114A	Grain Size
114B	Total Solids/Oven Room
115A	ICP Lab
115B	Metals Reporting
212A	Mercury and Flame AA Lab
212B	Low Level Mercury Lab
213	General Chemistry Lab
214	General Chemistry Lab
215A	Drinking Water Lab
215B	Information Technology
216	Data Review & Storage
217	Sample Storage
218	Volatiles Organics Lab
219	Semivolatile Organics GC/MS Lab
220A	Semivolatile Organics GC/MS Office
220B	Semivolatile Organics GC/MS Extractions Lab
221	Drinking Water Sample Preparation Lab
222	Purchasing Office
223	General Receiving
301	Reception Lobby
302	Lunch Room
303	Conference Room
304	Sample Storage
305	Sample Receiving
306A	Pharmaceutical Metals
306B	Pharmaceutical Microbiology
307	Pharmaceutical Instrument Lab
308	Pharmaceutical General Chemistry Lab
309	Organics Sample Preparation Lab
310	Communication Room
311	Electrical Room
312	Fire Room/Water System
313	Glass Wash Room
314	Clean Room
315	Metals Digestion Room
316	Tissue Preparation
317	Mechanical
500	Janitorial Room
999	Computer Room

Revised 9/21/10

APPENDIX E – Analytical Equipment

GENERAL CHEMISTRY/WATER CHEMISTRY LABORATORY			
Equipment Description	**Year Acquired**	**Manufacturer or Laboratory Maintained (MM/LM)**	**# of Trained Operators**
Analytical Balances (14):			
Precisa, Mettler, Ohaus, Adams models	1990-2011	LM	13
Autoclave - Market Forge Sterilmatic	1988	LM	5
Autoclave – Heidolph Brinkman 3870EP	2010	LM	3
Autotitrator – Thermo Orion 500	2007	LM	3
Calorimeters (2):			
Parr 1241 EA Adiabatic	1987	LM	4
Parr 6300 Isoparabolic	2005	LM	4
Centrifuge - Damon/IEC Model K	1992	LM	13
Colony Counter - Quebec Darkfield	1988	LM	2
Conductivity Meter (1):			
YSI Model 3200	2004	LM	4
Digestion Systems (4):			
COD (2)	1989	LM	4
Kjeldahl, Lachat 46-place (1)	1999	LM	3
Skalar Micro Digester, 120 place (1)	2016	LM	2
Dissolved Oxygen Meter - YSI Model 58 (2)	1988, 1991	LM	4
Distillation apparatus (Midi) - Easy Still (1)	2000	LM	5
Drying Ovens (12):			
Shel-Lab and VWR models	1990-2010	LM	13
Flash Point Tester (1):			
Petroleum Systems Services	2005	LM	3
Flow-Injection Analyzers (2):			
Bran-Leubbe	2002	LM	2
Lachat 8500	2007	LM	2
Ion Chromatographs (4)			
Thermo/Dionex ICS-2500	2002	LM	3
Thermo/Dionex ICS-2000	2006	LM	3
Thermo/Dionex ICS-1600	2009	LM	3
Thermo/Dionex ICS-1600	2015	LM	3
Meters (ISE and pH) (4)			
Fisher Scientific Accument Model 50	1997	LM	4
Fisher Scientific Accument Model 25	1993	LM	4
Fisher Scientific Accument Model 20	2000	LM	4
Fisher Scientific Accument Model AR25	1992	LM	4
Microscope - Olympus	1988	LM	1
Muffle Furnace- Sybron Thermolyne Model F-A1730	1991	LM	13

Shatter Box (2): GP 1000 SPEX 8530	 1989 2011	 LM LM	 5 5
Sieve Shakers (2): CE Tyler - Portable RX 24 WS Tyler - RX 86	 1990 1991	 LM LM	 5 5
Thomas-Wiley Laboratory Mill, Model 4	1989	LM	5
Total Organic Carbon (TOC) Analyzers (3) Coulemetrics Model 5012 Teledyne Tekmar Fusion 1 Analytik Jena 2500	 1997 2009 2013	 LM LM LM	 3 3 3
Total Organic Halogen (TOX) Analyzers (2): Mitsubishi TOX-100 Mitsubishi TOX-200	 2001 2015	 LM LM	 2 2
Turbidimeter - Hach Model 2100N	1996	LM	5
UV-Visible Spectrophotometers (3): Beckman-Coulter DU520 Perkin Elmer Lambda 25 Abrazix	 2005 2008 2011	 LM LM LM	 4 4 2
Discrete Autoanlayzer –Westco SmartChem AD20-1	2011	LM	2
Vacuum Pumps (3): Welch Duo-Seal Model 1376 Busch R-5 Series Single Stage Chem Star 1402N-01	 1990 1991 2011	 LM	 13
Water Baths/Incubators (5): Various Fisher Scientific and VWR Models	1986 - 2009	LM	13
Drill Press – Craftsman	2012	-	4
METALS LABORATORY			
Equipment Description	**Year Acquired**	**Manufacturer or Laboratory Maintained (MM/LM)**	**# of Trained Operators**
Analytical Balance (8) Mettler AE 200 analytical balance Various Mettler, Sartorius, and Ohaus models	1988-2010	MM	12
Atomic Absorption Spectrophotometers (4): Perkin Elmer AAnalyst 200 Flame AA CETAC Mercury Analyzer M-6100 Buck AA Spectrophotometer Model 205	 2005 2010 2008	 MM MM LM	 3 3 3
Atomic Fluorescence Spectrophotometer (2) Brooks-Rand Model III Brooks-Rand Merx	 2005 2014	 LM LM	 3 3
Centrifuge - IEC Model Clinical Centrifuge	1990	LM	12
Drying Oven - VWR Model 1370F	1990	LM	12

Freeze Dryers (1) - Labconco	2006	LM	5
Inductively Coupled Plasma Atomic Emission Spectrometer (ICP-AES) (2)			
Thermo Scientific Model iCAP 6500	2007	MM	3
Thermo Scientific Model iCAP 6500	2012	MM	3
Inductively Coupled Plasma Mass Spectrometers (ICP-MS) (4):			
Agilent 7700	2014	MM	2
Agilent 7800	2016	MM	2
Thermo X-Series	2006	MM	2
Nexion Model 300D	2011	MM	2
Muffle Furnace (2) - Thermolyne Furnatrol - 53600	1991, 2005	LM	5
Shaker - Burrell Wrist Action Model 75	1990	LM	12
TCLP Extractors (3)	1989, 2002	LM	5
Turbidimeter – Hach			
SEMIVOLATILE ORGANICS SAMPLE PREPARATION LABORATORY			
Equipment Description	**Year Acquired**	**Manufacturer or Laboratory Maintained (MM/LM)**	**# of Trained Operators**
Analytical Balance (3)			
Mettler PM480, AG204, AE240	1999 - 2015	MM	6
Sartorius LP3200D	2016	MM	
Centrifuge – Sorvall GLC-1 (2)	2014	LM	3
Drying Ovens (2)			
Fisher Model 655G	1991	LM	3
VWR Model 1305U	1999	LM	3
Evaporators/concentrators			
Organomation N-Evap (7)	1990-2010	LM	4
Organomation S-Evap (7)	1990-2010	LM	7
Biotage Turbovap (3)	2013 - 2016	LM	2
Extractor Heaters: Lab-Line Multi-Unit for Soxhlet and Continuous Liquid-Liquid Extractions (90)	1987-2007	LM	4
Solids Extractors:			
Sonic Bath VWR	1994	LM	3
Sonic Horn (4)	1994	LM	3
Soxtherm		LM	
Gerhardt (4)	2000	LM	2
OI Analytical (5)	2008	LM	2

Extractors, TCLP (8): Millipore TCLP Zero Headspace Extractors (10) TCLP 12 position Extractor/Tumbler (2)	 1992-2011 1989-2011	 LM LM	 1 1
Gel Permeation Chromatography (GPC) (4) J2 Scientific AccuPrep (3) Gilson (1)	 2005, 2010 2013	 LM LM	 2 2
Muffle Furnace (2)	2006, 2009	LM	1
Solid Phase Extractors (18) – Horizon SPE-Dex 4790	2003, 2006,2008	LM	4
Microwave Extractor – Mars 6	2014	LM	2
Edmund Buhler 3-Storey top frame VKS 'Shaker table' (1)	2016	LM	1
GC SEMIVOLATILE ORGANICS INSTRUMENT LABORATORY			
Equipment Description	**Year Acquired**	**Manufacturer or Laboratory Maintained (MM/LM)**	**# of Trained Operators**
Gas Chromatographs (18): Agilent 6890 GC with Agilent 7683 Autosampler and Dual ECD Detectors (6) Agilent 6890 GC with Agilent 7683 Autosampler and Dual FPD Detectors Agilent 7890A Dual ECD Detectors Agilent 7683B autosampler (4) Hewlett-Packard 5890 GC with HP 7673 Autosampler and FID Detector Agilent 6890 with Dual FID Detectors and Agilent 7873 Autosampler (4) Agilent 7890A Dual NPD Detectors and Agilent 7683B autosampler	 2001, 2005, 2007,2011 2003 2010 - 2014 1995 2001, 2005 2012	 LM LM LM LM LM LM	 4 3 4 3 4 2
Varian Ion trap GC/MS: Varian 3800 GC w/CP8400 autosampler Varian Saturn 2100T mass spectrometer	2003 2006 2003	LM LM LM	2 2 2
Thermo Ion Trap ITQ-90C GC/MS w/TriPlus autosampler	2008	LM	2
GC/MS SEMIVOLATILE ORGANICS INSTRUMENT LABORATORY			
Equipment Description	**Year Acquired**	**Manufacturer or Laboratory Maintained (MM/LM)**	**# of Trained Operators**
Analytical Balance - Mettler AB 104-S	2000	MM	6
Gas Chromatograph: Hewlett-Packard 5890 with HP 7673 autosampler and FID Detector	1994	LM	5

Semivolatile GC/MS Systems (11): Agilent 6890/5973 with ATAS Optic2 LVI and HP 7673 Autosampler (2) Agilent 5890/5970 and HP 7673 Autosampler Agilent 5890/5972 with ATAS Optic2 LVI and HP 7673 Autosampler (1) Agilent 6890/5973 with ATAS Optic3 LVI and HP 7683 Autosampler Agilent 6890/5973 with Agilent PTV Injector and 7683 Autosampler (2) Agilent7890A/5975C with Agilent 7693 Autosampler (4)	1997, 2001 1990 1993, 1994 2005 2007 2010 - 2011	LM LM LM LM LM LM	5 5 5 5 5 5
Semivolatile GC/MS/MS – Waters Quattro Micro GC Micromass with Agilent 6890, Agilent PTV Injector, 7683B Autosampler	2008	MM	1
HPLC LABORATORY			
Equipment Description	**Year Acquired**	**Manufacturer or Laboratory Maintained (MM/LM)**	**# of Trained Operators**
Analytical Balance - Mettler BB240	1994	MM	8
Drying Oven - Fisher Model 630F	1991	LM	?
Evaporator – Turbo Vap	2009	LM	8
Centrifuge (2) Beckman Coulter Eppendorf	 2002 2012	 LM LM	 8 8
High-Performance Liquid Chromatographs (3): Agilent 1260 Infinity with Diode Array UV Detector	2011	LM	3
High-Performance LC/MS (5) Spectrometer - Thermo Electron TSQ Vantage LC/MS/MS and autosampler API 5000 LC/MS/MS and SIL-20AC autosampler AB Sciex 5500 and Shimadzu DGU 20A5 Shimadzu LC/MS 8050 with 2x LC-30AD UHPLC pumps and SIL-30AC MP autosampler Shimadzu LC/MS 8050 with 2x LC-30AD UHPLC pumps and SIL-30AC MP autosampler	 2005 2008 2011 2016 2016	 MM MM MM MM MM	 2 5 3 2 2
Agilent 1100 HPLC -UV/Fluorescence detector	2003	LM	1
VOLATILE ORGANICS LABORATORY			
Equipment Description	**Year Acquired**	**Manufacturer or Laboratory Maintained (MM/LM)**	**# of Trained Operators**

Analytical Balance - Mettler PE 160	1989	MM	4
Fisher Vortex Mixer	1989	LM	4
Drying Ovens (1): Boekel 107801	 1989	 LM	 4
Sonic Water Bath - Branson Model 2200	1989	LM	4
Volatile GC/MS Systems (8): Agilent 5890/5970 Tekmar 3000 Purge and Trap Concentrator Dynatech ARCHON 5100 Autosampler Agilent 6890/5973 Tekmar 3100 Purge and Trap Concentrator Encon Centurion Autosampler Agilent 6890/5973 Tekmar Velocity Purge and Trap Concentrator Tekmar Aquatech Autosampler Agilent 7980A/5975C (2) Teledyne Tekmar-Atomx Agilent 6890/5973 Encon Evolution Purge and Trap Concentrator Encon Centurion Autosampler Agilent 7890/5977A Encon Evolution Purge and Trap Concentrator Encon Centurion Autosampler Agilent 7890B/5977B Teledyne Tekmar Atomx	 1989 1995 1996 2001 2001 2001 2005 2005 2005 2010, 2011 2010, 2011 2013 2013 2013 2014 2014 2014 2016 2016	 LM LM LM LM LM LM LM LM LM LM LM LM LM LM LM LM LM LM LM	 4 4 4 4 4 4 4 4 4 3 3 4 4 4 4 4 4 3 3
Agilent 7890 GC with FID Encon Evolution Purge and Trap Concentrator Encon Centurion Autosampler Agilent 7890 GC with FID Encon Evolution Purge and Trap Concentrator Encon Centurion Autosampler	 2013 2013 2016	 LM LM	 2 2

AUTOMATED DATA PROCESSING EQUIPMENT			
Equipment Description	**Year Acquired**	**Manufacturer or Laboratory Maintained (MM/LM)**	**# of Trained Operators**
1 - WAN: LIMS Sample Manager using Oracle 11gR2 Enterprise RDBMS running on Red Hat Enterprise Linux Advanced Server v.6.6 platform connected via DMVPN circuits (100 Mbps)	2013	LM	NA
1 - Network Server for reporting and data acquisition running Windows Server 2008 R2 with a 1.4 TB capacity, 1 - Application server running Windows Server 2008 R2	2012	LM	NA
Approximately 90+ HP (3015, 4000, 4014, 4050, 4200, 4250, 4300), Dell 1720dn, and Lexmark	2010 - 2015	LM	NA

M5155 printers.			
Approximately 220+ Dell/HP PC workstations running Windows XP/Windows 7 on LAN connected via 100BT/1GigE network	2010 - 2015	LM	NA
Microsoft Office 2013 Professional as the base office application suite for all PC workstations. Some systems using Microsoft Office 2003/2007/2010	1996 - 2014	LM	NA
E-mail via Exchange 2010 with webmail via Outlook Web Access. Microsoft Outlook 2013 is standard email client, with some using Outlook 2010	2011 - 2014	LM	NA
Facsimile Machines - Brother 4750e, Brother 2920, and Brother 1860	2005 - 2008	LM	NA
Copier/Scanners - BizHub 283, BizHub 600, BizHub 601 (2), BizHub 654, BizHUb754e (2), BizHub 951, BizHub 1050.	2005 - 2015	LM	NA
Thru-Put, MARRS, Stealth, Harold, Blackbird, EDDGE, CASLIMS, & LabCoat reporting software systems.	1998 - 2014	LM	NA
Data processing terminals (79) - EnviroQuant, Target, Saturn, MassHunter, Chromeleon, MassLynx, Insight.	1996 - 2016	LM	NA

APPENDIX F – Containers, Preservation and Holding Times

DETERMINATION[a]	MATRIX[b]	CONTAINER[C]	PRESERVATION	HOLDING TIME
Bacterial Tests				
Coliform, Colilert (SM 9223)	W, DW	P, Bottle or Bag	Cool, 4°C, 0.008% $Na_2S_2O_3$[d]	6-24 hours[e]
Coliform, Fecal and Total (SM 9221, 9222D)	W, S, DW	P,G	Cool, 4°C, 0.008% $Na_2S_2O_3$[d]	6-24 hours[e]
Enterococci (Enterolert)	W	P	Cool, 4°C, 0.008% $Na_2S_2O_3$[d]	8 hours
Inorganic Tests				
Acidity (SM 2310B)	W	P,G	Cool, 4°C	14 days[EPA]
Alkalinity (SM 2320B)	W, DW	P,G	Cool, 4°C	14 days[EPA]
Ammonia (SM 4500 NH_3)	W, DW	P,G	Cool, 4°C, H_2SO_4 to pH<2	28 days
Biochemical Oxygen Demand(SM 5210B)	W	P,G	Cool, 4°C	48 hours
Bromate (EPA 300.1)	W, DW	P,G	50mg/L EDA, cool to 4°C	28 days
Bromide (EPA 300.1)	W, DW	P,G	None Required	28 days
Chemical Oxygen Demand (SM 5220C)	W	P,G	Cool, 4°C, H_2SO_4 to pH<2	28 days
Chloride (EPA 300.0)	W, DW	P,G	None Required	28 days
Chloride (EPA 9056)	W, S	P,G	Cool, 4°C	28 days
Chlorine, Total Residual (SM 4500 Cl F)	W, S	P,G	None Required	24 hours
Chlorite (EPA 300.1)	W, DW	P,G	50mg/L EDA, cool to 4°C	14 days
Chlorophyll-A (SM 11200H)	W	G Amber	Cool, 4°C	Analyze immediately
Chromium VI (EPA 7196A)	W	P,G	Cool, 4°C	24 hours
Color (SM 2120B)	W, DW	P,G	Cool, 4°C	48 hours
Cyanide, Total and Amenable to Chlorination (EPA 335.4, 9010, 9012) (SM 4500 CN E,G)	W, S, DW	P,G	Cool, 4°C, NaOH to pH>12, plus 0.6 g Ascorbic Acid	14 days
Cyanide, Weak Acid Dissociable (SM 4500 CN I)	W, S	P,G	Cool, 4°C, NaOH to pH >12	14 days

DETERMINATION[a]	MATRIX[b]	CONTAINER[c]	PRESERVATION	HOLDING TIME
Ferrous Iron (ALS SOP)	W, D	G Amber	Cool, 4°C	24 hours
Fluoride (EPA 300.0, 9056, SM 4500 F-C)	W, S	P,G	Cool, 4°C	28 days
Formaldehyde (ASTM D6303)	W	G Amber	Cool, 4°C	48 hours
Hardness (SM 2340C)	W, DW	P,G	HNO_3 to pH<2	6 months
Hydrogen Ion (pH) (SM 4500H B)	W, DW	P,G	None Required	Analyze immediately
Kjeldahl and Organic Nitrogen (ASTM D3590-89)	W	P,G	Cool, 4°C, H H_2SO_4 to pH<2	28 days
Nitrate (EPA 300.0)	W, DW	P,G	Cool, 4°C	48 hours
Nitrate (EPA 353.2)	W, S	P,G	Cool, 4°C, H_2SO_4 to pH<2	48 hours
Nitrate (EPA 9056)	W, S	P,G	Cool, 4°C	Analyze immediately
Nitrate-Nitrite (EPA 353.2)	W, DW	P,G	Cool, 4°C, H_2SO_4 to pH<2	28 days
Nitrite (EPA 300.0)	W, DW	P,G	Cool, 4°C	48 hours
Nitrite (EPA 353.2)	W, S	P,G	Cool, 4°C, H_2SO_4 to pH<2	48 hours
Nitrite (EPA 9056)	W, S	P,G	Cool, 4°C	Analyze immediately
Nitrocellulose	S	G	Cool, 4°C	28 days
Oil and Grease, Hexane Extractable Material (EPA 1664)	W	G, Teflon Lined Cap	Cool, 4°C, H_2SO_4 or HCL to pH<2	28 days
Organic Carbon, Total (9060 & SM 5310 C)	W	P,G	Cool, 4°C, H_2SO_4 to pH<2	28 days
Organic Carbon, Total (ASTM-D4129)	S	P,G	Cool, 4°C	28 days
Organic Halogens, Adsorbable (EPA 1650B)	W	G, Teflon Lined Cap	Cool, 4°C, HNO_3 to pH<2	6 months
Organic Halogens, Total (EPA 9020)	W	G, Teflon Lined Cap	Cool, 4°C, H_2SO_4 to pH<2, No headspace	28 days
Orthophosphate (SM 4500 P-E)	W, DW	P,G	Cool, 4°C	Analyze immediately
Oxygen, Dissolved (Probe) (SM 4500O G)	W, DW	G, Bottle and Top	None Required	Analyze immediately
Oxygen, Dissolved (Winkler)	W, DW	G, Bottle and Top	Fix on Site and Store in Dark	8 hours
Perchlorate (EPA 314.0)	W, DW ,S	P,G	Protect from temp. extremes	28 days

DETERMINATION[a]	MATRIX[b]	CONTAINER[c]	PRESERVATION	HOLDING TIME
Phenolics, Total (EPA 420.1, 9056)	W, S	G Amber	Cool, 4°C, H_2SO_4 to pH<4	28 days
Phosphorus, Total (EPA 365.3)	W	P,G	Cool, 4°C, H_2SO_4 to pH<2	28 days
Residue, Filterable (TDS) (SM 2540C)	W	P,G	Cool, 4°C	7 days
Residue, Nonfilterable (TSS) (SM 2540D)	W	P,G	Cool, 4°C	7 days
Residue, Settleable (SM 2540F)	W	P,G	Cool, 4°C	48 hours
Residue, Total (SM 2540B)	W	P,G	Cool, 4°C	7 days
Residue, Volatile (EPA 160.4)	W	P,G	Cool, 4°C	7 days
Silica (SM 4500 SiO2 C)	W	P Only	Cool, 4°C	28 days
Specific Conductance (SM 2510 B)	W, DW	P,G	Cool, 4°C	28 days
Sulfate (EPA 300.0)	W, DW	P,G	Cool, 4°C	28 days
Sulfate (EPA 9056)	W, S	P,G	Cool, 4°C	28 days
Sulfide (9030/934)	W, S	P,G	Cool, 4°C, Add Zinc Acetate, plus Sodium Hydroxide to pH>9	7 days
Sulfide (SM 4500 S_2 D)	W	P,G	Cool, 4°C, Add Zinc Acetate, plus Sodium Hydroxide to pH>9	7 days
Sulfide (SM 4500 S_2 F)	W	P,G	Cool, 4°C, Add Zinc Acetate, plus Sodium Hydroxide to pH>9	7 days
Sulfite (SM 4500 SO_3 B)	W	P,G	None Required	24 hours
Sullfides, Acid Voaltile	S	G	Cool, 4°C	14 days
Surfactants (MBAS) (SM 5540 C)	W	P,G	Cool, 4°C	48 hours
Tannin and Lignin (SM 5550B)	W	P,G	Cool, 4°C	28 days
Turbidity (EPA 180.1)	W, DW	P,G	Cool, 4°C	48 hours
Metals				
Arsenic Species 1632	W	G	HCL to pH<2, Cool < 4°C	28 days
Mercury (1631E)	W	F	Cool, 4°C, HCl or H_2SO_4 to pH<2	90 days

DETERMINATION[a]	MATRIX[b]	CONTAINER[c]	PRESERVATION	HOLDING TIME
Mercury (1631E)	S	F	Freeze < -15°C	1 Yr
Mercury (7471)	S	P,G	Cool, 4°C	28 days
Mercury (EPA 245.1, 7470, 7471)	W, DW	P,G	HNO_3 to pH<2	28 days
Metals (200.7, 200.8, 200.9, 6010, 6020)	W, DW	P,G	HNO_3 to pH<2	6 months
Metals (200.7, 200.8, 200.9, 6010, 6020)	S	G, Teflon Lined cap	Cool, 4°C	6 months
Methyl Mercury 1630	W, S, T	F	HCL to pH<2	6 months
Volatile Organics				
Gasoline Range Organics (8015, NWTPH-Gx)	W	G, Teflon-Lined, Septum Cap	Cool, 4°C, HCl to pH<2, No headspace	14 days
Gasoline Range Organics (8015, NWTPH-Gx)	S	G, Teflon-Lined Cap	Cool, 4°C, Minimize Headspace	14 days
Purgeable Halocarbons (624, 8260)	W	G, Teflon-Lined, Septum Cap	No Residual Chlorine Present; HCl to pH<2, Cool, 4°C, No Headspace	14 days
Purgeable Halocarbons (624, 8260)	W	G, Teflon-Lined, Septum Cap	Residual Chlorine Present; 10% $Na_2S_2O_3$, HCl to pH<2, Cool, 4°C	14 days
Purgeable Halocarbons (8260)	S	G, Teflon-Lined Cap	Cool, 4°C, Minimize Headspace	14 days
Purgeable Halocarbons (8260)	S	Method 5035	Terracore/Encore device, Freeze at -20°C Methanol, Cool, 4C	48 hrs to prepare from device, 14 days after preparing.
Purgeable Halocarbons (8260)	S	Method 5035	Sodium Bisulfate Cool, 4°C	48 hrs to prepare, 14 days after preparation
Purgeable Aromatic Hydrocarbons (including BTEX and MTBE 624, 8260)	W	G, Teflon-Lined,Septum Cap, No Headspace	No Residual Chlorine Present: HCl to pH<2, Cool, 4°C, No Headspace	14 days
Purgeable Aromatic Hydrocarbons (including BTEX and MTBE 624, 8260)	W	G, Teflon-Lined,Septum Cap, No Headspace	Residual Chlorine Present: 10% $Na_2S_2O_3$, HCl to pH<2, Cool 4°C	14 days

DETERMINATION[a]	MATRIX[b]	CONTAINER[C]	PRESERVATION	HOLDING TIME
Purgeable Aromatic Hydrocarbons (including BTEX and MTBE 624, 8260)	S	G, Teflon-Lined Cap	Cool, 4°C, Minimize Headspace	14 days
Purgeable Aromatic Hydrocarbons (including BTEX and MTBE 624, 8260)	S	Method 5035	Encore, Freeze at -20°C Methanol, Cool, 4C	48 hr to prepare from Encore, 14 days after preparation.
Purgeable Aromatic Hydrocarbons (including BTEX and MTBE 624, 8260)	S	Method 5035	Sodium Bisulfate, Cool, 4°C	48 hr to prepare from Encore, 14 days after preparation
Acrolein, Acrylonitrile, Acetonitrile (624, 8260)	W	G, Teflon - Lined Septum Cap	Adjust pH to 4-5, Cool, 4°C, No headspace	14 days
2-chloroethyl vinyl ether (8260)	W	G, Teflon - Lined Septum Cap	Cool, 4°C, Minimize Headspace	7 days
Semivolatile Organics				
Nonylphenols	W	G, Teflon-Lined Cap	H_2SO_4 to pH<2, Cool, 4°C	28 days until extraction;40 days after extraction
Organotins (ALS SOP)	W, S	G, Teflon-Lined Cap	Cool, 4°C	7[f] days until extraction;40 days after extraction
Otto Fuel		G, Teflon-Lined Cap	Cool, 4°C	7[f] days until extraction;40 days after extraction
Methanol in Process Liquid NCASI 94.03	L	G, Teflon-Lined Cap	Cool, 4°C	30 days
HAPS - Condensates NCASI 99.01		G, Teflon-Lined Cap	Cool, 4°C	14/30 days
HAPS - Impinger/Canisters NCASI 99.02			Cool, 4°C	21 days
Perfluorinated Compounds HPLC/MS/MS	W	P	Cool, 4°C	14 days until extraction; 40 days after extraction
PBDE/PBB - ROHS GC/MS	W, S, T	G	Cool, 4°C	40 days after extraction

DETERMINATION[a]	MATRIX[b]	CONTAINER[c]	PRESERVATION	HOLDING TIME
Pharma Personal Care Products (EPA 1694)	W, S	Amber G, Teflon-Lined Cap	Cool, < 6°C	7[f] days until extraction; 30 days after extraction
Nitroaromatics and Nitramines (EPA 8330B)	W, S	G, Teflon-Lined Cap	Cool, 4°C	7[f] days until extraction; 40 days after extraction
Nitroaromatics/Nitroamines HPLC/MS/MS	W, S, T	G	Cool, 4°C Tissues < -10 C	7[f] days until extraction; 40 days after extraction
Organic acids HPLC/MS/MS	W	G, Teflon-Lined, Septum Cap	H_2SO_4 to pH<2, Cool, 4°C	14 days
Petroleum Hydrocarbons, Extractable (Diesel-Range Organics) (EPA 8015)	W, S	G, Teflon-Lined Cap	Cool, 4°C	7[f] days until extraction, 40 days after extraction
Alcohols and Glycols (EPA 8015)	W, S	G, Teflon-Lined Cap	Cool, 4°C[g]	7[f] days until extraction; 40 days after extraction
Acid Extractable Semivolatile Organics (EPA 625, 8270)	W	G, Teflon-Lined Cap	Cool, 4°C[g]	7[f] days until extraction; 40 days after extraction
Base/Neutral Extractable Semivolatile Organics (EPA 625, 8270)	W	G, Teflon-Lined Cap	Cool, 4°C[g]	7[f] days until extraction; 40 days after extraction
Acid Extractable Semivolatile Organics (EPA 8270)	S	G, Teflon-Lined Cap	Cool, 4°C[g]	14 days until extraction; 40 days after extraction
Base/Neutral Extractable Semivolatile Organics (EPA 8270)	S	G, Teflon-Lined Cap	Cool, 4°C[g]	14 days until extraction; 40 days after extraction
Chlorinated Herbicides (EPA 8151)	W, S	G, Teflon-Lined Cap	Cool, 4°C[g]	7[f] days until extraction; 40 days after extraction
Chlorinated Phenolics (EPA 1653)	W	G, Teflon-Lined Cap	H_2SO_4 to pH<2, Cool, 4°C[g]	30 days until extraction; 30 days after extraction

DETERMINATION[a]	MATRIX[b]	CONTAINER[C]	PRESERVATION	HOLDING TIME
Polynuclear Aromatic Hydrocarbons (EPA 625, 8270)	W, S	G, Teflon-Lined Cap	Cool, 4°C, Store in Dark[g]	7[f] days until extraction; 40 days after extraction
Organochlorine Pesticides and PCBs (EPA 608, 8081, 8082, GC/MS/MS)	W, S	G, Teflon-Lined Cap	Cool, 4°C	7[f] days until extraction; 40 days after extraction
Organophosphorus Pesticides (EPA 8141, GC/MS/MS)	W, S	G, Teflon-Lined Cap	Cool, 4°C, Store in Dark[g]	7[f] days until extraction; 40 days after extraction
Nitrogen- and Phosphorus-Containing Pesticides (EPA 8141)	W,S	G, Teflon-Lined Cap	Cool, 4°C[g]	7[f] days until extraction; 40 days after extraction
Drinking Water Organics				
Purgeable Organics (EPA 524.2)	DW	G, Teflon-Lined, Septum cap	Ascorbic Acid, HCl to pH≤2, Cool, 4°C, No Headspace	14 days
EDB, DBCP, and TCP (EPA 504.1)	W	G, Teflon-Lined Cap	Cool, 4°C, 3 mg $Na_2S_2O_3$, No Headspace	14 days
Chlorinated Herbicides (EPA 515.4)	DW	G, Amber, Teflon-Lined Cap	If Res.Cl, 2mg/40 mL NaS; Cool , <6°C	14 days until extraction; 21 days after extraction
Chlorinated Pesticides (EPA 508.1, 525.2)	DW	G, Amber, Teflon-Lined Cap	50 mg/L NaS, HCl to pH≤ 2;Cool 4°C	14 days until extraction; 30 days after extraction
Diquat and Paraquat (EPA 549.2)	DW	G, Amber, Teflon-Lined Cap	100 mg/L $Na_2S_2O_3$, Res.Cl.Cool 4°C	7 days until extraction; 21 days after extraction
Endothall (EPA 548.1)	DW	G, Amber, Teflon-Lined Cap	Cool, 4°C	7 days until extraction; 14 days after extraction
Haloacetic Acids (EPA 552.2)	DW	G, Amber, Teflon-Lined Cap	100 mg/L NH_4Cl, Cool, 4°C	14 days until extraction; 7 days after extraction
Semivolatile Organics (EPA 525.2)	DW	G, Amber, Teflon-Lined Cap	50 mg/L NaS, HCl to pH≤ 2;Cool, 4°C	14 days until extraction; 30 days after extraction

DETERMINATION[a]	MATRIX[b]	CONTAINER[c]	PRESERVATION	HOLDING TIME
Nitrosoamines (EPA 521)	DW	G, Amber, Teflon-Lined Cap	Dechlorinate at collection[g]	14 days until extraction; 28 days after extraction
Selected Pesticides and Flame Retardants (EPA 527)	DW	G, Amber, Teflon-Lined Cap	See Method, Cool, 4°C	14 days until extraction; 28 days after extraction
Toxicity Characteristic Leaching Procedure (TCLP)				
Semivolatile Organics (EPA 1311/8270)	HW	G, Teflon - Lined Cap	Sample: Cool, 4°C, Store in dark[g]	14 days until TCLP extraction
			TCLP extract: Cool, 4°C, Store in dark[g]	7 days until extraction; 40 days after extraction
Organochlorine Pesticides (EPA 1311/8081)	HW	G, Teflon Lined Cap	Sample: Cool, 4°C	14 days until TCLP extraction
			TCLP extract: Cool, 4°C	7 days until extraction;40 days after extraction
Chlorinated Herbicides (EPA 1311/8151)	HW	G, Teflon Lined Cap	Sample: Cool, 4°C	14 days until TCLP extraction
			TCLP extract: Cool, 4°C	7 days until extraction;40 days after extraction
Mercury(EPA 1311/7470)	HW	P,G	Sample: Cool, 4°C	28 days until extraction
			TCLP extract: HNO_3 to pH<2	28 days after extraction
Metals, except Mercury (EPA 1311/6010)	HW	P,G	Sample: Cool, 4°C	180 days until extraction;
			TCLP extract: HNO_3 to pH<2	14 days until TCLP extraction
Volatile Organics (EPA 1311/8260)	HW	G, Teflon Lined Cap	Sample: Cool, 4°C , Minimize Headspace	14 days until TCLP extraction
			Extract: Cool 4°C, HCL to pH,2, No Headspace	14 days after extraction

a For EPA SW-846 methods the method listed generically, without specific revision suffixes
b DW = Drinking Water, W = Water; S = Soil or Sediment; HW = Hazardous Waste
c P = Polyethylene; G = Glass, F- Fluoropolymer
d For chlorinated water samples
e The maximum holding time dependent upon the geographical proximity of sample source to the lab.
f Fourteen days until extraction for soil, sediment, and sludge samples.
g If the water sample contains residual chlorine, 10% sodium thiosulfate is used to dechlorinate.

APPENDIX G – Standard Operating Procedures

Corporate General and Quality Assurance SOPs

SOP TITLE	SOP ID	Revision
Laboratory Ethics and Data Integrity	CE-GEN001	3.00
(proprietary- client specific)	CE-GEN002	1.00
Records Management Policy	CE-GEN003	2.00
Preventive Action	CE-GEN004	1.00
Document Control	CE-GEN005	2.00
Data Recall	CE-GEN006	2.00
Procurement and Control of Laboratory Services and Supplies	CE-GEN007	2.00
Method Development	CE-GEN008	1.00
Establishing Standard Operating Procedures	CE-GEN009	2.00
Handling Customer Feedback	CE-GEN010	1.00
Assigning and TSR to a Project	CE-GEN011	0.00
Policy for the Use of Accreditation Organization Names, Symbols, and Logos	CE-GEN012	1.00
(proprietary – client specific)	CE-GEN013	0.00
(proprietary- client specific)	CE-GEN014	0.00
Internal Audits	CE-QA001	2.00
Manual Integration Policy	CE-QA002	2.00
Training Policy	CE-QA003	2.00
Qualification of Subcontract Laboratories	CE-QA004	1.00
Laboratory Management Review	CE-QA005	2.00
Proficiency Testing Sample Analysis	CE-QA006	2.00
Making Entries onto Analytical Records	CE-QA007	2.00
Nonconformance and Corrective Action	CE-QA008	2.00
Control Limits	CE-QA009	1.00
Estimation of Uncertainty of Analytical Measurements	CE-QA010	1.00
Performing Method Detection Limit Studies and Establishing Limits of Detection and Quantitation	CE-QA011	1.00
Quality of Reagents and Standards	CE-QA012	1.00

LABORATORY SOPs

SOP TITLE	SOP ID	Revision
DATA ARCHIVING	ADM-ARCH	6
DOCUMENTING LABORATORY BALANCE AND TEMPERATURE CHECKS	ADM-BAL	7
SAMPLE BATCHES	ADM-BATCH	10
CONTROL CHARTING QUALITY CONTROL DATA	ADM-CHRT	3
DEPARTMENT OF DEFENSE PROJECTS LABORATORY PRACTICES AND PROJECT MANAGEMENT	ADM-DOD	6
DEPARTMENT OF DEFENSE PROJECTS LABORATORY PRACTICES AND PROJECT MANAGEMENT – QSM 5.0	ADM-DOD5	0
LABORATORY DATA REVIEW PROCESS	ADM-DREV	8
CONTINGENCY PLAN FOR LABORATORY EQUIPMENT FAILURE	ADM-ECP	3
METHOD VALIDATION DOCUMENTATION	ADM-MDLC	4
MANUAL INTEGRATION OF CHROMATOGRAPHIC PEAKS	ADM-MI	0
PROJECT MANAGEMENT	ADM-PCM	12
DATA REPORTING AND REPORT GENERATION	ADM-RG	9
REAGENT AND STANDARDS LOGIN AND TRACKING	ADM-RLT	5
SUPPORT EQUIPMENT MONITORING AND CALIBRATION	ADM-SEMC	13
SIGNIFICANT FIGURES	ADM-SIGFIG	8
SOFTWARE QUALITY ASSURANCE AND DATA SECURITY	ADM-SWQADATA	0
ALS KELSO TRAINING PROCEDURE	ADM-TRAIN	2
CHECKING VOLUMETRIC LABWARE	ADM-VOLWARE	4
COLIFORM, FECAL	BIO-9221FC	9
COLIFORM, TOTAL	BIO-9221TC	6
COLIFORM, TOTAL (MEMBRANE FILTER PROCEDURE)	BIO-9222B	0
COLIFORM, FECAL (MEMBRANE FILTER PROCEDURE)	BIO-9222D	4
COLILERT® , COLILERT-18®, & COLISURE®	BIO-9223	9
ENTEROLERT	BIO-ENT	2
HEPTEROTROPHIC PLATE COUNT	BIO-HPC	7
MICROBIOLOGY QUALITY ASSURANCE AND QUALITY CONTROL	BIO-QAQC	16
SHEEN SCREEN/OIL DEGRADING MICROORGANISMS	BIO-SHEEN	3

SOP TITLE	SOP ID	Revision
SEPARATORY FUNNEL LIQUID-LIQUID EXTRACTION	EXT-3510	11
CONTINUOUS LIQUID - LIQUID EXTRACTION	EXT-3520	16
SOLID PHASE EXTRACTION	EXT-3535	7
SOXHLET EXTRACTION	EXT-3540	11
AUTOMATED SOXHLET EXTRACTION	EXT-3541	10
ULTRASONIC EXTRACTION	EXT-3550	11
WASTE DILUTION EXTRACTION	EXT-3580	7
SILICA GEL CLEANUP	EXT-3630	5
GEL PERMEATION CHROMATOGRAPHY	EXT-3640A	9
REMOVAL OF SULFUR USING COPPER	EXT-3660	7
REMOVAL OF SULFUR USING MERCURY	EXT-3660M	4
SULFURIC ACID CLEANUP	EXT-3665	6
CARBON CLEANUP	EXT-CARCU	4
DIAZOMETHANE PREPARATION	EXT-DIAZ	7
FLORISIL CLEANUP	EXT-FLOR	6
ORGANIC EXTRACTIONS GLASSWARE CLEANING	EXT-GC	7
PERCENT LIPIDS IN TISSUE	EXT-LIPID	5
EXTRACTION METHOD FOR ORGANOTINS IN SEDIMENTS, WATER, AND TISSUE	EXT-OSWT	8
PREPARATION OF REAGENTS AND BLANK MATRICES USED IN SEMIVOLATILE ORGANICS ANALYSIS	EXT-REAG	3
ADDITION OF SPIKES AND SURROGATES	EXT-SAS	10
MEASURING SAMPLE WEIGHTS AND VOLUMES FOR ORGANIC ANALYSIS	EXT-WVOL	4
FACILITY AND LABORATORY CLEANING	FAC-CLEAN	2
OPERATION AND MAINTENANCE OF LABORATORY REAGENT WATER SYSTEMS	FAC-WATER	2
FLASHPOINT DETERMINATION - SETAFLASH	GEN-1020	8
COLOR	GEN-110.2	7
TOTAL SOLIDS	GEN-160.3	14
SOLIDS, TOTAL VOLATILE AND PERCENT ASH IN SOIL AND SOLID SAMPLES	GEN-160.4	8
SETTEABLE SOLIDS	GEN-160.5	5

SOP TITLE	SOP ID	Revision
HALIDES, ADSORBABLE ORGANIC (AOX)	GEN-1650	4
GRAVIMETRIC DETERMINATION OF HEXANE EXTRACTABLE MATERIAL (1664)	GEN-1664	10
ALKALINITY TOTAL	GEN-2320	9
HARDNESS, TOTAL	GEN-2340	10
DETERMINATION OF INORGANIC ANIONS IN DRINKING WATER BY ION CHROMATOGRAPHY	GEN-300.1	8
ACIDITY	GEN-305.2	5
PERCHLORATE BY ION CHROMATOGRAPHY	GEN-314.0	14
CHLORIDE (TITRIMETRIC, MERCURIC NITRATE)	GEN-325.3	5
CHLORINE, TOTAL/FREE RESIDUAL	GEN-330.4	3
TOTAL RESIDUAL CHLORINE - METHOD 330.5	GEN-330.5	2
AMMONIA BY FLOW INJECTION ANALYSIS	GEN-350.1	12
NITRATE/NITRITE, NITRITE BY FLOW INJECTION ANALYSIS	GEN-353.2	10
PHOSPHORUS DETERMINATION USING COLORMETRIC PROCEDURE	GEN-365.3	13
PHENOLICS, TOTAL	GEN-420.1	15
AMMONIA AS NITROGEN BY ION SPECIFIC ELECTRODE	GEN-4500 NH3 E	7
DISSOLVED SILICA	GEN-4500 SIO2C	3
SILICA DETERMINATION USING SMARTCHEM METHOD	GEN-4500 SiO2E	2
NITRITE BY COLORIMETRIC PROCEDURE	GEN-4500NO2 B	3
ORTHOPHOSPHATE DETERMINATION USING COLORIMETRIC PROCEDURE	GEN-4500-P-E	2
SULFIDE, METHYLENE BLUE	GEN-4500S2D	3
SULFIDE, TITRIMETRIC (IODINE)	GEN-4500S2F	3
HALOGENS TOTAL AS CHLORIDE BY BOMB COMBUSTION	GEN-5050	3
BIOCHEMICAL OXYGEN DEMAND	GEN-5210B	6
HALIDES, ADSORBABLE ORGANIC (AOX) - SM 5320B	GEN-5320B	3
AQUATIC HUMIC SUBSTANCES	GEN-5510B	1
DETERMINATION OF METHYLENE BLUE ACTIVE SUBSTANCES (MBAS)	GEN-5540C	7
TANNIN AND LIGNIN	GEN-5550	6
HALIDES, TOTAL ORGANIC (TOX)	GEN-9020	9

SOP TITLE	SOP ID	Revision
HALIDES, EXTRACTABLE ORGANIC (EOX)	GEN-9020M	4
TOTAL SULFIDES BY METHYLENE BLUE DETERMINATION	GEN-9030	10
TOTAL CARBON IN SOIL	GEN-ASTM	9
SULFIDES, ACIDS VOLATILE	GEN-AVS	7
HEAT OF COMBUSTION	GEN-BTU	5
CHLOROPHYLL-a BY COLORIMETRY	GEN-CHLOR	3
TOTAL CYANIDES AND CYANIDES AMENABLE TO CHLORINATION	GEN-CN	19
CYANIDE, WEAK ACID DISSOCIABLE	GEN-CNWAD	2
CHEMICAL OXYGEN DEMAND	GEN-COD	9
CONDUCTIVITY IN WATER AND WASTES	GEN-COND	10
CORROSIVITY TOWARDS STEEL	GEN-CORR	2
HEXAVALENT CHROMIUM - COLORIMETRIC	GEN-CR6	13
STANDARD TEST METHODS FOR DETERMINING SEDIMENT CONCENTRATION IN WATER SAMPLES	GEN-D3977	2
CARBONATE (CO3) BY EVOLUTION AND COLUMETRIC TITRATION	GEN-D513-82M	2
SULFIDE, SOLUBLE DETERMINATION OF SOLUBLE SULFIDE IN SEDIMENT	GEN-DIS.S2	3
BULK DENSITY OF SOLID WASTE FRACTIONS	GEN-E1109	1
FREE CYANIDE IN WATER, WASTEWATER, AND SOIL BY MICRODIFFUSION	GEN-FCN	0
FDA EXTRACTABLES	GEN-FDAEX	2
FERROUS IRON IN WATER	GEN-FeII	5
FLUORIDE BY ION SELECTIVE ELECTRODE	GEN-FISE	9
FORMALDEHYDE COLORIMETRIC DETERMINATION	GEN-FORM	3
HYDROGEN PEROXIDE BY PERMANGANATE TITRATION	GEN-H2O2	3
HYDROGEN HALIDES BY ION CHROMATOGTRAPHY (METHOD 26)	GEN-HA26	4
HYDAZINE IN WATER USING COLORIMETRIC PROCEDURE	GEN-HYD	2
TOTAL SULFUR FOR ION CHROMATOGRAPHY	GEN-ICS	3
ION CHROMATOGRAPHY	GEN-IONC	17
COLOR, NCASI	GEN-NCAS	4
NITROCELLULOSE IN SOIL	GEN-NCEL	1

SOP TITLE	SOP ID	Revision
OXYGEN CONSUMPTION RATE	GEN-O2RATE	1
CARBON, TOTAL ORGANIC DETERMINATION (WALKELY BLACK METHOD)	GEN-OSU	3
Ph IN SOIL AND SOLIDS	GEN-pHS	14
Ph IN WATER	GEN-pHW	14
PARTICLE SIZE DETERMINATION - ASTM PROCEDURE	GEN-PSASTM	3
PARTICLE SIZE DETERMINATION	GEN-PSP	8
SULFIDES, REACTIVE	GEN-RS	5
TOTAL SULFIDE BY PSEP	GEN-S2PS	2
SULFITE	GEN-SO3	3
SPECIFIC GRAVITY	GEN-SPGRAV	2
SUBSAMPLING AND COMPOSITING OF SAMPLES	GEN-SUBS	6
SOLIDS, TOTAL DISSOLVED (TDS)	GEN-TDS	12
THIOCYANATE	GEN-THIOCN	2
NITROGEN, TOTAL AND SOLUBLE KJELDAHL	GEN-TKN	15
TOTAL NITROGEN AND TOTAL PHOSPHORUS BY ALKALINE PERSULFATE DIGESTION NCASI METHOD TNTP-W10900	GEN-TNTP	1
TOTAL ORGANIC CARBON IN WATER	GEN-TOC	14
SOLIDS, TOTAL SUSPENDED (TSS)	GEN-TSS	12
TURBIDITY MEASUREMENT	GEN-TURB	7
GLASSWASHING FOR INORGANIC ANALYSES	GEN-WASH	5
PHARMACEUTICALS, PERSONAL CARE PRODUCTS AND ENDOCRINE DISRUPTING COMPOUNDS BY HPLC/TANDEM MASS SPECTROMETRY (HPLC/MS/MS)	LCP-1694	5
DETERMINATION OF SELECTED PERFLUORINATED ALKYL ACIDS IN DRINKING WATER BY SOLID PHASE EXTRACTION AND TANDEM (LC/MS/MS)	LCP-537	3
DETERMINATION OF HORMONES IN DRINKING WATER BY SOLID PHASE EXTRACTION AND LIQUID CHROMATOGRAPHY ELECTROSPRAY IONIZATION	LCP-539	3
PERCHLORATE IN WATER, SOILS, AND SOLID WASTE USING LIQUID CHROMATOGRAPHY TANDEM MASS SPECTROMETRY (LC/MS/MS)	LCP-6850	0
ALDEHYDES BY HPLC	LCP-8315	7
Quantitative Determination of Carbamate Pesticides in Solid Matrices by High Performance Liquid Chromatography/Tandem Mass Spectrometry (HPLC/MS/MS)	LCP-8321(S)	1
Determination of Carbamates in Water by EPA 8321 Using LC Tandem Mass Spectrometry	LCP-8321W	2
NITROAROMATICS AND NITRAMINES BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY(HPLC)	LCP-8330B	5
Acrylamide by High Performance Liquid Chromatography/tandem mass spectrometry (HPLC/MS/MS)	LCP-ACRYL	2

SOP TITLE	SOP ID	Revision
Dioctyl sulfosuccinate by High Performance Liquid Chromatography/tandem mass spectrometry (HPLC/MS/MS)	LCP-DOS	5
QUANTITATION OF NITROAROMATICS AND NITRAMINES IN WATER, SOIL, AND TISSUE BY LIQUID CHROMATOGRAPHY AND TANDEM MASS SPECTROMETRY (LC-MS/MS)	LCP-LCMS4	3
NITROGUANIDINE BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY	LCP-NITG	7
QUANTITATION OF NITROPHENOLS IN SOILS BY LIQUID CHROMATOGRAPHYAND TANDEM MASS SPECTROMETRY (LC/MS/MS)	LCP-NITRO	3
ORGANIC ACIDS IN AQUEOUS MATRICES BY HPLC	LCP-OALC	5
QUANTITATIVE DETERMINATION OF OPTICAL BRIGHTENER 220 By High Performance Liquid Chromatography (HPLC)	LCP-OPBr	1
OXYANIONS IN WATER USING LIQUID CHROMATOGRAPHY TANDEM MASS SPECTROMETRY (LC/MS/MS)	LCP-OXY	1
PERFLUORINATED COMPOUNDS BY HPLC/MS/MS	LCP-PFC	6
DETERMINATION OF PHTHALATES IN FOOD BY LIQUID CHROMATOGRAPHY TANDEM MASS SPECTROMETRY (LC/MS/MS)	LCP-PHT	1
PICRIC ACID AND PICRAMIC ACID BY HPLC	LCP-PICRIC	3
METHYL MERCURY IN SOIL AND SEDIMENT BY ATOMIC FLUORESCENCE SPECTROMETRY	MET-1630S	3
METHYL MERCURY IN TISSUE BY ALCOHOLIC POTASSIUM HYDROXIDE DIGESTION, ETHYLATION, PURGE AND TRAP, AND COLD VAPOR ATOMIC FLUORESCENCE	MET-1630T	2
METHYL MERCURY IN WATER BY ATOMIC FLUORESCENCE SPECTROMETRY	MET-1630W	3
MERCURY IN WATER BY OXIDATION, PURGE&TRAP, AND COLD VAPOR ATOMIC FLUORES. SPECTROMETRY	MET-1631	14
DETERMINATION OF ARSENIC SPECIES BY HYDRIDE GENERATION CRYOGENIC TRAPPING GAS CHROMATOGRAPHY ATOMIC ABSORPTION SPECTROPHOTOMETRY	MET-1632	3
MERCURY IN WATER	MET-245.1	14
METALS DIGESTION	MET-3010A	13
METALS DIGESTION	MET-3020A	16
METALS DIGESTION	MET-3050B	15
CLOSED VESSEL OIL DIGESTION	MET-3051M	4
CLOSED VESSEL DIGESTION OF SILICEOUS AND ORGANICALLY BASED MATRICIES	MET-3052M	2
DETERMINATION OF METALS & TRACE ELEMENTS BY INDUCTIVELY COUPLED PLASMA-MS (METHOD 6020)	MET-6020	17
ARSENIC BY BOROHYDRIDE REDUCTION ATOMIC ABSORPTION	MET-7062	4
METALS DIGESTION FOR HEXAVALENT CHROMIUM	MET-7195	10
MERCURY IN LIQUID WASTE	MET-7470A	16
MERCURY IN SOLID OR SEMISOLID WASTE	MET-7471	17
SELENIUM BY BOROHYDRIDE REDUCTION ATOMIC ABSORPTION	MET-7742	4
AUTOFLUFF	MET-AUTOFLU	3

SOP TITLE	SOP ID	Revision
BIOACCESSIBILITY OF METALS IN SOIL AND SOLID WASTE	MET-BIOACC	2
METALS DIGESTION OF AQUEOUS SAMPLES	MET-DIG	16
SAMPLE FILTRATION FOR METALS ANALYSIS	MET-FILT	4
METALS LABORATORY GLASSWARE CLEANING	MET-GC	6
DETERMINATION OF TRACE METALS BY GRAPHITE FURNACE ATOMIC ABSORPTION SPECTROMETRY (GFAA)	MET-GFAA	21
DETERMINATION OF METALS AND TRACE ELEMENTS BY ICP/AES	MET-ICP	26
DETERMINATION OF METALS & TRACE ELEMENTS BY INDUCTIVELY COUPLED PLASMA-MS (METHOD 200.8)	MET-ICPMS	17
TRACE METALS IN WATER BY PRECONCENTRATION USING REDUCTIVE PRECIPITATION FOLLOWED BY ICP-MS	MET-RPMS	8.1
METALS AND SEMIVOLATILES SPLP EXTRACTION (EPA METHOD 1312)	MET-SPLP	2
WASTE EXTRACTION TEST (WET) PROCEDURE (STLC) for NONVOLATILE and SEMIVOLATILE PARAMETERS	MET-STLC	3
METALS AND SEMIVOLATILES TCLP EXTRACTION (EPA METHOD 1311)	MET-TCLP	9
SAMPLE PREPARATION OF BIOLOGICAL TISSUES FOR METALS ANALYSIS BY GFAA, ICP-OES, AND ICP-MS	MET-TDIG	5
TISSUE SAMPLE PREPARATION	MET-TISP	10
ANALYSIS OF WATER AND SOLID SAMPLES FOR ALIPHATIC HYDROCARBONS	PET-ALIPHAT	2
ANALYSIS OF WATER, SOLIDS AND SOLUBLE WASTE SAMPLES FOR SEMI-VOLATILE FUEL HYDROCARBONS	PET-SVF	14
ANALYSIS OF WATER AND SOLIDS SAMPLES FOR TOTAL PETROLEUM HYDROCARBONS	PET-TPH	2
ANALYSIS OF SOLID AND AQUEOUS SAMPLES FOR STATE OF WISCONSIN DIESEL RANGE ORGANICS	PHC-WIDRO	5
GC-FID IMPURITIES IN METHYLSULFONYLMETHANE (MSM)	PHM-MSM	5
ASSAY FOR METHYLSULFONYLMETHANE (MSM)	PHM-MSMAssay	0
OPERATION, CALIBRATION, AND MAINTENANCE OF THE METTLER TOLEDO DL38 TITRATOR	PHM-KF	5
OPERATION, CALIBRATION, AND MAINTENANCE OF THE STANFORD RESEARCH SYSTEMS MPA100 OPTIMELT AUTOMATED MELTING POINT SYSTEM	PHM-MP	6
BOTTLE ORDER PREPARATION AND SHIPPING	SMO-BORD	17
SAMPLE DISPOSAL	SMO-DISP	12
FOREIGN SOILS HANDLING TREATMENT	SMO-FSHT	11
SAMPLE RECEIVING	SMO-GEN	33
SAMPLE TRACKING AND INTERNAL CHAIN OF CUSTODY	SMO-SCOC	15
ORGANOCHLORINE PESTICIDES AND PCBs (METHOD 608)	SOC-608	8
1,2-DIBROMOETHANE (EDB) AND 1,2-DIBROMO-3-CHLORO-PROPANE (DBCP) IN AQUEOUS SAMPLES BY MICROEXTRACTION AND GAS CHROMATOGRAPHY	SOC-8011	1

SOP TITLE	SOP ID	Revision
1,2-DIBROMOETHANE (EDB) AND 1,2-DIBROMO-3-CHLORO-PROPANE (DBCP) IN SOLIDS BY MICROEXTRACTION AND GAS CHROMATOGRAPHY	SOC-8011S	1
GLYCOLS	SOC-8015	12
ORGANOCHLORINE PESTICIDES BY GAS CHROMATOGRAPHY: CAPILLARY COLUMN TECHNIQUE	SOC-8081	19
PCBS AS AROCLORS	SOC-8082Ar	17
CONGENER-SPECIFIC DETERMINATION OF PCBS BY GC/ECD	SOC-8082Co	14
DETERMINATION OF NITROGEN OR PHOSPHORUS CONTAINING PESTICIDES	SOC-8141	14
CHLORINATED HERBICIDES	SOC-8151	16
CHLORINATED PHENOLS METHOD 8151 MODIFIED	SOC-8151M	11
METHANOL IN PROCESS LIQUIDS AND STATIONARY SOURCE EMISSIONS	SOC-9403	9
HAZARDOUS AIR POLLUTANTS (HAPS) IN PULP AND PAPER INDUSTRY CONDENSATES	SOC-9901	6
HAPS AND OTHER COMPOUNDS IN IMPINGER/CANISTER SAMPLES FROM WOOD PRODUCTS FACILITIES	SOC-9902	5
ALCOHOLS	SOC-ALC	3
BUTYLTINS	SOC-BUTYL	13
CALIBRATION OF INSTRUMENTS FOR ORGANICS CHROMATOGRAPHIC ANALYSES	SOC-CAL	9
CONFIRMATION PROCEDURE FOR GC AND HPLC ANALYSES	SOC-CONF	7
DETERMINATION OF OTTO FUEL II IN WATER	SOC-OTTO	2
PREPARATION OF POLYETHYLENE (PE) PASSIVE SAMPLERS WITH PERFORMANCE REFERENCE COMPOUNDS (PRC) LOADING	SOC-PE/PRC	0
SEMI-VOLATILE ORGANICS SCREENING	SOC-SCR	5
1,2-DIBROMOETHANE, 1,2-DIBROMO-3-CHLOROPROPANE, AND 1,2,3-TCP BY GC	SVD-504	11
ORGANOCHLORINE PESTICIDES AND PCBS IN DRINKING WATER	SVD-508_1	9
CHLORINATED HEBICIDES IN DRINKING WATER	SVD-515.4	10
N-NITROSAMINES BY GC/MS/MS	SVD-521	7
SEMIVOLATILE ORGANIC COMPOUNDS BY GC/MS (METHOD 525.2)	SVD-525	10
ENDOTHALL IN DRINKING WATER BY GC/MS	SVD-548	11
DIQUAT AND PARAQUAT BY HPLC	SVD-549	8
HALOACETIC ACIDS IN DRINKING WATER	SVD-552	8
CHLORINATED PHENOLICS BY IN-SITU ACETYLATION AND GC/MS	SVM-1653A	10
SEMIVOLATILE ORGANIC COMPOUNDS BY GC/MS	SVM-625	8

SOP TITLE	SOP ID	Revision
SEMIVOLATILE ORGANIC COMPOUNDS BY GC/MS - METHOD 8270D	SVM-8270D	5
SEMIVOLATILE ORGANIC COMPOUNDS BY GC/MS - LOW LEVEL PROCEDURE	SVM-8270L	10
POLYNUCLEAR AROMATIC HYDROCARBONS BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY SIM	SVM-8270P	10
SEMIVOLATILE ORGANIC COMPOUNDS BY GC/MS SELECTED ION MONITORING	SVM-8270S	8
ANTRHAQUINONE IN PAPERBOARD BY GC/MS SELECTED ION MONITORING	SVM-AQ	0
QUANTITATIVE GEOCHEMICAL BIOMARKERS BY GC/MS SELECTIVE ION MONITORING	SVM-BIO	1
OCTAMETHYLCYCLOTETRASILOXANE (D4) IN AQUEOUS SAMPLES BY GC/MS	SVM-D4AQ	1
OCTAMETHYLCYCLOTETRASILOXANE (D4) IN SEDIMENTS AND BIOSOLIDS BY GC/MS	SVM-D4SO	1
OCTAMETHYLCYCLOTETRASILOXANE (D4) IN BIOLOGICAL MATRICES BY GC/MS	SVM-D4TI	1
DIISOPROPYL METHYLPHOSPHONATE BY GC/MS SELECTIVE ION MONITORING	SVM-DIMP	0
NONYLPHENOLS ISOMERS AND NONYLPHENOL ETHOXYLATES	SVM-NONYL	6
ORGANOPHOSPHOROUS PESTICIDES BY GC/MS/MS	SVM-OPPMS2	2
CHLORINATED PESTICIDES BY GC/MS/MS	SVM-PESTMS2	5
POLYBROMINATED DIPHENYL ETHERS (PBDEs) AND POLYBROMINATED BIPHENYLS (PBBs) BY GC/MS	SVM-ROHS	2
1,2,3-TRICHLOROPROPANE BY ISOTOPE DILUTION-GC/MS SIM	SVM-TCP	0
PURGE AND TRAP FOR AQUEOUS SAMPLES	VOC-5030	10
PURGE AND TRAP/EXTRACTION FOR VOC IN SOIL AND WASTE SAMPLES , CLOSED SYSTEM	VOC-5035	11
VOLATILE ORGANIC COMPOUNDS BY GC/MS	VOC-524.2	17
VOLATILE ORGANIC COMPOUNDS IN WATER BY GC/MS SIM	VOC-524.2SIM	0
VOLATILE ORGANIC COMPOUNDS BY GC/MS	VOC-624	13
VOLATILE ORGANIC COMPOUNDS BY GC/MS	VOC-8260	19
VOLATILE ORGANIC COMPOUNDS BY GC/MS SELECTIVE ION MONITORING	VOC-8260S	3
VOA STORAGE BLANKS	VOC-BLAN	10
SAMPLE SCREENING FOR VOLATILE ORGANIC COMPOUNDS IN SOIL, WATER AND MISC. MATRICES	VOC-BVOC	8
GASOLINE RANGE ORGANICS BY GAS CHROMATOGRAPHY	VOC-GRO	11
ZERO HEADSPACE EXTRACTION (EPA METHOD 1311)	VOC-ZHE	8

APPENDIX H – Data Qualifiers

Inorganic Data Qualifiers

*	The result is an outlier. See case narrative.
#	The control limit criteria is not applicable. See case narrative.
B	The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
E	The result is an estimate amount because the value exceeded the instrument calibration range.
J	The result is an estimated value.
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
i	The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
X	See case narrative.
Q	See case narrative. One or more quality control criteria was outside the limits.
H	The holding time for this test is immediately following sample collection. The samples were analyzed as soon as possible after receipt by the laboratory.

Metals Data Qualifiers

#	The control limit criteria is not applicable. See case narrative.
J	The result is an estimated value.
E	The percent difference for the serial dilution was greater than 10%, indicating a possible matrix interference in the sample.
M	The duplicate injection precision was not met.
N	The Matrix Spike sample recovery is not within control limits. See case narrative.
S	The reported value was determined by the Method of Standard Additions (MSA).
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
W	The post-digestion spike for furnace AA analysis is out of control limits, while sample absorbance is less than 50% of spike absorbance.
i	The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
X	See case narrative.
+	The correlation coefficient for the MSA is less than 0.995.
Q	See case narrative. One or more quality control criteria was outside the limits.

Organic Data Qualifiers

*	The result is an outlier. See case narrative.
#	The control limit criteria is not applicable. See case narrative.
A	A tentatively identified compound, a suspected aldol-condensation product.
B	The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
C	The analyte was qualitatively confirmed using GC/MS techniques, pattern recognition, or by comparing to historical data.
D	The reported result is from a dilution.
E	The result is an estimated value.
J	The result is an estimated value.
N	The result is presumptive. The analyte was tentatively identified, but a confirmation analysis was not performed.
P	The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 40% between the two analytical results.
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
i	The MRL/MDL or LOQ/LOD is elevated due to a chromatographic interference.
X	See case narrative.
Q	See case narrative. One or more quality control criteria was outside the limits.

Additional Petroleum Hydrocarbon Specific Qualifiers

F	The chromatographic fingerprint of the sample matches the elution pattern of the calibration standard.
L	The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of lighter molecular weight constituents than the calibration standard.
H	The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of heavier molecular weight constituents than the calibration standard.
O	The chromatographic fingerprint of the sample resembles an oil, but does not match the calibration standard.
Y	The chromatographic fingerprint of the sample resembles a petroleum product eluting in approximately the correct carbon range, but the elution pattern does not match the calibration standard.
Z	The chromatographic fingerprint does not resemble a petroleum product.

APPENDIX I – Controlled and Normative Documents

Internal QA Documents	Location
Quality Assurance Manual	Q:\QA Manual\QAM.rXX.DOC
ALS-Kelso Certifications/Accreditations	Cert_kel.xls (QA Dept.)
MDL/LOD/LOQ Tracking Spreadsheet	MDL_LIST.(*date*).xls
Technical Training Summary Database	TrainDat.mdb
Approved Signatories List	QAM App A
Personnel resumes/qualifications	HR Department
Personnel Job Descriptions	HR Department
ALS – Kelso Data Quality Objectives	Kelso DQO table – mmddyy.xls
Master Logbook of Laboratory Logbooks	QA Masterlog-001
Standard Operating Procedures and Spreadsheet	1_ Kelso SOP.xls
Proficiency Testing Schedule and Tracking Spreadsheet	PT_Schedule.xls
External Normative Documents	**Location**
USEPA Manual for the Certification of Laboratories Analyzing Drinking Water, 5th Edition, EPA 815-B-97-001 (January 2005	QA Department
USEPA 40 CFR Part 136, Guidelines for Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act, and EPA Method Update Rule 2007 and 2012.	QA Department and online access
USEPA 40 CFR Part 141, National Primary Drinking Water Regulations and EPA Method Update Rule 2007.	QA Department and online access
National Environmental Laboratory Accreditation Program (NELAP), 2003 Quality Standards.	QA Department
TNI: TNI Standard – Environmental Laboratory Sector, Volume 1, Management and Technical Requirements for Laboratories Performing Environmental Analysis, EL-V1-2009.	QA Department
Quality Standards. American National Standard General requirements for the competence of testing and calibration laboratories, ANSI/ISO/IEC 17025:2005(E)	QA Department
DoD Quality Systems Manual for Environmental Laboratories, Versions 4.2 and 5.0	QA Department and online access
Analytical Methods (see References section)	Laboratory Departments and Online access

APPENDIX J – Laboratory Accreditations

The list of accreditations, certifications, licenses, and permits existing at the time of this QA Manual revision is given below, followed by the entire primary NELAP and DOD ELAP accreditations (un-numbered attachments). Current accreditation information is available at any time by contacting the laboratory or viewing the ALS Global website www.alsglobal.com.

Program	Number
National Programs	
DoD ELAP	L14-51-R2
ISO 17025	L14-50
State Programs	
Alaska DEC UST	UST-040
Arizona DHS	AZ0339
Arkansas – DEQ	88-0637
California DHS	2795
Florida DOH	E87412
Hawaii DOH	-
Louisiana DEQ	3016
Maine DHS	WA01276
Minnesota DOH	053-999-457
Montana DPHHS	CERT0047
Nevada DEP	WA012762015-3
New Jersey DEP	WA005
New York DoH	12060
North Carolina DWQ	605
Oklahoma DEQ	9801
Oregon – DOH (primary NELAP)	WA100010
South Carolina DHEC	61002
Texas CEQ	T104704427-14-7
Utah	WA012762015-4
Washington DOE	C544
Wyoming (EPA Region8)	-
Miscellaneous	
Foreign Soil Permit	USDA
Plant Import Permit	USDA
Controlled Substances Permit	US DEA
Controlled Substances Permit	WA DOH

END

OF

DOCUMENT

STATE OF LOUISIANA
DEPARTMENT OF ENVIRONMENTAL QUALITY

Is hereby granting a Louisiana Environmental Laboratory Accreditation to

ALS Environmental - Burlington
1435 Norjohn Ct Unit 1
Burlington, Ontario, Canada L7L 0E6

Agency Interest No. 199920
Activity No. ACC20180001

According to the Louisiana Administrative Code, Title 33, Part I, Subpart 3, LABORATORY ACCREDITATION, the State of Louisiana formally recognizes that this laboratory is technically competent to perform the environmental analyses listed on the scope of accreditation detailed in the attachment.

The laboratory agrees to perform all analyses listed on this scope of accreditation according to the Part I, Subpart 3 requirements and agrees to adapt to any changes in the requirements. It also acknowledges that continued accreditation is dependent on successful ongoing compliance with the applicable requirements of Part I and the 2009 TNI standards by which the laboratory was assessed. Please contact the Department of Environmental Quality, Louisiana Environmental Laboratory Accreditation Program (LELAP) to verify the laboratory's scope of accreditation and accreditation status.

Accreditation by the State of Louisiana is not an endorsement or a guarantee of validity of the data generated by the laboratory. Accreditation of the environmental laboratory does not imply that a product, process, system, or person is approved by LELAP. To be accredited initially and maintain accreditation, the laboratory agrees to participate in two single-blind, single-concentration PT studies, where available, per year for each field of testing for which it seeks accreditation or maintains accreditation as required in LAC 33:I.4711.

Cheryl Sonnier Nolan
Administrator
Public Participation and Permit Support Services Division

Issued Date: 22 June 2018

Effective Date: July 1, 2018
Expiration Date: June 30, 2019
Certificate Number: 05064

STATE OF LOUISIANA
DEPARTMENT OF ENVIRONMENTAL QUALITY

ALS Environmental - Burlington
AI Number: 199920
Activity No. ACC20180001
Expiration Date: June 30, 2019

Effective Date: July 1, 2018

1435 Norjohn Ct Unit 1, Burlington, Ontario, Canada L7L 0E6

Certificate Number: 05064

Air Emissions

Analyte	Method Name	Method Code	Type	AB
1005 - Antimony	EPA 0060	10003404	NELAP	LA
1010 - Arsenic	EPA 0060	10003404	NELAP	LA
1015 - Barium	EPA 0060	10003404	NELAP	LA
1020 - Beryllium	EPA 0060	10003404	NELAP	LA
1030 - Cadmium	EPA 0060	10003404	NELAP	LA
1050 - Cobalt	EPA 0060	10003404	NELAP	LA
1055 - Copper	EPA 0060	10003404	NELAP	LA
1075 - Lead	EPA 0060	10003404	NELAP	LA
1090 - Manganese	EPA 0060	10003404	NELAP	LA
1095 - Mercury	EPA 0060	10003404	NELAP	LA
1105 - Nickel	EPA 0060	10003404	NELAP	LA
1140 - Selenium	EPA 0060	10003404	NELAP	LA
1150 - Silver	EPA 0060	10003404	NELAP	LA
1165 - Thallium	EPA 0060	10003404	NELAP	LA
1910 - Total Phosphorus	EPA 0060	10003404	NELAP	LA
1600 - Total chromium	EPA 0060	10003404	NELAP	LA
1190 - Zinc	EPA 0060	10003404	NELAP	LA
100011 - Extraction of Semivolatile Analytes Collected Using Method 0010 (Modified Method 5 Sampling Train)	EPA 3542	10140600	NELAP	LA
3847 - Modified Method 5 Sampling Train	EPA 3542	10140600	NELAP	LA
5160 - 1,1,1-Trichloroethane	EPA 5041A	10154800	NELAP	LA
5110 - 1,1,2,2-Tetrachloroethane	EPA 5041A	10154800	NELAP	LA
5165 - 1,1,2-Trichloroethane	EPA 5041A	10154800	NELAP	LA
4630 - 1,1-Dichloroethane	EPA 5041A	10154800	NELAP	LA
5180 - 1,2,3-Trichloropropane	EPA 5041A	10154800	NELAP	LA
4635 - 1,2-Dichloroethane (Ethylene dichloride)	EPA 5041A	10154800	NELAP	LA
4655 - 1,2-Dichloropropane	EPA 5041A	10154800	NELAP	LA
4410 - 2-Butanone (Methyl ethyl ketone, MEK)	EPA 5041A	10154800	NELAP	LA
4860 - 2-Hexanone	EPA 5041A	10154800	NELAP	LA
4315 - Acetone	EPA 5041A	10154800	NELAP	LA
4375 - Benzene	EPA 5041A	10154800	NELAP	LA
4395 - Bromodichloromethane	EPA 5041A	10154800	NELAP	LA
4400 - Bromoform	EPA 5041A	10154800	NELAP	LA
4450 - Carbon disulfide	EPA 5041A	10154800	NELAP	LA
4455 - Carbon tetrachloride	EPA 5041A	10154800	NELAP	LA
4475 - Chlorobenzene	EPA 5041A	10154800	NELAP	LA
4575 - Chlorodibromomethane	EPA 5041A	10154800	NELAP	LA
4485 - Chloroethane (Ethyl chloride)	EPA 5041A	10154800	NELAP	LA
4505 - Chloroform	EPA 5041A	10154800	NELAP	LA
4595 - Dibromomethane (Methylene bromide)	EPA 5041A	10154800	NELAP	LA
4765 - Ethylbenzene	EPA 5041A	10154800	NELAP	LA
4950 - Methyl bromide (Bromomethane)	EPA 5041A	10154800	NELAP	LA
4960 - Methyl chloride (Chloromethane)	EPA 5041A	10154800	NELAP	LA
4975 - Methylene chloride (Dichloromethane)	EPA 5041A	10154800	NELAP	LA

Air Emissions

Analyte	Method Name	Method Code	Type	AB
5100 - Styrene	EPA 5041A	10154800	NELAP	LA
5115 - Tetrachloroethylene (Perchloroethylene)	EPA 5041A	10154800	NELAP	LA
5140 - Toluene	EPA 5041A	10154800	NELAP	LA
5170 - Trichloroethene (Trichloroethylene)	EPA 5041A	10154800	NELAP	LA
5175 - Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	EPA 5041A	10154800	NELAP	LA
5235 - Vinyl chloride	EPA 5041A	10154800	NELAP	LA
100719 - Volatile Principle Organic Hazardous Constituents	EPA 5041A	10154800	NELAP	LA
4705 - cis & trans-1,2-Dichloroethene	EPA 5041A	10154800	NELAP	LA
4645 - cis-1,2-Dichloroethylene	EPA 5041A	10154800	NELAP	LA
4680 - cis-1,3-Dichloropropene	EPA 5041A	10154800	NELAP	LA
5240 - m+p-xylene	EPA 5041A	10154800	NELAP	LA
5245 - m-Xylene	EPA 5041A	10154800	NELAP	LA
5250 - o-Xylene	EPA 5041A	10154800	NELAP	LA
5255 - p-Xylene	EPA 5041A	10154800	NELAP	LA
4700 - trans-1,2-Dichloroethylene	EPA 5041A	10154800	NELAP	LA
4685 - trans-1,3-Dichloropropylene	EPA 5041A	10154800	NELAP	LA
1095 - Mercury	EPA 7470	10165603	NELAP	LA
1095 - Mercury	EPA 7470A	10165807	NELAP	LA
5160 - 1,1,1-Trichloroethane	EPA 8260B	10184802	NELAP	LA
5110 - 1,1,2,2-Tetrachloroethane	EPA 8260B	10184802	NELAP	LA
5165 - 1,1,2-Trichloroethane	EPA 8260B	10184802	NELAP	LA
4630 - 1,1-Dichloroethane	EPA 8260B	10184802	NELAP	LA
5180 - 1,2,3-Trichloropropane	EPA 8260B	10184802	NELAP	LA
4635 - 1,2-Dichloroethane (Ethylene dichloride)	EPA 8260B	10184802	NELAP	LA
4655 - 1,2-Dichloropropane	EPA 8260B	10184802	NELAP	LA
4410 - 2-Butanone (Methyl ethyl ketone, MEK)	EPA 8260B	10184802	NELAP	LA
4860 - 2-Hexanone	EPA 8260B	10184802	NELAP	LA
4315 - Acetone	EPA 8260B	10184802	NELAP	LA
4375 - Benzene	EPA 8260B	10184802	NELAP	LA
4395 - Bromodichloromethane	EPA 8260B	10184802	NELAP	LA
4400 - Bromoform	EPA 8260B	10184802	NELAP	LA
4450 - Carbon disulfide	EPA 8260B	10184802	NELAP	LA
4455 - Carbon tetrachloride	EPA 8260B	10184802	NELAP	LA
4475 - Chlorobenzene	EPA 8260B	10184802	NELAP	LA
4575 - Chlorodibromomethane	EPA 8260B	10184802	NELAP	LA
4485 - Chloroethane (Ethyl chloride)	EPA 8260B	10184802	NELAP	LA
4505 - Chloroform	EPA 8260B	10184802	NELAP	LA
4595 - Dibromomethane (Methylene bromide)	EPA 8260B	10184802	NELAP	LA
4765 - Ethylbenzene	EPA 8260B	10184802	NELAP	LA
4950 - Methyl bromide (Bromomethane)	EPA 8260B	10184802	NELAP	LA
4960 - Methyl chloride (Chloromethane)	EPA 8260B	10184802	NELAP	LA
4975 - Methylene chloride (Dichloromethane)	EPA 8260B	10184802	NELAP	LA
5100 - Styrene	EPA 8260B	10184802	NELAP	LA
5115 - Tetrachloroethylene (Perchloroethylene)	EPA 8260B	10184802	NELAP	LA
5140 - Toluene	EPA 8260B	10184802	NELAP	LA
5170 - Trichloroethene (Trichloroethylene)	EPA 8260B	10184802	NELAP	LA
5175 - Trichlorofluoromethane	EPA 8260B	10184802	NELAP	LA

Air Emissions

Analyte	Method Name	Method Code	Type	AB
(Fluorotrichloromethane, Freon 11)				
5235 - Vinyl chloride	EPA 8260B	10184802	NELAP	LA
4705 - cis & trans-1,2-Dichloroethene	EPA 8260B	10184802	NELAP	LA
4645 - cis-1,2-Dichloroethylene	EPA 8260B	10184802	NELAP	LA
4680 - cis-1,3-Dichloropropene	EPA 8260B	10184802	NELAP	LA
5240 - m+p-xylene	EPA 8260B	10184802	NELAP	LA
5245 - m-Xylene	EPA 8260B	10184802	NELAP	LA
5250 - o-Xylene	EPA 8260B	10184802	NELAP	LA
5255 - p-Xylene	EPA 8260B	10184802	NELAP	LA
4700 - trans-1,2-Dichloroethylene	EPA 8260B	10184802	NELAP	LA
4685 - trans-1,3-Dichloropropylene	EPA 8260B	10184802	NELAP	LA
6715 - 1,2,4,5-Tetrachlorobenzene	EPA 8270	10185203	NELAP	LA
5155 - 1,2,4-Trichlorobenzene	EPA 8270	10185203	NELAP	LA
4610 - 1,2-Dichlorobenzene	EPA 8270	10185203	NELAP	LA
6885 - 1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8270	10185203	NELAP	LA
4615 - 1,3-Dichlorobenzene	EPA 8270	10185203	NELAP	LA
6160 - 1,3-Dinitrobenzene (1,3-DNB)	EPA 8270	10185203	NELAP	LA
4835 - 1,3-Hexachlorobutadiene	EPA 8270	10185203	NELAP	LA
4620 - 1,4-Dichlorobenzene	EPA 8270	10185203	NELAP	LA
5790 - 1-Chloronaphthalene	EPA 8270	10185203	NELAP	LA
6425 - 1-Naphthylamine	EPA 8270	10185203	NELAP	LA
6735 - 2,3,4,6-Tetrachlorophenol	EPA 8270	10185203	NELAP	LA
6835 - 2,4,5-Trichlorophenol	EPA 8270	10185203	NELAP	LA
6840 - 2,4,6-Trichlorophenol	EPA 8270	10185203	NELAP	LA
6000 - 2,4-Dichlorophenol	EPA 8270	10185203	NELAP	LA
6130 - 2,4-Dimethylphenol	EPA 8270	10185203	NELAP	LA
6175 - 2,4-Dinitrophenol	EPA 8270	10185203	NELAP	LA
6185 - 2,4-Dinitrotoluene (2,4-DNT)	EPA 8270	10185203	NELAP	LA
6005 - 2,6-Dichlorophenol	EPA 8270	10185203	NELAP	LA
6190 - 2,6-Dinitrotoluene (2,6-DNT)	EPA 8270	10185203	NELAP	LA
5515 - 2-Acetylaminofluorene	EPA 8270	10185203	NELAP	LA
5795 - 2-Chloronaphthalene	EPA 8270	10185203	NELAP	LA
5800 - 2-Chlorophenol	EPA 8270	10185203	NELAP	LA
6360 - 2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	EPA 8270	10185203	NELAP	LA
5145 - 2-Methylaniline (o-Toluidine)	EPA 8270	10185203	NELAP	LA
6385 - 2-Methylnaphthalene	EPA 8270	10185203	NELAP	LA
6400 - 2-Methylphenol (o-Cresol)	EPA 8270	10185203	NELAP	LA
6430 - 2-Naphthylamine	EPA 8270	10185203	NELAP	LA
6460 - 2-Nitroaniline	EPA 8270	10185203	NELAP	LA
6490 - 2-Nitrophenol	EPA 8270	10185203	NELAP	LA
6355 - 3-Methylcholanthrene	EPA 8270	10185203	NELAP	LA
6405 - 3-Methylphenol (m-Cresol)	EPA 8270	10185203	NELAP	LA
6465 - 3-Nitroaniline	EPA 8270	10185203	NELAP	LA
5540 - 4-Aminobiphenyl	EPA 8270	10185203	NELAP	LA
5660 - 4-Bromophenyl phenyl ether	EPA 8270	10185203	NELAP	LA
5700 - 4-Chloro-3-methylphenol	EPA 8270	10185203	NELAP	LA
5745 - 4-Chloroaniline	EPA 8270	10185203	NELAP	LA
5825 - 4-Chlorophenyl phenylether	EPA 8270	10185203	NELAP	LA
6410 - 4-Methylphenol (p-Cresol)	EPA 8270	10185203	NELAP	LA
6470 - 4-Nitroaniline	EPA 8270	10185203	NELAP	LA
6500 - 4-Nitrophenol	EPA 8270	10185203	NELAP	LA
6115 - 7,12-Dimethylbenz(a) anthracene	EPA 8270	10185203	NELAP	LA
9417 - 7h-Dibenzo(c,g) carbazole	EPA 8270	10185203	NELAP	LA
5500 - Acenaphthene	EPA 8270	10185203	NELAP	LA

Air Emissions

Analyte	Method Name	Method Code	Type	AB
5505 - Acenaphthylene	EPA 8270	10185203	NELAP	LA
5510 - Acetophenone	EPA 8270	10185203	NELAP	LA
5545 - Aniline	EPA 8270	10185203	NELAP	LA
5555 - Anthracene	EPA 8270	10185203	NELAP	LA
5575 - Benz(a)anthracene	EPA 8270	10185203	NELAP	LA
5580 - Benzo(a)pyrene	EPA 8270	10185203	NELAP	LA
5585 - Benzo(b)fluoranthene	EPA 8270	10185203	NELAP	LA
5590 - Benzo(g,h,i)perylene	EPA 8270	10185203	NELAP	LA
5600 - Benzo(k)fluoranthene	EPA 8270	10185203	NELAP	LA
5630 - Benzyl alcohol	EPA 8270	10185203	NELAP	LA
5670 - Butyl benzyl phthalate	EPA 8270	10185203	NELAP	LA
5855 - Chrysene	EPA 8270	10185203	NELAP	LA
6065 - Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate, DEHP)	EPA 8270	10185203	NELAP	LA
5925 - Di-n-butyl phthalate	EPA 8270	10185203	NELAP	LA
6200 - Di-n-octyl phthalate	EPA 8270	10185203	NELAP	LA
9354 - Dibenz(a, h) acridine	EPA 8270	10185203	NELAP	LA
5900 - Dibenz(a, j)acridine	EPA 8270	10185203	NELAP	LA
5895 - Dibenz(a,h)anthracene	EPA 8270	10185203	NELAP	LA
5890 - Dibenzo(a,e)pyrene	EPA 8270	10185203	NELAP	LA
9348 - Dibenzo(a,h) pyrene	EPA 8270	10185203	NELAP	LA
9351 - Dibenzo(a,i) pyrene	EPA 8270	10185203	NELAP	LA
5905 - Dibenzofuran	EPA 8270	10185203	NELAP	LA
6070 - Diethyl phthalate	EPA 8270	10185203	NELAP	LA
6135 - Dimethyl phthalate	EPA 8270	10185203	NELAP	LA
8620 - Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 8270	10185203	NELAP	LA
6205 - Diphenylamine	EPA 8270	10185203	NELAP	LA
6260 - Ethyl methanesulfonate	EPA 8270	10185203	NELAP	LA
6265 - Fluoranthene	EPA 8270	10185203	NELAP	LA
6270 - Fluorene	EPA 8270	10185203	NELAP	LA
6275 - Hexachlorobenzene	EPA 8270	10185203	NELAP	LA
6285 - Hexachlorocyclopentadiene	EPA 8270	10185203	NELAP	LA
4840 - Hexachloroethane	EPA 8270	10185203	NELAP	LA
6295 - Hexachloropropene	EPA 8270	10185203	NELAP	LA
6315 - Indeno(1,2,3-cd)pyrene	EPA 8270	10185203	NELAP	LA
6320 - Isophorone	EPA 8270	10185203	NELAP	LA
6325 - Isosafrole	EPA 8270	10185203	NELAP	LA
6375 - Methyl methanesulfonate	EPA 8270	10185203	NELAP	LA
5005 - Naphthalene	EPA 8270	10185203	NELAP	LA
6590 - Pentachlorobenzene	EPA 8270	10185203	NELAP	LA
5035 - Pentachloroethane	EPA 8270	10185203	NELAP	LA
6600 - Pentachloronitrobenzene	EPA 8270	10185203	NELAP	LA
6605 - Pentachlorophenol	EPA 8270	10185203	NELAP	LA
6610 - Phenacetin	EPA 8270	10185203	NELAP	LA
6615 - Phenanthrene	EPA 8270	10185203	NELAP	LA
6625 - Phenol	EPA 8270	10185203	NELAP	LA
6665 - Pyrene	EPA 8270	10185203	NELAP	LA
6685 - Safrole	EPA 8270	10185203	NELAP	LA
5760 - bis(2-Chloroethoxy)methane	EPA 8270	10185203	NELAP	LA
5765 - bis(2-Chloroethyl) ether	EPA 8270	10185203	NELAP	LA
5780 - bis(2-Chloroisopropyl) ether	EPA 8270	10185203	NELAP	LA
5025 - n-Nitroso-di-n-butylamine	EPA 8270	10185203	NELAP	LA
6545 - n-Nitrosodi-n-propylamine	EPA 8270	10185203	NELAP	LA
6525 - n-Nitrosodiethylamine	EPA 8270	10185203	NELAP	LA

Air Emissions

Analyte	Method Name	Method Code	Type	AB
6530 - n-Nitrosodimethylamine	EPA 8270	10185203	NELAP	LA
6535 - n-Nitrosodiphenylamine	EPA 8270	10185203	NELAP	LA
6550 - n-Nitrosomethylethylamine	EPA 8270	10185203	NELAP	LA
6555 - n-Nitrosomorpholine	EPA 8270	10185203	NELAP	LA
6560 - n-Nitrosopiperidine	EPA 8270	10185203	NELAP	LA
6565 - n-Nitrosopyrrolidine	EPA 8270	10185203	NELAP	LA
6105 - p-Dimethylaminoazobenzene	EPA 8270	10185203	NELAP	LA
9519 - 1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	EPA 8290	10187209	NELAP	LA
9516 - 1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	EPA 8290	10187209	NELAP	LA
9426 - 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)	EPA 8290	10187209	NELAP	LA
9420 - 1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)	EPA 8290	10187209	NELAP	LA
9423 - 1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)	EPA 8290	10187209	NELAP	LA
9453 - 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd)	EPA 8290	10187209	NELAP	LA
9471 - 1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-Hxcdf)	EPA 8290	10187209	NELAP	LA
9456 - 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin(1,2,3,6,7,8-Hxcdd)	EPA 8290	10187209	NELAP	LA
9474 - 1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf)	EPA 8290	10187209	NELAP	LA
9459 - 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd)	EPA 8290	10187209	NELAP	LA
9477 - 1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf)	EPA 8290	10187209	NELAP	LA
9540 - 1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd)	EPA 8290	10187209	NELAP	LA
9543 - 1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf)	EPA 8290	10187209	NELAP	LA
9480 - 2,3,4,6,7,8-Hexachlorodibenzofuran	EPA 8290	10187209	NELAP	LA
9549 - 2,3,4,7,8-Pentachlorodibenzofuran	EPA 8290	10187209	NELAP	LA
9618 - 2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD)	EPA 8290	10187209	NELAP	LA
9612 - 2,3,7,8-Tetrachlorodibenzofuran	EPA 8290	10187209	NELAP	LA
100489 - Dibenzo-p-dioxins & dibenzofurans	EPA 8290	10187209	NELAP	LA
9438 - Total Hpcdd	EPA 8290	10187209	NELAP	LA
9444 - Total Hpcdf	EPA 8290	10187209	NELAP	LA
9468 - Total Hxcdd	EPA 8290	10187209	NELAP	LA
9483 - Total Hxcdf	EPA 8290	10187209	NELAP	LA
9555 - Total Pecdd	EPA 8290	10187209	NELAP	LA
9552 - Total Pecdf	EPA 8290	10187209	NELAP	LA
9609 - Total TCDD	EPA 8290	10187209	NELAP	LA
9615 - Total TCDF	EPA 8290	10187209	NELAP	LA
9519 - 1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	EPA 8290A	10187403	NELAP	LA
9516 - 1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	EPA 8290A	10187403	NELAP	LA
9426 - 1,2,3,4,6,7,8-Heptachlorodibenzo-p-	EPA 8290A	10187403	NELAP	LA

Air Emissions

Analyte	Method Name	Method Code	Type	AB
dioxin (1,2,3,4,6,7,8-hpcdd)				
9420 - 1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)	EPA 8290A	10187403	NELAP	LA
9423 - 1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)	EPA 8290A	10187403	NELAP	LA
9453 - 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd)	EPA 8290A	10187403	NELAP	LA
9471 - 1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-Hxcdf)	EPA 8290A	10187403	NELAP	LA
9456 - 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin(1,2,3,6,7,8-Hxcdd)	EPA 8290A	10187403	NELAP	LA
9474 - 1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf)	EPA 8290A	10187403	NELAP	LA
9459 - 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd)	EPA 8290A	10187403	NELAP	LA
9477 - 1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf)	EPA 8290A	10187403	NELAP	LA
9540 - 1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd)	EPA 8290A	10187403	NELAP	LA
9543 - 1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf)	EPA 8290A	10187403	NELAP	LA
9480 - 2,3,4,6,7,8-Hexachlorodibenzofuran	EPA 8290A	10187403	NELAP	LA
9549 - 2,3,4,7,8-Pentachlorodibenzofuran	EPA 8290A	10187403	NELAP	LA
9618 - 2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD)	EPA 8290A	10187403	NELAP	LA
9612 - 2,3,7,8-Tetrachlorodibenzofuran	EPA 8290A	10187403	NELAP	LA
100489 - Dibenzo-p-dioxins & dibenzofurans	EPA 8290A	10187403	NELAP	LA
9438 - Total Hpcdd	EPA 8290A	10187403	NELAP	LA
9444 - Total Hpcdf	EPA 8290A	10187403	NELAP	LA
9468 - Total Hxcdd	EPA 8290A	10187403	NELAP	LA
9483 - Total Hxcdf	EPA 8290A	10187403	NELAP	LA
9555 - Total Pecdd	EPA 8290A	10187403	NELAP	LA
9552 - Total Pecdf	EPA 8290A	10187403	NELAP	LA
9609 - Total TCDD	EPA 8290A	10187403	NELAP	LA
9615 - Total TCDF	EPA 8290A	10187403	NELAP	LA
1575 - Chloride	EPA 9057	10199801	NELAP	LA
1515 - Ammonia as N	EPA CTM-027	10214707	NELAP	LA
9519 - 1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	EPA Method 23	10246705	NELAP	LA
9516 - 1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	EPA Method 23	10246705	NELAP	LA
9426 - 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)	EPA Method 23	10246705	NELAP	LA
9420 - 1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)	EPA Method 23	10246705	NELAP	LA
9423 - 1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)	EPA Method 23	10246705	NELAP	LA
9453 - 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd)	EPA Method 23	10246705	NELAP	LA
9471 - 1,2,3,4,7,8-Hexachlorodibenzofuran	EPA Method 23	10246705	NELAP	LA

Air Emissions

Analyte	Method Name	Method Code	Type	AB
(1,2,3,4,7,8-Hxcdf)				
9456 - 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin(1,2,3,6,7,8-Hxcdd)	EPA Method 23	10246705	NELAP	LA
9474 - 1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf)	EPA Method 23	10246705	NELAP	LA
9459 - 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd)	EPA Method 23	10246705	NELAP	LA
9477 - 1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf)	EPA Method 23	10246705	NELAP	LA
9540 - 1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd)	EPA Method 23	10246705	NELAP	LA
9543 - 1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf)	EPA Method 23	10246705	NELAP	LA
9480 - 2,3,4,6,7,8-Hexachlorodibenzofuran	EPA Method 23	10246705	NELAP	LA
9549 - 2,3,4,7,8-Pentachlorodibenzofuran	EPA Method 23	10246705	NELAP	LA
9618 - 2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD)	EPA Method 23	10246705	NELAP	LA
9612 - 2,3,7,8-Tetrachlorodibenzofuran	EPA Method 23	10246705	NELAP	LA
9438 - Total Hpcdd	EPA Method 23	10246705	NELAP	LA
9444 - Total Hpcdf	EPA Method 23	10246705	NELAP	LA
9468 - Total Hxcdd	EPA Method 23	10246705	NELAP	LA
9483 - Total Hxcdf	EPA Method 23	10246705	NELAP	LA
9555 - Total Pecdd	EPA Method 23	10246705	NELAP	LA
9552 - Total Pecdf	EPA Method 23	10246705	NELAP	LA
9609 - Total TCDD	EPA Method 23	10246705	NELAP	LA
9615 - Total TCDF	EPA Method 23	10246705	NELAP	LA
5500 - Acenaphthene	EPA TO-13A	10248405	NELAP	LA
5505 - Acenaphthylene	EPA TO-13A	10248405	NELAP	LA
5555 - Anthracene	EPA TO-13A	10248405	NELAP	LA
5575 - Benz(a)anthracene	EPA TO-13A	10248405	NELAP	LA
5580 - Benzo(a)pyrene	EPA TO-13A	10248405	NELAP	LA
5585 - Benzo(b)fluoranthene	EPA TO-13A	10248405	NELAP	LA
5605 - Benzo(e)pyrene	EPA TO-13A	10248405	NELAP	LA
5590 - Benzo(g,h,i)perylene	EPA TO-13A	10248405	NELAP	LA
5600 - Benzo(k)fluoranthene	EPA TO-13A	10248405	NELAP	LA
5855 - Chrysene	EPA TO-13A	10248405	NELAP	LA
5856 - Coronene	EPA TO-13A	10248405	NELAP	LA
5895 - Dibenz(a,h)anthracene	EPA TO-13A	10248405	NELAP	LA
6265 - Fluoranthene	EPA TO-13A	10248405	NELAP	LA
6270 - Fluorene	EPA TO-13A	10248405	NELAP	LA
6315 - Indeno(1,2,3-cd)pyrene	EPA TO-13A	10248405	NELAP	LA
5005 - Naphthalene	EPA TO-13A	10248405	NELAP	LA
6608 - Perylene	EPA TO-13A	10248405	NELAP	LA
6615 - Phenanthrene	EPA TO-13A	10248405	NELAP	LA
6665 - Pyrene	EPA TO-13A	10248405	NELAP	LA
7355 - 4,4'-DDD	EPA TO-4A	10249204	NELAP	LA
7360 - 4,4'-DDE	EPA TO-4A	10249204	NELAP	LA
7365 - 4,4'-DDT	EPA TO-4A	10249204	NELAP	LA
8880 - Aroclor-1016 (PCB-1016)	EPA TO-4A	10249204	NELAP	LA
8885 - Aroclor-1221 (PCB-1221)	EPA TO-4A	10249204	NELAP	LA
8890 - Aroclor-1232 (PCB-1232)	EPA TO-4A	10249204	NELAP	LA
8895 - Aroclor-1242 (PCB-1242)	EPA TO-4A	10249204	NELAP	LA
8900 - Aroclor-1248 (PCB-1248)	EPA TO-4A	10249204	NELAP	LA
8905 - Aroclor-1254 (PCB-1254)	EPA TO-4A	10249204	NELAP	LA
8910 - Aroclor-1260 (PCB-1260)	EPA TO-4A	10249204	NELAP	LA

Air Emissions

Analyte	Method Name	Method Code	Type	AB
8913 - Aroclor-1268 (PCB-1268)	EPA TO-4A	10249204	NELAP	LA
9519 - 1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	EPA TO-9A	10249408	NELAP	LA
9516 - 1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	EPA TO-9A	10249408	NELAP	LA
9426 - 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)	EPA TO-9A	10249408	NELAP	LA
9420 - 1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)	EPA TO-9A	10249408	NELAP	LA
9423 - 1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)	EPA TO-9A	10249408	NELAP	LA
9453 - 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd)	EPA TO-9A	10249408	NELAP	LA
9471 - 1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-Hxcdf)	EPA TO-9A	10249408	NELAP	LA
9456 - 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin(1,2,3,6,7,8-Hxcdd)	EPA TO-9A	10249408	NELAP	LA
9474 - 1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf)	EPA TO-9A	10249408	NELAP	LA
9459 - 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd)	EPA TO-9A	10249408	NELAP	LA
9477 - 1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf)	EPA TO-9A	10249408	NELAP	LA
9540 - 1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd)	EPA TO-9A	10249408	NELAP	LA
9543 - 1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf)	EPA TO-9A	10249408	NELAP	LA
9480 - 2,3,4,6,7,8-Hexachlorodibenzofuran	EPA TO-9A	10249408	NELAP	LA
9549 - 2,3,4,7,8-Pentachlorodibenzofuran	EPA TO-9A	10249408	NELAP	LA
9618 - 2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD)	EPA TO-9A	10249408	NELAP	LA
9612 - 2,3,7,8-Tetrachlorodibenzofuran	EPA TO-9A	10249408	NELAP	LA
9438 - Total Hpcdd	EPA TO-9A	10249408	NELAP	LA
9444 - Total Hpcdf	EPA TO-9A	10249408	NELAP	LA
9468 - Total Hxcdd	EPA TO-9A	10249408	NELAP	LA
9483 - Total Hxcdf	EPA TO-9A	10249408	NELAP	LA
9555 - Total Pecdd	EPA TO-9A	10249408	NELAP	LA
9552 - Total Pecdf	EPA TO-9A	10249408	NELAP	LA
9609 - Total TCDD	EPA TO-9A	10249408	NELAP	LA
9615 - Total TCDF	EPA TO-9A	10249408	NELAP	LA
1095 - Mercury	EPA 101A	10401204	NELAP	LA
4467 - Condensible Particulate Matter	EPA 202	10403006	NELAP	LA
100798 - Extractable Condensable Particulate Matter	EPA 202	10403006	NELAP	LA
100799 - Non-extractable Condensable Particulate Matter	EPA 202	10403006	NELAP	LA
1541 - Bromine	EPA 26	10403108	NELAP	LA
1575 - Chloride	EPA 26	10403108	NELAP	LA
1580 - Chlorine	EPA 26	10403108	NELAP	LA
1770 - Hydrochloric acid (Hydrogen chloride (gas only))	EPA 26	10403108	NELAP	LA
100096 - Hydrogen Bromide (HBr)	EPA 26	10403108	NELAP	LA
1775 - Hydrogen fluoride (Hydrofluoric	EPA 26	10403108	NELAP	LA

Air Emissions

Analyte	Method Name	Method Code	Type	AB
acid)				
1541 - Bromine	EPA 26A	10403200	NELAP	LA
1575 - Chloride	EPA 26A	10403200	NELAP	LA
1580 - Chlorine	EPA 26A	10403200	NELAP	LA
1770 - Hydrochloric acid (Hydrogen chloride (gas only))	EPA 26A	10403200	NELAP	LA
100096 - Hydrogen Bromide (HBr)	EPA 26A	10403200	NELAP	LA
1775 - Hydrogen fluoride (Hydrofluoric acid)	EPA 26A	10403200	NELAP	LA
1095 - Mercury	EPA Method 29 (CVAA)	10403302	NELAP	LA
1000 - Aluminum	EPA Method 29 (ICP-MS)	10403700	NELAP	LA
1005 - Antimony	EPA Method 29 (ICP-MS)	10403700	NELAP	LA
1010 - Arsenic	EPA Method 29 (ICP-MS)	10403700	NELAP	LA
1015 - Barium	EPA Method 29 (ICP-MS)	10403700	NELAP	LA
1020 - Beryllium	EPA Method 29 (ICP-MS)	10403700	NELAP	LA
1030 - Cadmium	EPA Method 29 (ICP-MS)	10403700	NELAP	LA
1040 - Chromium	EPA Method 29 (ICP-MS)	10403700	NELAP	LA
1050 - Cobalt	EPA Method 29 (ICP-MS)	10403700	NELAP	LA
1055 - Copper	EPA Method 29 (ICP-MS)	10403700	NELAP	LA
1070 - Iron	EPA Method 29 (ICP-MS)	10403700	NELAP	LA
1075 - Lead	EPA Method 29 (ICP-MS)	10403700	NELAP	LA
1090 - Manganese	EPA Method 29 (ICP-MS)	10403700	NELAP	LA
1100 - Molybdenum	EPA Method 29 (ICP-MS)	10403700	NELAP	LA
1105 - Nickel	EPA Method 29 (ICP-MS)	10403700	NELAP	LA
1140 - Selenium	EPA Method 29 (ICP-MS)	10403700	NELAP	LA
1150 - Silver	EPA Method 29 (ICP-MS)	10403700	NELAP	LA
1165 - Thallium	EPA Method 29 (ICP-MS)	10403700	NELAP	LA
1175 - Tin	EPA Method 29 (ICP-MS)	10403700	NELAP	LA
1910 - Total Phosphorus	EPA Method 29 (ICP-MS)	10403700	NELAP	LA
1185 - Vanadium	EPA Method 29 (ICP-MS)	10403700	NELAP	LA
1190 - Zinc	EPA Method 29 (ICP-MS)	10403700	NELAP	LA
3915 - Particulates	EPA 5	10404305	NELAP	LA
3915 - Particulates	EPA Method 5D	10404601	NELAP	LA
1095 - Mercury	ASTM D6784	30033104	NELAP	LA

Non Potable Water

Analyte	Method Name	Method Code	Type	AB
9519 - 1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	EPA 1613B	10120602	NELAP	LA
9516 - 1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	EPA 1613B	10120602	NELAP	LA
9426 - 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)	EPA 1613B	10120602	NELAP	LA
9420 - 1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)	EPA 1613B	10120602	NELAP	LA
9423 - 1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)	EPA 1613B	10120602	NELAP	LA
9453 - 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd)	EPA 1613B	10120602	NELAP	LA
9471 - 1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-Hxcdf)	EPA 1613B	10120602	NELAP	LA

Non Potable Water

Analyte	Method Name	Method Code	Type	AB
9456 - 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin(1,2,3,6,7,8-Hxcdd)	EPA 1613B	10120602	NELAP	LA
9474 - 1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf)	EPA 1613B	10120602	NELAP	LA
9459 - 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd)	EPA 1613B	10120602	NELAP	LA
9477 - 1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf)	EPA 1613B	10120602	NELAP	LA
9540 - 1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd)	EPA 1613B	10120602	NELAP	LA
9543 - 1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf)	EPA 1613B	10120602	NELAP	LA
9480 - 2,3,4,6,7,8-Hexachlorodibenzofuran	EPA 1613B	10120602	NELAP	LA
9549 - 2,3,4,7,8-Pentachlorodibenzofuran	EPA 1613B	10120602	NELAP	LA
9618 - 2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD)	EPA 1613B	10120602	NELAP	LA
9612 - 2,3,7,8-Tetrachlorodibenzofuran	EPA 1613B	10120602	NELAP	LA
9438 - Total Hpcdd	EPA 1613B	10120602	NELAP	LA
9444 - Total Hpcdf	EPA 1613B	10120602	NELAP	LA
9468 - Total Hxcdd	EPA 1613B	10120602	NELAP	LA
9483 - Total Hxcdf	EPA 1613B	10120602	NELAP	LA
9555 - Total Pecdd	EPA 1613B	10120602	NELAP	LA
9552 - Total Pecdf	EPA 1613B	10120602	NELAP	LA
9609 - Total TCDD	EPA 1613B	10120602	NELAP	LA
9615 - Total TCDF	EPA 1613B	10120602	NELAP	LA
9873 - 2,2',3,3',4',5,6-Heptabromodiphenylether (BDE-177)	EPA 1614A	10120704	NELAP	LA
9902 - 2,2',3,3',4,4',5,5',6-Nonabromodiphenylether (BDE-206)	EPA 1614A	10120704	NELAP	LA
9892 - 2,2',3,3',4,4',5,6'-Octabromodiphenylether (BDE-196)	EPA 1614A	10120704	NELAP	LA
9903 - 2,2',3,3',4,4',5,6,6'-Nonabromodiphenylether (BDE-207)	EPA 1614A	10120704	NELAP	LA
9893 - 2,2',3,3',4,4',6,6'-Octabromodiphenylether (BDE-197)	EPA 1614A	10120704	NELAP	LA
9867 - 2,2',3,3',4,4',6-Heptabromodiphenylether (BDE-171)	EPA 1614A	10120704	NELAP	LA
9897 - 2,2',3,3',4,5',6,6'-Octabromodiphenylether (BDE-201)	EPA 1614A	10120704	NELAP	LA
9904 - 2,2',3,3',4,5,5',6,6'-Nonabromodiphenylether (BDE-208)	EPA 1614A	10120704	NELAP	LA
9896 - 2,2',3,3',4,5,6,6'-Octabromodiphenylether (BDE-200)	EPA 1614A	10120704	NELAP	LA
9872 - 2,2',3,3',4,6,6'-Heptabromodiphenylether (BDE-176)	EPA 1614A	10120704	NELAP	LA
9789 - 2,2',3,4',5-Pentabromodiphenylether (BDE-90)	EPA 1614A	10120704	NELAP	LA
9879 - 2,2',3,4,4',5',6-Heptabromodiphenylether (BDE-183)	EPA 1614A	10120704	NELAP	LA
9835 - 2,2',3,4,4',5'-Hexabromodiphenylether (BDE-138)	EPA 1614A	10120704	NELAP	LA
9899 - 2,2',3,4,4',5,5',6-Octabromodiphenylether (BDE-203)	EPA 1614A	10120704	NELAP	LA
9876 - 2,2',3,4,4',5,5'-Heptabromodiphenylether (BDE-180)	EPA 1614A	10120704	NELAP	LA

Non Potable Water

Analyte	Method Name	Method Code	Type	AB
9878 - 2,2',3,4,4',5,6'-Heptabromodiphenylether (BDE-182)	EPA 1614A	10120704	NELAP	LA
9900 - 2,2',3,4,4',5,6,6'-Octabromodiphenylether (BDE-204)	EPA 1614A	10120704	NELAP	LA
9877 - 2,2',3,4,4',5,6-Heptabromodiphenylether (BDE-181)	EPA 1614A	10120704	NELAP	LA
9837 - 2,2',3,4,4',6'-Hexabromodiphenylether (BDE-140)	EPA 1614A	10120704	NELAP	LA
9880 - 2,2',3,4,4',6,6'-Heptabromodiphenylether (BDE-184)	EPA 1614A	10120704	NELAP	LA
9836 - 2,2',3,4,4',6-Hexabromodiphenylether (BDE-139)	EPA 1614A	10120704	NELAP	LA
9784 - 2,2',3,4,4'-Pentabromodiphenylether (BDE-85)	EPA 1614A	10120704	NELAP	LA
9850 - 2,2',4,4',5',6-Hexabromodiphenylether (BDE-154)	EPA 1614A	10120704	NELAP	LA
9569 - 2,2',4,4',5,5'-Hexabromodiphenyl ether (BDE-153)	EPA 1614A	10120704	NELAP	LA
9571 - 2,2',4,4',5-Pentabromodiphenyl ether (BDE-99)	EPA 1614A	10120704	NELAP	LA
9851 - 2,2',4,4',6,6'-Hexabromodiphenylether (BDE-155)	EPA 1614A	10120704	NELAP	LA
9572 - 2,2',4,4',6-Pentabromodiphenyl ether (BDE-100)	EPA 1614A	10120704	NELAP	LA
9773 - 2,2',4,4'-Tetrabromodiphenyl ether (BDE-47)	EPA 1614A	10120704	NELAP	LA
9747 - 2,2',4,5'-Tetrabromodiphenylether (BDE-49)	EPA 1614A	10120704	NELAP	LA
9716 - 2,2',4-Tribromodiphenylether (BDE-17)	EPA 1614A	10120704	NELAP	LA
9749 - 2,2'4,6'-Tetrabromodiphenylether (BDE-51)	EPA 1614A	10120704	NELAP	LA
9769 - 2,3',4',6-Tetrabromodiphenylether (BDE-71)	EPA 1614A	10120704	NELAP	LA
9815 - 2,3',4,4',5-Pentabromodiphenylether (BDE-118)	EPA 1614A	10120704	NELAP	LA
9764 - 2,3',4,4'-Tetrabromodiphenylether (BDE-66)	EPA 1614A	10120704	NELAP	LA
9724 - 2,3',4-Tribromodiphenylether (BDE-25)	EPA 1614A	10120704	NELAP	LA
9887 - 2,3,3',4,4',5',6-Heptabromodiphenylether (BDE-191)	EPA 1614A	10120704	NELAP	LA
9901 - 2,3,3',4,4',5,5',6-Octabromodiphenylether (BDE-205)	EPA 1614A	10120704	NELAP	LA
9886 - 2,3,3',4,4',5,6-Heptabromodiphenylether (BDE-190)	EPA 1614A	10120704	NELAP	LA
9852 - 2,3,3',4,4,'5-Hexabromodiphenylether (BDE-156)	EPA 1614A	10120704	NELAP	LA
9862 - 2,3,4,4',5,6-Hexabromodiphenylether (BDE-166)	EPA 1614A	10120704	NELAP	LA
9813 - 2,3,4,5,6-Pentabromodiphenylether (BDE-116)	EPA 1614A	10120704	NELAP	LA
9720 - 2,3,4-Tribromodiphenylether (BDE-21)	EPA 1614A	10120704	NELAP	LA
9731 - 2,4',6-Tribromodiphenylether (BDE-	EPA 1614A	10120704	NELAP	LA

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Analyte	Method Name	Method Code	Type	AB
32)				
9774 - 2,4,4',6-Tetrabromodiphenylether (BDE-75)	EPA 1614A	10120704	NELAP	LA
9729 - 2,4,6-Tribromodiphenylether (BDE-30)	EPA 1614A	10120704	NELAP	LA
9706 - 2,4-Dibromodiphenylether (BDE-7)	EPA 1614A	10120704	NELAP	LA
9709 - 2,6-Dibromodiphenylether (BDE-10)	EPA 1614A	10120704	NELAP	LA
9700 - 2-Bromodiphenylether (BDE-1)	EPA 1614A	10120704	NELAP	LA
9865 - 3,3',4,4',5,5'-Hexabromodiphenylether (BDE-169)	EPA 1614A	10120704	NELAP	LA
9823 - 3,3',4,4',5-Pentabromodiphenylether (BDE-126)	EPA 1614A	10120704	NELAP	LA
9776 - 3,3',4,4'-Tetrabromodiphenylether (BDE-77)	EPA 1614A	10120704	NELAP	LA
9734 - 3,3',4-Tribromodiphenylether (BDE-35)	EPA 1614A	10120704	NELAP	LA
9712 - 3,4'-Dibromodiphenylether (BDE-13)	EPA 1614A	10120704	NELAP	LA
9736 - 3,4,4'-Tribromodiphenylether (BDE-37)	EPA 1614A	10120704	NELAP	LA
9711 - 3,4-Dibromodiphenylether (BDE-12)	EPA 1614A	10120704	NELAP	LA
9701 - 3-Bromodiphenylether (BDE-2)	EPA 1614A	10120704	NELAP	LA
9714 - 4,4'-Dibromodiphenylether (BDE-15)	EPA 1614A	10120704	NELAP	LA
5660 - 4-Bromophenyl phenyl ether	EPA 1614A	10120704	NELAP	LA
8902 - Coelution - Dibromodiphenyl ethers (BDE-8 + BDE-11)	EPA 1614A	10120704	NELAP	LA
9908 - Coelution - Pentabromodiphenyl ethers (BDE-119 + BDE-120)	EPA 1614A	10120704	NELAP	LA
9909 - Coelution - Tribromodiphenyl ethers (BDE-28 + BDE-33)	EPA 1614A	10120704	NELAP	LA
9905 - Decabromodiphenylether (BDE-209)	EPA 1614A	10120704	NELAP	LA
9105 - 2,2',3,3',4,4',5,5',6,6'-Decachlorobiphenyl (BZ-209)	EPA 1668A	10129405	NELAP	LA
9095 - 2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ-206)	EPA 1668A	10129405	NELAP	LA
9090 - 2,2',3,3',4,4',5,5'-Octachlorobiphenyl (BZ-194)	EPA 1668A	10129405	NELAP	LA
9102 - 2,2',3,3',4,4',5,6'-Octachlorobiphenyl (BZ-196)	EPA 1668A	10129405	NELAP	LA
9101 - 2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl (BZ-207)	EPA 1668A	10129405	NELAP	LA
9103 - 2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ-195)	EPA 1668A	10129405	NELAP	LA
9065 - 2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ-170)	EPA 1668A	10129405	NELAP	LA
9104 - 2,2',3,3',4,4',6,6'-Octachlorobiphenyl (BZ-197)	EPA 1668A	10129405	NELAP	LA
9106 - 2,2',3,3',4,4',6-Heptachlorobiphenyl (BZ-171)	EPA 1668A	10129405	NELAP	LA
9020 - 2,2',3,3',4,4'-Hexachlorobiphenyl (BZ-128)	EPA 1668A	10129405	NELAP	LA
9114 - 2,2',3,3',4,5',6'-Heptachlorobiphenyl (BZ-177)	EPA 1668A	10129405	NELAP	LA
9112 - 2,2',3,3',4,5',6,6'-Octachlorobiphenyl	EPA 1668A	10129405	NELAP	LA

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Analyte	Method Name	Method Code	Type	AB
(BZ-201)				
9115 - 2,2',3,3',4,5',6-Heptachlorobiphenyl (BZ-175)	EPA 1668A	10129405	NELAP	LA
9117 - 2,2',3,3',4,5'-Hexachlorobiphenyl (BZ-130)	EPA 1668A	10129405	NELAP	LA
9108 - 2,2',3,3',4,5,5',6'-Octachlorobiphenyl (BZ-199)	EPA 1668A	10129405	NELAP	LA
9107 - 2,2',3,3',4,5,5',6,6'-Nonachlorobiphenyl (BZ-208)	EPA 1668A	10129405	NELAP	LA
9109 - 2,2',3,3',4,5,5',6-Octachlorobiphenyl (BZ-198)	EPA 1668A	10129405	NELAP	LA
9110 - 2,2',3,3',4,5,5'-Heptachlorobiphenyl (BZ-172)	EPA 1668A	10129405	NELAP	LA
9116 - 2,2',3,3',4,5,6'-Heptachlorobiphenyl (BZ-174)	EPA 1668A	10129405	NELAP	LA
9111 - 2,2',3,3',4,5,6,6'-Octachlorobiphenyl (BZ-200)	EPA 1668A	10129405	NELAP	LA
9113 - 2,2',3,3',4,5,6-Heptachlorobiphenyl (BZ-173)	EPA 1668A	10129405	NELAP	LA
9118 - 2,2',3,3',4,5-Hexachlorobiphenyl (BZ-129)	EPA 1668A	10129405	NELAP	LA
9120 - 2,2',3,3',4,6'-Hexachlorobiphenyl (BZ-132)	EPA 1668A	10129405	NELAP	LA
9119 - 2,2',3,3',4,6,6'-Heptachlorobiphenyl (BZ-176)	EPA 1668A	10129405	NELAP	LA
9121 - 2,2',3,3',4,6-Hexachlorobiphenyl (BZ-131)	EPA 1668A	10129405	NELAP	LA
9122 - 2,2',3,3',4-Pentachlorobiphenyl (BZ-82)	EPA 1668A	10129405	NELAP	LA
9123 - 2,2',3,3',5,5',6,6'-Octachlorobiphenyl (BZ-202)	EPA 1668A	10129405	NELAP	LA
9124 - 2,2',3,3',5,5',6-Heptachlorobiphenyl (BZ-178)	EPA 1668A	10129405	NELAP	LA
9125 - 2,2',3,3',5,5'-Hexachlorobiphenyl (BZ-133)	EPA 1668A	10129405	NELAP	LA
9127 - 2,2',3,3',5,6'-Hexachlorobiphenyl (BZ-135)	EPA 1668A	10129405	NELAP	LA
9126 - 2,2',3,3',5,6,6'-Heptachlorobiphenyl (BZ-179)	EPA 1668A	10129405	NELAP	LA
9128 - 2,2',3,3',5,6-Hexachlorobiphenyl (BZ-134)	EPA 1668A	10129405	NELAP	LA
9129 - 2,2',3,3',5-Pentachlorobiphenyl (BZ-83)	EPA 1668A	10129405	NELAP	LA
9130 - 2,2',3,3',6,6'-Hexachlorobiphenyl (BZ-136)	EPA 1668A	10129405	NELAP	LA
9131 - 2,2',3,3',6-Pentachlorobiphenyl (BZ-84)	EPA 1668A	10129405	NELAP	LA
9132 - 2,2',3,3'-Tetrachlorobiphenyl (BZ-40)	EPA 1668A	10129405	NELAP	LA
9151 - 2,2',3,4',5',6-Hexachlorobiphenyl (BZ-149)	EPA 1668A	10129405	NELAP	LA
9154 - 2,2',3,4',5'-Pentachlorobiphenyl (BZ-97)	EPA 1668A	10129405	NELAP	LA
9080 - 2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ-187)	EPA 1668A	10129405	NELAP	LA

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Analyte	Method Name	Method Code	Type	AB
9144 - 2,2',3,4',5,5'-Hexachlorobiphenyl (BZ-146)	EPA 1668A	10129405	NELAP	LA
9147 - 2,2',3,4',5,6'-Hexachlorobiphenyl (BZ-148)	EPA 1668A	10129405	NELAP	LA
9146 - 2,2',3,4',5,6,6'-Heptachlorobiphenyl (BZ-188)	EPA 1668A	10129405	NELAP	LA
9149 - 2,2',3,4',5,6-Hexachlorobiphenyl (BZ-147)	EPA 1668A	10129405	NELAP	LA
9155 - 2,2',3,4',5-Pentachlorobiphenyl (BZ-90)	EPA 1668A	10129405	NELAP	LA
9159 - 2,2',3,4',6'-Pentachlorobiphenyl (BZ-98)	EPA 1668A	10129405	NELAP	LA
9157 - 2,2',3,4',6,6'-Hexachlorobiphenyl (BZ-150)	EPA 1668A	10129405	NELAP	LA
9160 - 2,2',3,4',6-Pentachlorobiphenyl (BZ-91)	EPA 1668A	10129405	NELAP	LA
9162 - 2,2',3,4'-Tetrachlorobiphenyl (BZ-42)	EPA 1668A	10129405	NELAP	LA
9075 - 2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ-183)	EPA 1668A	10129405	NELAP	LA
9025 - 2,2',3,4,4',5'-Hexachlorobiphenyl (BZ-138)	EPA 1668A	10129405	NELAP	LA
9133 - 2,2',3,4,4',5,5',6-Octachlorobiphenyl (BZ-203)	EPA 1668A	10129405	NELAP	LA
9134 - 2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ-180)	EPA 1668A	10129405	NELAP	LA
9136 - 2,2',3,4,4',5,6'-Heptachlorobiphenyl (BZ-182)	EPA 1668A	10129405	NELAP	LA
9135 - 2,2',3,4,4',5,6,6'-Octachlorobiphenyl (BZ-204)	EPA 1668A	10129405	NELAP	LA
9137 - 2,2',3,4,4',5,6-Heptachlorobiphenyl (BZ-181)	EPA 1668A	10129405	NELAP	LA
9138 - 2,2',3,4,4',5-Hexachlorobiphenyl (BZ-137)	EPA 1668A	10129405	NELAP	LA
9140 - 2,2',3,4,4',6'-Hexachlorobiphenyl (BZ-140)	EPA 1668A	10129405	NELAP	LA
9139 - 2,2',3,4,4',6,6'-Heptachlorobiphenyl (BZ-184)	EPA 1668A	10129405	NELAP	LA
9141 - 2,2',3,4,4',6-Hexachlorobiphenyl (BZ-139)	EPA 1668A	10129405	NELAP	LA
9142 - 2,2',3,4,4'-Pentachlorobiphenyl (BZ-85)	EPA 1668A	10129405	NELAP	LA
9150 - 2,2',3,4,5',6-Hexachlorobiphenyl (BZ-144)	EPA 1668A	10129405	NELAP	LA
8975 - 2,2',3,4,5'-Pentachlorobiphenyl (BZ-87)	EPA 1668A	10129405	NELAP	LA
9143 - 2,2',3,4,5,5',6-Heptachlorobiphenyl (BZ-185)	EPA 1668A	10129405	NELAP	LA
9030 - 2,2',3,4,5,5'-Hexachlorobiphenyl (BZ-141)	EPA 1668A	10129405	NELAP	LA
9152 - 2,2',3,4,5,6'-Hexachlorobiphenyl (BZ-143)	EPA 1668A	10129405	NELAP	LA
9145 - 2,2',3,4,5,6,6'-Heptachlorobiphenyl (BZ-186)	EPA 1668A	10129405	NELAP	LA
9148 - 2,2',3,4,5,6-Hexachlorobiphenyl	EPA 1668A	10129405	NELAP	LA

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Analyte	Method Name	Method Code	Type	AB
(BZ-142)				
9153 - 2,2',3,4,5-Pentachlorobiphenyl (BZ-86)	EPA 1668A	10129405	NELAP	LA
9161 - 2,2',3,4,6'-Pentachlorobiphenyl (BZ-89)	EPA 1668A	10129405	NELAP	LA
9156 - 2,2',3,4,6,6'-Hexachlorobiphenyl (BZ-145)	EPA 1668A	10129405	NELAP	LA
9158 - 2,2',3,4,6-Pentachlorobiphenyl (BZ-88)	EPA 1668A	10129405	NELAP	LA
9163 - 2,2',3,4-Tetrachlorobiphenyl (BZ-41)	EPA 1668A	10129405	NELAP	LA
9166 - 2,2',3,5',6-Pentachlorobiphenyl (BZ-95)	EPA 1668A	10129405	NELAP	LA
8945 - 2,2',3,5'-Tetrachlorobiphenyl (BZ-44)	EPA 1668A	10129405	NELAP	LA
9035 - 2,2',3,5,5',6-Hexachlorobiphenyl (BZ-151)	EPA 1668A	10129405	NELAP	LA
9164 - 2,2',3,5,5'-Pentachlorobiphenyl (BZ-92)	EPA 1668A	10129405	NELAP	LA
9167 - 2,2',3,5,6'-Pentachlorobiphenyl (BZ-94)	EPA 1668A	10129405	NELAP	LA
9165 - 2,2',3,5,6,6'-Hexachlorobiphenyl (BZ-152)	EPA 1668A	10129405	NELAP	LA
9168 - 2,2',3,5,6-Pentachlorobiphenyl (BZ-93)	EPA 1668A	10129405	NELAP	LA
9169 - 2,2',3,5-Tetrachlorobiphenyl (BZ-43)	EPA 1668A	10129405	NELAP	LA
9171 - 2,2',3,6'-Tetrachlorobiphenyl (BZ-46)	EPA 1668A	10129405	NELAP	LA
9170 - 2,2',3,6,6'-Pentachlorobiphenyl (BZ-96)	EPA 1668A	10129405	NELAP	LA
9172 - 2,2',3,6-Tetrachlorobiphenyl (BZ-45)	EPA 1668A	10129405	NELAP	LA
9173 - 2,2',3-Trichlorobiphenyl (BZ-16)	EPA 1668A	10129405	NELAP	LA
9040 - 2,2',4,4',5,5'-Hexachlorobiphenyl (BZ-153)	EPA 1668A	10129405	NELAP	LA
9174 - 2,2',4,4',5,6'-Hexachlorobiphenyl (BZ-154)	EPA 1668A	10129405	NELAP	LA
9175 - 2,2',4,4',5-Pentachlorobiphenyl (BZ-99)	EPA 1668A	10129405	NELAP	LA
9176 - 2,2',4,4',6,6'-Hexachlorobiphenyl (BZ-155)	EPA 1668A	10129405	NELAP	LA
9177 - 2,2',4,4',6-Pentachlorobiphenyl (BZ-100)	EPA 1668A	10129405	NELAP	LA
9178 - 2,2',4,4'-Tetrachlorobiphenyl (BZ-47)	EPA 1668A	10129405	NELAP	LA
9179 - 2,2',4,5',6-Pentachlorobiphenyl (BZ-103)	EPA 1668A	10129405	NELAP	LA
8950 - 2,2',4,5'-Tetrachlorobiphenyl (BZ-49)	EPA 1668A	10129405	NELAP	LA
8980 - 2,2',4,5,5'-Pentachlorobiphenyl (BZ-101)	EPA 1668A	10129405	NELAP	LA
9180 - 2,2',4,5,6'-Pentachlorobiphenyl (BZ-102)	EPA 1668A	10129405	NELAP	LA
9181 - 2,2',4,5-Tetrachlorobiphenyl (BZ-	EPA 1668A	10129405	NELAP	LA

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Analyte	Method Name	Method Code	Type	AB
48)				
9183 - 2,2',4,6'-Tetrachlorobiphenyl (BZ-51)	EPA 1668A	10129405	NELAP	LA
9182 - 2,2',4,6,6'-Pentachlorobiphenyl (BZ-104)	EPA 1668A	10129405	NELAP	LA
9184 - 2,2',4,6-Tetrachlorobiphenyl (BZ-50)	EPA 1668A	10129405	NELAP	LA
9185 - 2,2',4-Trichlorobiphenyl (BZ-17)	EPA 1668A	10129405	NELAP	LA
8955 - 2,2',5,5'-Tetrachlorobiphenyl (BZ-52)	EPA 1668A	10129405	NELAP	LA
9186 - 2,2',5,6'-Tetrachlorobiphenyl (BZ-53)	EPA 1668A	10129405	NELAP	LA
8930 - 2,2',5-Trichlorobiphenyl (BZ-18)	EPA 1668A	10129405	NELAP	LA
9187 - 2,2',6,6'-Tetrachlorobiphenyl (BZ-54)	EPA 1668A	10129405	NELAP	LA
9188 - 2,2',6-Trichlorobiphenyl (BZ-19)	EPA 1668A	10129405	NELAP	LA
9189 - 2,2'-Dichlorobiphenyl (BZ-4)	EPA 1668A	10129405	NELAP	LA
9224 - 2,3',4',5',6-Pentachlorobiphenyl (BZ-125)	EPA 1668A	10129405	NELAP	LA
9229 - 2,3',4',5'-Tetrachlorobiphenyl (BZ-76)	EPA 1668A	10129405	NELAP	LA
9222 - 2,3',4',5,5'-Pentachlorobiphenyl (BZ-124)	EPA 1668A	10129405	NELAP	LA
9230 - 2,3',4',5-Tetrachlorobiphenyl (BZ-70)	EPA 1668A	10129405	NELAP	LA
9237 - 2,3',4',6-Tetrachlorobiphenyl (BZ-71)	EPA 1668A	10129405	NELAP	LA
9239 - 2,3',4'-Trichlorobiphenyl (BZ-33)	EPA 1668A	10129405	NELAP	LA
9218 - 2,3',4,4',5',6-Hexachlorobiphenyl (BZ-168)	EPA 1668A	10129405	NELAP	LA
9000 - 2,3',4,4',5'-Pentachlorobiphenyl (BZ-123)	EPA 1668A	10129405	NELAP	LA
9011 - 2,3',4,4',5'-Pentachlorobiphenyl (BZ-123)	EPA 1668A	10129405	NELAP	LA
9055 - 2,3',4,4',5,5'-Hexachlorobiphenyl (BZ-167)	EPA 1668A	10129405	NELAP	LA
8995 - 2,3',4,4',5-Pentachlorobiphenyl (BZ-118)	EPA 1668A	10129405	NELAP	LA
9220 - 2,3',4,4',6-Pentachlorobiphenyl (BZ-119)	EPA 1668A	10129405	NELAP	LA
8960 - 2,3',4,4'-Tetrachlorobiphenyl (BZ-66)	EPA 1668A	10129405	NELAP	LA
9226 - 2,3',4,5',6-Pentachlorobiphenyl (BZ-121)	EPA 1668A	10129405	NELAP	LA
9231 - 2,3',4,5'-Tetrachlorobiphenyl (BZ-68)	EPA 1668A	10129405	NELAP	LA
9223 - 2,3',4,5,5'-Pentachlorobiphenyl (BZ-120)	EPA 1668A	10129405	NELAP	LA
9232 - 2,3',4,5-Tetrachlorobiphenyl (BZ-67)	EPA 1668A	10129405	NELAP	LA
9235 - 2,3',4,6-Tetrachlorobiphenyl (BZ-69)	EPA 1668A	10129405	NELAP	LA
9240 - 2,3',4-Trichlorobiphenyl (BZ-25)	EPA 1668A	10129405	NELAP	LA
9244 - 2,3',5',6-Tetrachlorobiphenyl (BZ-73)	EPA 1668A	10129405	NELAP	LA

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Analyte	Method Name	Method Code	Type	AB
9246 - 2,3',5'-Trichlorobiphenyl (BZ-34)	EPA 1668A	10129405	NELAP	LA
9242 - 2,3',5,5'-Tetrachlorobiphenyl (BZ-72)	EPA 1668A	10129405	NELAP	LA
8935 - 2,3',5-Trichlorobiphenyl (BZ-26)	EPA 1668A	10129405	NELAP	LA
9248 - 2,3',6-Trichlorobiphenyl (BZ-27)	EPA 1668A	10129405	NELAP	LA
9249 - 2,3'-Dichlorobiphenyl (BZ-6)	EPA 1668A	10129405	NELAP	LA
9201 - 2,3,3',4',5',6-Hexachlorobiphenyl (BZ-164)	EPA 1668A	10129405	NELAP	LA
9202 - 2,3,3',4',5'-Pentachlorobiphenyl (BZ-122)	EPA 1668A	10129405	NELAP	LA
9195 - 2,3,3',4',5,5',6-Heptachlorobiphenyl (BZ-193)	EPA 1668A	10129405	NELAP	LA
9197 - 2,3,3',4',5,5'-Hexachlorobiphenyl (BZ-162)	EPA 1668A	10129405	NELAP	LA
9199 - 2,3,3',4',5,6-Hexachlorobiphenyl (BZ-163)	EPA 1668A	10129405	NELAP	LA
9205 - 2,3,3',4',5-Pentachlorobiphenyl (BZ-107)	EPA 1668A	10129405	NELAP	LA
8990 - 2,3,3',4',6-Pentachlorobiphenyl (BZ-110)	EPA 1668A	10129405	NELAP	LA
9207 - 2,3,3',4'-Tetrachlorobiphenyl (BZ-56)	EPA 1668A	10129405	NELAP	LA
9192 - 2,3,3',4,4',5',6-Heptachlorobiphenyl (BZ-191)	EPA 1668A	10129405	NELAP	LA
9045 - 2,3,3',4,4',5'-Hexachlorobiphenyl (BZ-157)	EPA 1668A	10129405	NELAP	LA
9190 - 2,3,3',4,4',5,5',6-Octachlorobiphenyl (BZ-205)	EPA 1668A	10129405	NELAP	LA
9085 - 2,3,3',4,4',5,5'-Heptachlorobiphenyl (BZ-189)	EPA 1668A	10129405	NELAP	LA
9191 - 2,3,3',4,4',5,6-Heptachlorobiphenyl (BZ-190)	EPA 1668A	10129405	NELAP	LA
9050 - 2,3,3',4,4',5-Hexachlorobiphenyl (BZ-156)	EPA 1668A	10129405	NELAP	LA
9193 - 2,3,3',4,4',6-Hexachlorobiphenyl (BZ-158)	EPA 1668A	10129405	NELAP	LA
8985 - 2,3,3',4,4'-Pentachlorobiphenyl (BZ-105)	EPA 1668A	10129405	NELAP	LA
9200 - 2,3,3',4,5',6-Hexachlorobiphenyl (BZ-161)	EPA 1668A	10129405	NELAP	LA
9203 - 2,3,3',4,5'-Pentachlorobiphenyl (BZ-108)	EPA 1668A	10129405	NELAP	LA
9194 - 2,3,3',4,5,5',6-Heptachlorobiphenyl (BZ-192)	EPA 1668A	10129405	NELAP	LA
9196 - 2,3,3',4,5,5'-Hexachlorobiphenyl (BZ-159)	EPA 1668A	10129405	NELAP	LA
9198 - 2,3,3',4,5,6-Hexachlorobiphenyl (BZ-160)	EPA 1668A	10129405	NELAP	LA
9204 - 2,3,3',4,5-Pentachlorobiphenyl (BZ-106)	EPA 1668A	10129405	NELAP	LA
9206 - 2,3,3',4,6-Pentachlorobiphenyl (BZ-109)	EPA 1668A	10129405	NELAP	LA
9208 - 2,3,3',4-Tetrachlorobiphenyl (BZ-55)	EPA 1668A	10129405	NELAP	LA
9212 - 2,3,3',5',6-Pentachlorobiphenyl	EPA 1668A	10129405	NELAP	LA

Non Potable Water

Analyte	Method Name	Method Code	Type	AB
(BZ-113)				
9213 - 2,3,3',5'-Tetrachlorobiphenyl (BZ-58)	EPA 1668A	10129405	NELAP	LA
9209 - 2,3,3',5,5',6-Hexachlorobiphenyl (BZ-165)	EPA 1668A	10129405	NELAP	LA
9210 - 2,3,3',5,5'-Pentachlorobiphenyl (BZ-111)	EPA 1668A	10129405	NELAP	LA
9211 - 2,3,3',5,6-Pentachlorobiphenyl (BZ-112)	EPA 1668A	10129405	NELAP	LA
9214 - 2,3,3',5-Tetrachlorobiphenyl (BZ-57)	EPA 1668A	10129405	NELAP	LA
9215 - 2,3,3',6-Tetrachlorobiphenyl (BZ-59)	EPA 1668A	10129405	NELAP	LA
9216 - 2,3,3'-Trichlorobiphenyl (BZ-20)	EPA 1668A	10129405	NELAP	LA
9227 - 2,3,4',5,6-Pentachlorobiphenyl (BZ-117)	EPA 1668A	10129405	NELAP	LA
9233 - 2,3,4',5-Tetrachlorobiphenyl (BZ-63)	EPA 1668A	10129405	NELAP	LA
9236 - 2,3,4',6-Tetrachlorobiphenyl (BZ-64)	EPA 1668A	10129405	NELAP	LA
9241 - 2,3,4'-Trichlorobiphenyl (BZ-22)	EPA 1668A	10129405	NELAP	LA
9217 - 2,3,4,4',5,6-Hexachlorobiphenyl (BZ-166)	EPA 1668A	10129405	NELAP	LA
9005 - 2,3,4,4',5-Pentachlorobiphenyl (BZ-114)	EPA 1668A	10129405	NELAP	LA
9219 - 2,3,4,4',6-Pentachlorobiphenyl (BZ-115)	EPA 1668A	10129405	NELAP	LA
9221 - 2,3,4,4'-Tetrachlorobiphenyl (BZ-60)	EPA 1668A	10129405	NELAP	LA
9225 - 2,3,4,5,6-Pentachlorobiphenyl (BZ-116)	EPA 1668A	10129405	NELAP	LA
9228 - 2,3,4,5-Tetrachlorobiphenyl (BZ-61)	EPA 1668A	10129405	NELAP	LA
9234 - 2,3,4,6-Tetrachlorobiphenyl (BZ-62)	EPA 1668A	10129405	NELAP	LA
9238 - 2,3,4-Trichlorobiphenyl (BZ-21)	EPA 1668A	10129405	NELAP	LA
9243 - 2,3,5,6-Tetrachlorobiphenyl (BZ-65)	EPA 1668A	10129405	NELAP	LA
9245 - 2,3,5-Trichlorobiphenyl (BZ-23)	EPA 1668A	10129405	NELAP	LA
9247 - 2,3,6-Trichlorobiphenyl (BZ-24)	EPA 1668A	10129405	NELAP	LA
8920 - 2,3-Dichlorobiphenyl (BZ-5)	EPA 1668A	10129405	NELAP	LA
8940 - 2,4',5-Trichlorobiphenyl (BZ-31)	EPA 1668A	10129405	NELAP	LA
9255 - 2,4',6-Trichlorobiphenyl (BZ-32)	EPA 1668A	10129405	NELAP	LA
9256 - 2,4'-Dichlorobiphenyl (BZ-8)	EPA 1668A	10129405	NELAP	LA
9250 - 2,4,4',5-Tetrachlorobiphenyl (BZ-74)	EPA 1668A	10129405	NELAP	LA
9251 - 2,4,4',6-Tetrachlorobiphenyl (BZ-75)	EPA 1668A	10129405	NELAP	LA
9252 - 2,4,4'-Trichlorobiphenyl (BZ-28)	EPA 1668A	10129405	NELAP	LA
9253 - 2,4,5-Trichlorobiphenyl (BZ-29)	EPA 1668A	10129405	NELAP	LA
9254 - 2,4,6-Trichlorobiphenyl (BZ-30)	EPA 1668A	10129405	NELAP	LA
9257 - 2,4-Dichlorobiphenyl (BZ-7)	EPA 1668A	10129405	NELAP	LA
9258 - 2,5-Dichlorobiphenyl (BZ-9)	EPA 1668A	10129405	NELAP	LA
9259 - 2,6-Dichlorobiphenyl (BZ-10)	EPA 1668A	10129405	NELAP	LA
8915 - 2-Chlorobiphenyl (BZ-1)	EPA 1668A	10129405	NELAP	LA

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Analyte	Method Name	Method Code	Type	AB
9060 - 3,3',4,4',5,5'-Hexachlorobiphenyl (BZ-169)	EPA 1668A	10129405	NELAP	LA
9015 - 3,3',4,4',5-Pentachlorobiphenyl (BZ-126)	EPA 1668A	10129405	NELAP	LA
8965 - 3,3',4,4'-Tetrachlorobiphenyl (BZ-77)	EPA 1668A	10129405	NELAP	LA
9261 - 3,3',4,5'-Tetrachlorobiphenyl (BZ-79)	EPA 1668A	10129405	NELAP	LA
9260 - 3,3',4,5,5'-Pentachlorobiphenyl (BZ-127)	EPA 1668A	10129405	NELAP	LA
9262 - 3,3',4,5-Tetrachlorobiphenyl (BZ-78)	EPA 1668A	10129405	NELAP	LA
9263 - 3,3',4-Trichlorobiphenyl (BZ-35)	EPA 1668A	10129405	NELAP	LA
9264 - 3,3',5,5'-Tetrachlorobiphenyl (BZ-80)	EPA 1668A	10129405	NELAP	LA
9265 - 3,3',5-Trichlorobiphenyl (BZ-36)	EPA 1668A	10129405	NELAP	LA
8925 - 3,3'-Dichlorobiphenyl (BZ-11)	EPA 1668A	10129405	NELAP	LA
9268 - 3,4',5-Trichlorobiphenyl (BZ-39)	EPA 1668A	10129405	NELAP	LA
9269 - 3,4'-Dichlorobiphenyl (BZ-13)	EPA 1668A	10129405	NELAP	LA
8970 - 3,4,4',5-Tetrachlorobiphenyl (BZ-81)	EPA 1668A	10129405	NELAP	LA
9266 - 3,4,4'-Trichlorobiphenyl (BZ-37)	EPA 1668A	10129405	NELAP	LA
9267 - 3,4,5-Trichlorobiphenyl (BZ-38)	EPA 1668A	10129405	NELAP	LA
9270 - 3,4-Dichlorobiphenyl (BZ-12)	EPA 1668A	10129405	NELAP	LA
9271 - 3,5-Dichlorobiphenyl (BZ-14)	EPA 1668A	10129405	NELAP	LA
9272 - 3-Chlorobiphenyl (BZ-2)	EPA 1668A	10129405	NELAP	LA
9273 - 4,4'-Dichlorobiphenyl (BZ-15)	EPA 1668A	10129405	NELAP	LA
9274 - 4-Chlorobiphenyl (BZ-3)	EPA 1668A	10129405	NELAP	LA
1444 - Separatory Funnel Liquid-liquid extraction	EPA 3510C	10138202	NELAP	LA
9105 - 2,2',3,3',4,4',5,5',6,6'-Decachlorobiphenyl (BZ-209)	EPA 1668C	10262109	NELAP	LA
9095 - 2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ-206)	EPA 1668C	10262109	NELAP	LA
9090 - 2,2',3,3',4,4',5,5'-Octachlorobiphenyl (BZ-194)	EPA 1668C	10262109	NELAP	LA
9102 - 2,2',3,3',4,4',5,6'-Octachlorobiphenyl (BZ-196)	EPA 1668C	10262109	NELAP	LA
9101 - 2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl (BZ-207)	EPA 1668C	10262109	NELAP	LA
9103 - 2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ-195)	EPA 1668C	10262109	NELAP	LA
9065 - 2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ-170)	EPA 1668C	10262109	NELAP	LA
9104 - 2,2',3,3',4,4',6,6'-Octachlorobiphenyl (BZ-197)	EPA 1668C	10262109	NELAP	LA
9106 - 2,2',3,3',4,4',6-Heptachlorobiphenyl (BZ-171)	EPA 1668C	10262109	NELAP	LA
9020 - 2,2',3,3',4,4'-Hexachlorobiphenyl (BZ-128)	EPA 1668C	10262109	NELAP	LA
9114 - 2,2',3,3',4,5',6'-Heptachlorobiphenyl (BZ-177)	EPA 1668C	10262109	NELAP	LA
9112 - 2,2',3,3',4,5',6,6'-Octachlorobiphenyl (BZ-201)	EPA 1668C	10262109	NELAP	LA
9115 - 2,2',3,3',4,5',6-Heptachlorobiphenyl	EPA 1668C	10262109	NELAP	LA

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Analyte	Method Name	Method Code	Type	AB
(BZ-175)				
9117 - 2,2',3,3',4,5'-Hexachlorobiphenyl (BZ-130)	EPA 1668C	10262109	NELAP	LA
9108 - 2,2',3,3',4,5,5',6'-Octachlorobiphenyl (BZ-199)	EPA 1668C	10262109	NELAP	LA
9107 - 2,2',3,3',4,5,5',6,6'-Nonachlorobiphenyl (BZ-208)	EPA 1668C	10262109	NELAP	LA
9109 - 2,2',3,3',4,5,5',6-Octachlorobiphenyl (BZ-198)	EPA 1668C	10262109	NELAP	LA
9110 - 2,2',3,3',4,5,5'-Heptachlorobiphenyl (BZ-172)	EPA 1668C	10262109	NELAP	LA
9116 - 2,2',3,3',4,5,6'-Heptachlorobiphenyl (BZ-174)	EPA 1668C	10262109	NELAP	LA
9111 - 2,2',3,3',4,5,6,6'-Octachlorobiphenyl (BZ-200)	EPA 1668C	10262109	NELAP	LA
9113 - 2,2',3,3',4,5,6-Heptachlorobiphenyl (BZ-173)	EPA 1668C	10262109	NELAP	LA
9118 - 2,2',3,3',4,5-Hexachlorobiphenyl (BZ-129)	EPA 1668C	10262109	NELAP	LA
9120 - 2,2',3,3',4,6'-Hexachlorobiphenyl (BZ-132)	EPA 1668C	10262109	NELAP	LA
9119 - 2,2',3,3',4,6,6'-Heptachlorobiphenyl (BZ-176)	EPA 1668C	10262109	NELAP	LA
9121 - 2,2',3,3',4,6-Hexachlorobiphenyl (BZ-131)	EPA 1668C	10262109	NELAP	LA
9122 - 2,2',3,3',4-Pentachlorobiphenyl (BZ-82)	EPA 1668C	10262109	NELAP	LA
9123 - 2,2',3,3',5,5',6,6'-Octachlorobiphenyl (BZ-202)	EPA 1668C	10262109	NELAP	LA
9124 - 2,2',3,3',5,5',6-Heptachlorobiphenyl (BZ-178)	EPA 1668C	10262109	NELAP	LA
9125 - 2,2',3,3',5,5'-Hexachlorobiphenyl (BZ-133)	EPA 1668C	10262109	NELAP	LA
9127 - 2,2',3,3',5,6'-Hexachlorobiphenyl (BZ-135)	EPA 1668C	10262109	NELAP	LA
9126 - 2,2',3,3',5,6,6'-Heptachlorobiphenyl (BZ-179)	EPA 1668C	10262109	NELAP	LA
9128 - 2,2',3,3',5,6-Hexachlorobiphenyl (BZ-134)	EPA 1668C	10262109	NELAP	LA
9129 - 2,2',3,3',5-Pentachlorobiphenyl (BZ-83)	EPA 1668C	10262109	NELAP	LA
9130 - 2,2',3,3',6,6'-Hexachlorobiphenyl (BZ-136)	EPA 1668C	10262109	NELAP	LA
9131 - 2,2',3,3',6-Pentachlorobiphenyl (BZ-84)	EPA 1668C	10262109	NELAP	LA
9132 - 2,2',3,3'-Tetrachlorobiphenyl (BZ-40)	EPA 1668C	10262109	NELAP	LA
9151 - 2,2',3,4',5',6-Hexachlorobiphenyl (BZ-149)	EPA 1668C	10262109	NELAP	LA
9154 - 2,2',3,4',5'-Pentachlorobiphenyl (BZ-97)	EPA 1668C	10262109	NELAP	LA
9080 - 2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ-187)	EPA 1668C	10262109	NELAP	LA
9144 - 2,2',3,4',5,5'-Hexachlorobiphenyl (BZ-146)	EPA 1668C	10262109	NELAP	LA

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Analyte	Method Name	Method Code	Type	AB
9147 - 2,2',3,4',5,6'-Hexachlorobiphenyl (BZ-148)	EPA 1668C	10262109	NELAP	LA
9146 - 2,2',3,4',5,6,6'-Heptachlorobiphenyl (BZ-188)	EPA 1668C	10262109	NELAP	LA
9149 - 2,2',3,4',5,6-Hexachlorobiphenyl (BZ-147)	EPA 1668C	10262109	NELAP	LA
9155 - 2,2',3,4',5-Pentachlorobiphenyl (BZ-90)	EPA 1668C	10262109	NELAP	LA
9159 - 2,2',3,4',6'-Pentachlorobiphenyl (BZ-98)	EPA 1668C	10262109	NELAP	LA
9157 - 2,2',3,4',6,6'-Hexachlorobiphenyl (BZ-150)	EPA 1668C	10262109	NELAP	LA
9160 - 2,2',3,4',6-Pentachlorobiphenyl (BZ-91)	EPA 1668C	10262109	NELAP	LA
9162 - 2,2',3,4'-Tetrachlorobiphenyl (BZ-42)	EPA 1668C	10262109	NELAP	LA
9075 - 2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ-183)	EPA 1668C	10262109	NELAP	LA
9025 - 2,2',3,4,4',5'-Hexachlorobiphenyl (BZ-138)	EPA 1668C	10262109	NELAP	LA
9133 - 2,2',3,4,4',5,5',6-Octachlorobiphenyl (BZ-203)	EPA 1668C	10262109	NELAP	LA
9134 - 2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ-180)	EPA 1668C	10262109	NELAP	LA
9136 - 2,2',3,4,4',5,6'-Heptachlorobiphenyl (BZ-182)	EPA 1668C	10262109	NELAP	LA
9135 - 2,2',3,4,4',5,6,6'-Octachlorobiphenyl (BZ-204)	EPA 1668C	10262109	NELAP	LA
9137 - 2,2',3,4,4',5,6-Heptachlorobiphenyl (BZ-181)	EPA 1668C	10262109	NELAP	LA
9138 - 2,2',3,4,4',5-Hexachlorobiphenyl (BZ-137)	EPA 1668C	10262109	NELAP	LA
9140 - 2,2',3,4,4',6'-Hexachlorobiphenyl (BZ-140)	EPA 1668C	10262109	NELAP	LA
9139 - 2,2',3,4,4',6,6'-Heptachlorobiphenyl (BZ-184)	EPA 1668C	10262109	NELAP	LA
9141 - 2,2',3,4,4',6-Hexachlorobiphenyl (BZ-139)	EPA 1668C	10262109	NELAP	LA
9142 - 2,2',3,4,4'-Pentachlorobiphenyl (BZ-85)	EPA 1668C	10262109	NELAP	LA
9150 - 2,2',3,4,5',6-Hexachlorobiphenyl (BZ-144)	EPA 1668C	10262109	NELAP	LA
8975 - 2,2',3,4,5'-Pentachlorobiphenyl (BZ-87)	EPA 1668C	10262109	NELAP	LA
9143 - 2,2',3,4,5,5',6-Heptachlorobiphenyl (BZ-185)	EPA 1668C	10262109	NELAP	LA
9030 - 2,2',3,4,5,5'-Hexachlorobiphenyl (BZ-141)	EPA 1668C	10262109	NELAP	LA
9152 - 2,2',3,4,5,6'-Hexachlorobiphenyl (BZ-143)	EPA 1668C	10262109	NELAP	LA
9145 - 2,2',3,4,5,6,6'-Heptachlorobiphenyl (BZ-186)	EPA 1668C	10262109	NELAP	LA
9148 - 2,2',3,4,5,6-Hexachlorobiphenyl (BZ-142)	EPA 1668C	10262109	NELAP	LA
9153 - 2,2',3,4,5-Pentachlorobiphenyl (BZ-	EPA 1668C	10262109	NELAP	LA

Non Potable Water

Analyte	Method Name	Method Code	Type	AB
86)				
9161 - 2,2',3,4,6'-Pentachlorobiphenyl (BZ-89)	EPA 1668C	10262109	NELAP	LA
9156 - 2,2',3,4,6,6'-Hexachlorobiphenyl (BZ-145)	EPA 1668C	10262109	NELAP	LA
9158 - 2,2',3,4,6-Pentachlorobiphenyl (BZ-88)	EPA 1668C	10262109	NELAP	LA
9163 - 2,2',3,4-Tetrachlorobiphenyl (BZ-41)	EPA 1668C	10262109	NELAP	LA
9166 - 2,2',3,5',6-Pentachlorobiphenyl (BZ-95)	EPA 1668C	10262109	NELAP	LA
8945 - 2,2',3,5'-Tetrachlorobiphenyl (BZ-44)	EPA 1668C	10262109	NELAP	LA
9035 - 2,2',3,5,5',6-Hexachlorobiphenyl (BZ-151)	EPA 1668C	10262109	NELAP	LA
9164 - 2,2',3,5,5'-Pentachlorobiphenyl (BZ-92)	EPA 1668C	10262109	NELAP	LA
9167 - 2,2',3,5,6'-Pentachlorobiphenyl (BZ-94)	EPA 1668C	10262109	NELAP	LA
9165 - 2,2',3,5,6,6'-Hexachlorobiphenyl (BZ-152)	EPA 1668C	10262109	NELAP	LA
9168 - 2,2',3,5,6-Pentachlorobiphenyl (BZ-93)	EPA 1668C	10262109	NELAP	LA
9169 - 2,2',3,5-Tetrachlorobiphenyl (BZ-43)	EPA 1668C	10262109	NELAP	LA
9171 - 2,2',3,6'-Tetrachlorobiphenyl (BZ-46)	EPA 1668C	10262109	NELAP	LA
9170 - 2,2',3,6,6'-Pentachlorobiphenyl (BZ-96)	EPA 1668C	10262109	NELAP	LA
9172 - 2,2',3,6-Tetrachlorobiphenyl (BZ-45)	EPA 1668C	10262109	NELAP	LA
9173 - 2,2',3-Trichlorobiphenyl (BZ-16)	EPA 1668C	10262109	NELAP	LA
9040 - 2,2',4,4',5,5'-Hexachlorobiphenyl (BZ-153)	EPA 1668C	10262109	NELAP	LA
9174 - 2,2',4,4',5,6'-Hexachlorobiphenyl (BZ-154)	EPA 1668C	10262109	NELAP	LA
9175 - 2,2',4,4',5-Pentachlorobiphenyl (BZ-99)	EPA 1668C	10262109	NELAP	LA
9176 - 2,2',4,4',6,6'-Hexachlorobiphenyl (BZ-155)	EPA 1668C	10262109	NELAP	LA
9177 - 2,2',4,4',6-Pentachlorobiphenyl (BZ-100)	EPA 1668C	10262109	NELAP	LA
9178 - 2,2',4,4'-Tetrachlorobiphenyl (BZ-47)	EPA 1668C	10262109	NELAP	LA
9179 - 2,2',4,5',6-Pentachlorobiphenyl (BZ-103)	EPA 1668C	10262109	NELAP	LA
8950 - 2,2',4,5'-Tetrachlorobiphenyl (BZ-49)	EPA 1668C	10262109	NELAP	LA
8980 - 2,2',4,5,5'-Pentachlorobiphenyl (BZ-101)	EPA 1668C	10262109	NELAP	LA
9180 - 2,2',4,5,6'-Pentachlorobiphenyl (BZ-102)	EPA 1668C	10262109	NELAP	LA
9181 - 2,2',4,5-Tetrachlorobiphenyl (BZ-48)	EPA 1668C	10262109	NELAP	LA
9183 - 2,2',4,6'-Tetrachlorobiphenyl (BZ-	EPA 1668C	10262109	NELAP	LA

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Analyte	Method Name	Method Code	Type	AB
51)				
9182 - 2,2',4,6,6'-Pentachlorobiphenyl (BZ-104)	EPA 1668C	10262109	NELAP	LA
9184 - 2,2',4,6-Tetrachlorobiphenyl (BZ-50)	EPA 1668C	10262109	NELAP	LA
9185 - 2,2',4-Trichlorobiphenyl (BZ-17)	EPA 1668C	10262109	NELAP	LA
8955 - 2,2',5,5'-Tetrachlorobiphenyl (BZ-52)	EPA 1668C	10262109	NELAP	LA
9186 - 2,2',5,6'-Tetrachlorobiphenyl (BZ-53)	EPA 1668C	10262109	NELAP	LA
8930 - 2,2',5-Trichlorobiphenyl (BZ-18)	EPA 1668C	10262109	NELAP	LA
9187 - 2,2',6,6'-Tetrachlorobiphenyl (BZ-54)	EPA 1668C	10262109	NELAP	LA
9188 - 2,2',6-Trichlorobiphenyl (BZ-19)	EPA 1668C	10262109	NELAP	LA
9189 - 2,2'-Dichlorobiphenyl (BZ-4)	EPA 1668C	10262109	NELAP	LA
9224 - 2,3',4',5',6-Pentachlorobiphenyl (BZ-125)	EPA 1668C	10262109	NELAP	LA
9229 - 2,3',4',5'-Tetrachlorobiphenyl (BZ-76)	EPA 1668C	10262109	NELAP	LA
9222 - 2,3',4',5,5'-Pentachlorobiphenyl (BZ-124)	EPA 1668C	10262109	NELAP	LA
9230 - 2,3',4',5-Tetrachlorobiphenyl (BZ-70)	EPA 1668C	10262109	NELAP	LA
9237 - 2,3',4',6-Tetrachlorobiphenyl (BZ-71)	EPA 1668C	10262109	NELAP	LA
9239 - 2,3',4'-Trichlorobiphenyl (BZ-33)	EPA 1668C	10262109	NELAP	LA
9218 - 2,3',4,4',5',6-Hexachlorobiphenyl (BZ-168)	EPA 1668C	10262109	NELAP	LA
9000 - 2,3',4,4',5'-Pentachlorobiphenyl (BZ-123)	EPA 1668C	10262109	NELAP	LA
9011 - 2,3',4,4',5'-Pentachlorobiphenyl (BZ-123)	EPA 1668C	10262109	NELAP	LA
9055 - 2,3',4,4',5,5'-Hexachlorobiphenyl (BZ-167)	EPA 1668C	10262109	NELAP	LA
8995 - 2,3',4,4',5-Pentachlorobiphenyl (BZ-118)	EPA 1668C	10262109	NELAP	LA
9220 - 2,3',4,4',6-Pentachlorobiphenyl (BZ-119)	EPA 1668C	10262109	NELAP	LA
8960 - 2,3',4,4'-Tetrachlorobiphenyl (BZ-66)	EPA 1668C	10262109	NELAP	LA
9226 - 2,3',4,5',6-Pentachlorobiphenyl (BZ-121)	EPA 1668C	10262109	NELAP	LA
9231 - 2,3',4,5'-Tetrachlorobiphenyl (BZ-68)	EPA 1668C	10262109	NELAP	LA
9223 - 2,3',4,5,5'-Pentachlorobiphenyl (BZ-120)	EPA 1668C	10262109	NELAP	LA
9232 - 2,3',4,5-Tetrachlorobiphenyl (BZ-67)	EPA 1668C	10262109	NELAP	LA
9235 - 2,3',4,6-Tetrachlorobiphenyl (BZ-69)	EPA 1668C	10262109	NELAP	LA
9240 - 2,3',4-Trichlorobiphenyl (BZ-25)	EPA 1668C	10262109	NELAP	LA
9244 - 2,3',5',6-Tetrachlorobiphenyl (BZ-73)	EPA 1668C	10262109	NELAP	LA
9246 - 2,3',5'-Trichlorobiphenyl (BZ-34)	EPA 1668C	10262109	NELAP	LA
9242 - 2,3',5,5'-Tetrachlorobiphenyl (BZ-	EPA 1668C	10262109	NELAP	LA

Non Potable Water

Analyte	Method Name	Method Code	Type	AB
72)				
8935 - 2,3',5-Trichlorobiphenyl (BZ-26)	EPA 1668C	10262109	NELAP	LA
9248 - 2,3',6-Trichlorobiphenyl (BZ-27)	EPA 1668C	10262109	NELAP	LA
9249 - 2,3'-Dichlorobiphenyl (BZ-6)	EPA 1668C	10262109	NELAP	LA
9201 - 2,3,3',4',5',6-Hexachlorobiphenyl (BZ-164)	EPA 1668C	10262109	NELAP	LA
9202 - 2,3,3',4',5'-Pentachlorobiphenyl (BZ-122)	EPA 1668C	10262109	NELAP	LA
9195 - 2,3,3',4',5,5',6-Heptachlorobiphenyl (BZ-193)	EPA 1668C	10262109	NELAP	LA
9197 - 2,3,3',4',5,5'-Hexachlorobiphenyl (BZ-162)	EPA 1668C	10262109	NELAP	LA
9199 - 2,3,3',4',5,6-Hexachlorobiphenyl (BZ-163)	EPA 1668C	10262109	NELAP	LA
9205 - 2,3,3',4',5-Pentachlorobiphenyl (BZ-107)	EPA 1668C	10262109	NELAP	LA
8990 - 2,3,3',4',6-Pentachlorobiphenyl (BZ-110)	EPA 1668C	10262109	NELAP	LA
9207 - 2,3,3',4'-Tetrachlorobiphenyl (BZ-56)	EPA 1668C	10262109	NELAP	LA
9192 - 2,3,3',4,4',5',6-Heptachlorobiphenyl (BZ-191)	EPA 1668C	10262109	NELAP	LA
9045 - 2,3,3',4,4',5'-Hexachlorobiphenyl (BZ-157)	EPA 1668C	10262109	NELAP	LA
9190 - 2,3,3',4,4',5,5',6-Octachlorobiphenyl (BZ-205)	EPA 1668C	10262109	NELAP	LA
9085 - 2,3,3',4,4',5,5'-Heptachlorobiphenyl (BZ-189)	EPA 1668C	10262109	NELAP	LA
9191 - 2,3,3',4,4',5,6-Heptachlorobiphenyl (BZ-190)	EPA 1668C	10262109	NELAP	LA
9050 - 2,3,3',4,4',5-Hexachlorobiphenyl (BZ-156)	EPA 1668C	10262109	NELAP	LA
9193 - 2,3,3',4,4',6-Hexachlorobiphenyl (BZ-158)	EPA 1668C	10262109	NELAP	LA
8985 - 2,3,3',4,4'-Pentachlorobiphenyl (BZ-105)	EPA 1668C	10262109	NELAP	LA
9200 - 2,3,3',4,5',6-Hexachlorobiphenyl (BZ-161)	EPA 1668C	10262109	NELAP	LA
9203 - 2,3,3',4,5'-Pentachlorobiphenyl (BZ-108)	EPA 1668C	10262109	NELAP	LA
9194 - 2,3,3',4,5,5',6-Heptachlorobiphenyl (BZ-192)	EPA 1668C	10262109	NELAP	LA
9196 - 2,3,3',4,5,5'-Hexachlorobiphenyl (BZ-159)	EPA 1668C	10262109	NELAP	LA
9198 - 2,3,3',4,5,6-Hexachlorobiphenyl (BZ-160)	EPA 1668C	10262109	NELAP	LA
9204 - 2,3,3',4,5-Pentachlorobiphenyl (BZ-106)	EPA 1668C	10262109	NELAP	LA
9206 - 2,3,3',4,6-Pentachlorobiphenyl (BZ-109)	EPA 1668C	10262109	NELAP	LA
9208 - 2,3,3',4-Tetrachlorobiphenyl (BZ-55)	EPA 1668C	10262109	NELAP	LA
9212 - 2,3,3',5',6-Pentachlorobiphenyl (BZ-113)	EPA 1668C	10262109	NELAP	LA
9213 - 2,3,3',5'-Tetrachlorobiphenyl (BZ-	EPA 1668C	10262109	NELAP	LA

Non Potable Water

Analyte	Method Name	Method Code	Type	AB
58)				
9209 - 2,3,3',5,5',6-Hexachlorobiphenyl (BZ-165)	EPA 1668C	10262109	NELAP	LA
9210 - 2,3,3',5,5'-Pentachlorobiphenyl (BZ-111)	EPA 1668C	10262109	NELAP	LA
9211 - 2,3,3',5,6-Pentachlorobiphenyl (BZ-112)	EPA 1668C	10262109	NELAP	LA
9214 - 2,3,3',5-Tetrachlorobiphenyl (BZ-57)	EPA 1668C	10262109	NELAP	LA
9215 - 2,3,3',6-Tetrachlorobiphenyl (BZ-59)	EPA 1668C	10262109	NELAP	LA
9216 - 2,3,3'-Trichlorobiphenyl (BZ-20)	EPA 1668C	10262109	NELAP	LA
9227 - 2,3,4',5,6-Pentachlorobiphenyl (BZ-117)	EPA 1668C	10262109	NELAP	LA
9233 - 2,3,4',5-Tetrachlorobiphenyl (BZ-63)	EPA 1668C	10262109	NELAP	LA
9236 - 2,3,4',6-Tetrachlorobiphenyl (BZ-64)	EPA 1668C	10262109	NELAP	LA
9241 - 2,3,4'-Trichlorobiphenyl (BZ-22)	EPA 1668C	10262109	NELAP	LA
9217 - 2,3,4,4',5,6-Hexachlorobiphenyl (BZ-166)	EPA 1668C	10262109	NELAP	LA
9005 - 2,3,4,4',5-Pentachlorobiphenyl (BZ-114)	EPA 1668C	10262109	NELAP	LA
9219 - 2,3,4,4',6-Pentachlorobiphenyl (BZ-115)	EPA 1668C	10262109	NELAP	LA
9221 - 2,3,4,4'-Tetrachlorobiphenyl (BZ-60)	EPA 1668C	10262109	NELAP	LA
9225 - 2,3,4,5,6-Pentachlorobiphenyl (BZ-116)	EPA 1668C	10262109	NELAP	LA
9228 - 2,3,4,5-Tetrachlorobiphenyl (BZ-61)	EPA 1668C	10262109	NELAP	LA
9234 - 2,3,4,6-Tetrachlorobiphenyl (BZ-62)	EPA 1668C	10262109	NELAP	LA
9238 - 2,3,4-Trichlorobiphenyl (BZ-21)	EPA 1668C	10262109	NELAP	LA
9243 - 2,3,5,6-Tetrachlorobiphenyl (BZ-65)	EPA 1668C	10262109	NELAP	LA
9245 - 2,3,5-Trichlorobiphenyl (BZ-23)	EPA 1668C	10262109	NELAP	LA
9247 - 2,3,6-Trichlorobiphenyl (BZ-24)	EPA 1668C	10262109	NELAP	LA
8920 - 2,3-Dichlorobiphenyl (BZ-5)	EPA 1668C	10262109	NELAP	LA
8940 - 2,4',5-Trichlorobiphenyl (BZ-31)	EPA 1668C	10262109	NELAP	LA
9255 - 2,4',6-Trichlorobiphenyl (BZ-32)	EPA 1668C	10262109	NELAP	LA
9256 - 2,4'-Dichlorobiphenyl (BZ-8)	EPA 1668C	10262109	NELAP	LA
9250 - 2,4,4',5-Tetrachlorobiphenyl (BZ-74)	EPA 1668C	10262109	NELAP	LA
9251 - 2,4,4',6-Tetrachlorobiphenyl (BZ-75)	EPA 1668C	10262109	NELAP	LA
9252 - 2,4,4'-Trichlorobiphenyl (BZ-28)	EPA 1668C	10262109	NELAP	LA
9253 - 2,4,5-Trichlorobiphenyl (BZ-29)	EPA 1668C	10262109	NELAP	LA
9254 - 2,4,6-Trichlorobiphenyl (BZ-30)	EPA 1668C	10262109	NELAP	LA
9257 - 2,4-Dichlorobiphenyl (BZ-7)	EPA 1668C	10262109	NELAP	LA
9258 - 2,5-Dichlorobiphenyl (BZ-9)	EPA 1668C	10262109	NELAP	LA
9259 - 2,6-Dichlorobiphenyl (BZ-10)	EPA 1668C	10262109	NELAP	LA
8915 - 2-Chlorobiphenyl (BZ-1)	EPA 1668C	10262109	NELAP	LA
9060 - 3,3',4,4',5,5'-Hexachlorobiphenyl (BZ-169)	EPA 1668C	10262109	NELAP	LA

Non Potable Water

Analyte	Method Name	Method Code	Type	AB
9015 - 3,3',4,4',5-Pentachlorobiphenyl (BZ-126)	EPA 1668C	10262109	NELAP	LA
8965 - 3,3',4,4'-Tetrachlorobiphenyl (BZ-77)	EPA 1668C	10262109	NELAP	LA
9261 - 3,3',4,5'-Tetrachlorobiphenyl (BZ-79)	EPA 1668C	10262109	NELAP	LA
9260 - 3,3',4,5,5'-Pentachlorobiphenyl (BZ-127)	EPA 1668C	10262109	NELAP	LA
9262 - 3,3',4,5-Tetrachlorobiphenyl (BZ-78)	EPA 1668C	10262109	NELAP	LA
9263 - 3,3',4-Trichlorobiphenyl (BZ-35)	EPA 1668C	10262109	NELAP	LA
9264 - 3,3',5,5'-Tetrachlorobiphenyl (BZ-80)	EPA 1668C	10262109	NELAP	LA
9265 - 3,3',5-Trichlorobiphenyl (BZ-36)	EPA 1668C	10262109	NELAP	LA
8925 - 3,3'-Dichlorobiphenyl (BZ-11)	EPA 1668C	10262109	NELAP	LA
9268 - 3,4',5-Trichlorobiphenyl (BZ-39)	EPA 1668C	10262109	NELAP	LA
9269 - 3,4'-Dichlorobiphenyl (BZ-13)	EPA 1668C	10262109	NELAP	LA
8970 - 3,4,4',5-Tetrachlorobiphenyl (BZ-81)	EPA 1668C	10262109	NELAP	LA
9266 - 3,4,4'-Trichlorobiphenyl (BZ-37)	EPA 1668C	10262109	NELAP	LA
9267 - 3,4,5-Trichlorobiphenyl (BZ-38)	EPA 1668C	10262109	NELAP	LA
9270 - 3,4-Dichlorobiphenyl (BZ-12)	EPA 1668C	10262109	NELAP	LA
9271 - 3,5-Dichlorobiphenyl (BZ-14)	EPA 1668C	10262109	NELAP	LA
9272 - 3-Chlorobiphenyl (BZ-2)	EPA 1668C	10262109	NELAP	LA
9273 - 4,4'-Dichlorobiphenyl (BZ-15)	EPA 1668C	10262109	NELAP	LA
9274 - 4-Chlorobiphenyl (BZ-3)	EPA 1668C	10262109	NELAP	LA

Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
9519 - 1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	EPA 1613B	10120602	NELAP	LA
9516 - 1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	EPA 1613B	10120602	NELAP	LA
9426 - 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)	EPA 1613B	10120602	NELAP	LA
9420 - 1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)	EPA 1613B	10120602	NELAP	LA
9423 - 1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)	EPA 1613B	10120602	NELAP	LA
9453 - 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd)	EPA 1613B	10120602	NELAP	LA
9471 - 1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-Hxcdf)	EPA 1613B	10120602	NELAP	LA
9456 - 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin(1,2,3,6,7,8-Hxcdd)	EPA 1613B	10120602	NELAP	LA
9474 - 1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf)	EPA 1613B	10120602	NELAP	LA
9459 - 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd)	EPA 1613B	10120602	NELAP	LA
9477 - 1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf)	EPA 1613B	10120602	NELAP	LA

Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
9540 - 1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd)	EPA 1613B	10120602	NELAP	LA
9543 - 1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf)	EPA 1613B	10120602	NELAP	LA
9480 - 2,3,4,6,7,8-Hexachlorodibenzofuran	EPA 1613B	10120602	NELAP	LA
9549 - 2,3,4,7,8-Pentachlorodibenzofuran	EPA 1613B	10120602	NELAP	LA
9618 - 2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD)	EPA 1613B	10120602	NELAP	LA
9612 - 2,3,7,8-Tetrachlorodibenzofuran	EPA 1613B	10120602	NELAP	LA
9438 - Total Hpcdd	EPA 1613B	10120602	NELAP	LA
9444 - Total Hpcdf	EPA 1613B	10120602	NELAP	LA
9468 - Total Hxcdd	EPA 1613B	10120602	NELAP	LA
9483 - Total Hxcdf	EPA 1613B	10120602	NELAP	LA
9555 - Total Pecdd	EPA 1613B	10120602	NELAP	LA
9552 - Total Pecdf	EPA 1613B	10120602	NELAP	LA
9609 - Total TCDD	EPA 1613B	10120602	NELAP	LA
9615 - Total TCDF	EPA 1613B	10120602	NELAP	LA
9873 - 2,2',3,3',4',5,6-Heptabromodiphenylether (BDE-177)	EPA 1614A	10120704	NELAP	LA
9902 - 2,2',3,3',4,4',5,5',6-Nonabromodiphenylether (BDE-206)	EPA 1614A	10120704	NELAP	LA
9892 - 2,2',3,3',4,4',5,6'-Octabromodiphenylether (BDE-196)	EPA 1614A	10120704	NELAP	LA
9903 - 2,2',3,3',4,4',5,6,6'-Nonabromodiphenylether (BDE-207)	EPA 1614A	10120704	NELAP	LA
9893 - 2,2',3,3',4,4',6,6'-Octabromodiphenylether (BDE-197)	EPA 1614A	10120704	NELAP	LA
9867 - 2,2',3,3',4,4',6-Heptabromodiphenylether (BDE-171)	EPA 1614A	10120704	NELAP	LA
9897 - 2,2',3,3',4,5',6,6'-Octabromodiphenylether (BDE-201)	EPA 1614A	10120704	NELAP	LA
9904 - 2,2',3,3',4,5,5',6,6'-Nonabromodiphenylether (BDE-208)	EPA 1614A	10120704	NELAP	LA
9896 - 2,2',3,3',4,5,6,6'-Octabromodiphenylether (BDE-200)	EPA 1614A	10120704	NELAP	LA
9872 - 2,2',3,3',4,6,6'-Heptabromodiphenylether (BDE-176)	EPA 1614A	10120704	NELAP	LA
9789 - 2,2',3,4',5-Pentabromodiphenylether (BDE-90)	EPA 1614A	10120704	NELAP	LA
9879 - 2,2',3,4,4',5',6-Heptabromodiphenylether (BDE-183)	EPA 1614A	10120704	NELAP	LA
9835 - 2,2',3,4,4',5'-Hexabromodiphenylether (BDE-138)	EPA 1614A	10120704	NELAP	LA
9899 - 2,2',3,4,4',5,5',6-Octabromodiphenylether (BDE-203)	EPA 1614A	10120704	NELAP	LA
9876 - 2,2',3,4,4',5,5'-Heptabromodiphenylether (BDE-180)	EPA 1614A	10120704	NELAP	LA
9878 - 2,2',3,4,4',5,6'-Heptabromodiphenylether (BDE-182)	EPA 1614A	10120704	NELAP	LA
9900 - 2,2',3,4,4',5,6,6'-Octabromodiphenylether (BDE-204)	EPA 1614A	10120704	NELAP	LA
9877 - 2,2',3,4,4',5,6-Heptabromodiphenylether (BDE-181)	EPA 1614A	10120704	NELAP	LA
9837 - 2,2',3,4,4',6'-Hexabromodiphenylether (BDE-140)	EPA 1614A	10120704	NELAP	LA

Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
9880 - 2,2',3,4,4',6,6'-Heptabromodiphenylether (BDE-184)	EPA 1614A	10120704	NELAP	LA
9836 - 2,2',3,4,4',6-Hexabromodiphenylether (BDE-139)	EPA 1614A	10120704	NELAP	LA
9784 - 2,2',3,4,4'-Pentabromodiphenylether (BDE-85)	EPA 1614A	10120704	NELAP	LA
9850 - 2,2',4,4',5',6-Hexabromodiphenylether (BDE-154)	EPA 1614A	10120704	NELAP	LA
9569 - 2,2',4,4',5,5'-Hexabromodiphenyl ether (BDE-153)	EPA 1614A	10120704	NELAP	LA
9571 - 2,2',4,4',5-Pentabromodiphenyl ether (BDE-99)	EPA 1614A	10120704	NELAP	LA
9851 - 2,2',4,4',6,6'-Hexabromodiphenylether (BDE-155)	EPA 1614A	10120704	NELAP	LA
9572 - 2,2',4,4',6-Pentabromodiphenyl ether (BDE-100)	EPA 1614A	10120704	NELAP	LA
9773 - 2,2',4,4'-Tetrabromodiphenyl ether (BDE-47)	EPA 1614A	10120704	NELAP	LA
9747 - 2,2',4,5'-Tetrabromodiphenylether (BDE-49)	EPA 1614A	10120704	NELAP	LA
9716 - 2,2',4-Tribromodiphenylether (BDE-17)	EPA 1614A	10120704	NELAP	LA
9749 - 2,2'4,6'-Tetrabromodiphenylether (BDE-51)	EPA 1614A	10120704	NELAP	LA
9769 - 2,3',4',6-Tetrabromodiphenylether (BDE-71)	EPA 1614A	10120704	NELAP	LA
9815 - 2,3',4,4',5-Pentabromodiphenylether (BDE-118)	EPA 1614A	10120704	NELAP	LA
9764 - 2,3',4,4'-Tetrabromodiphenylether (BDE-66)	EPA 1614A	10120704	NELAP	LA
9724 - 2,3',4-Tribromodiphenylether (BDE-25)	EPA 1614A	10120704	NELAP	LA
9887 - 2,3,3',4,4',5',6-Heptabromodiphenylether (BDE-191)	EPA 1614A	10120704	NELAP	LA
9901 - 2,3,3',4,4',5,5',6-Octabromodiphenylether (BDE-205)	EPA 1614A	10120704	NELAP	LA
9886 - 2,3,3',4,4',5,6-Heptabromodiphenylether (BDE-190)	EPA 1614A	10120704	NELAP	LA
9852 - 2,3,3',4,4,'5-Hexabromodiphenylether (BDE-156)	EPA 1614A	10120704	NELAP	LA
9862 - 2,3,4,4',5,6-Hexabromodiphenylether (BDE-166)	EPA 1614A	10120704	NELAP	LA
9813 - 2,3,4,5,6-Pentabromodiphenylether (BDE-116)	EPA 1614A	10120704	NELAP	LA
9720 - 2,3,4-Tribromodiphenylether (BDE-21)	EPA 1614A	10120704	NELAP	LA
9731 - 2,4',6-Tribromodiphenylether (BDE-32)	EPA 1614A	10120704	NELAP	LA
9774 - 2,4,4',6-Tetrabromodiphenylether (BDE-75)	EPA 1614A	10120704	NELAP	LA
9729 - 2,4,6-Tribromodiphenylether (BDE-30)	EPA 1614A	10120704	NELAP	LA
9706 - 2,4-Dibromodiphenylether (BDE-7)	EPA 1614A	10120704	NELAP	LA
9709 - 2,6-Dibromodiphenylether (BDE-10)	EPA 1614A	10120704	NELAP	LA
9700 - 2-Bromodiphenylether (BDE-1)	EPA 1614A	10120704	NELAP	LA

Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
9865 - 3,3',4,4',5,5'-Hexabromodiphenylether (BDE-169)	EPA 1614A	10120704	NELAP	LA
9823 - 3,3',4,4',5-Pentabromodiphenylether (BDE-126)	EPA 1614A	10120704	NELAP	LA
9776 - 3,3',4,4'-Tetrabromodiphenylether (BDE-77)	EPA 1614A	10120704	NELAP	LA
9734 - 3,3',4-Tribromodiphenylether (BDE-35)	EPA 1614A	10120704	NELAP	LA
9712 - 3,4'-Dibromodiphenylether (BDE-13)	EPA 1614A	10120704	NELAP	LA
9736 - 3,4,4'-Tribromodiphenylether (BDE-37)	EPA 1614A	10120704	NELAP	LA
9711 - 3,4-Dibromodiphenylether (BDE-12)	EPA 1614A	10120704	NELAP	LA
9701 - 3-Bromodiphenylether (BDE-2)	EPA 1614A	10120704	NELAP	LA
9714 - 4,4'-Dibromodiphenylether (BDE-15)	EPA 1614A	10120704	NELAP	LA
5660 - 4-Bromophenyl phenyl ether	EPA 1614A	10120704	NELAP	LA
8902 - Coelution - Dibromodiphenyl ethers (BDE-8 + BDE-11)	EPA 1614A	10120704	NELAP	LA
9908 - Coelution - Pentabromodiphenyl ethers (BDE-119 + BDE-120)	EPA 1614A	10120704	NELAP	LA
9909 - Coelution - Tribromodiphenyl ethers (BDE-28 + BDE-33)	EPA 1614A	10120704	NELAP	LA
9905 - Decabromodiphenylether (BDE-209)	EPA 1614A	10120704	NELAP	LA
9105 - 2,2',3,3',4,4',5,5',6,6'-Decachlorobiphenyl (BZ-209)	EPA 1668A	10129405	NELAP	LA
9095 - 2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ-206)	EPA 1668A	10129405	NELAP	LA
9090 - 2,2',3,3',4,4',5,5'-Octachlorobiphenyl (BZ-194)	EPA 1668A	10129405	NELAP	LA
9102 - 2,2',3,3',4,4',5,6'-Octachlorobiphenyl (BZ-196)	EPA 1668A	10129405	NELAP	LA
9101 - 2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl (BZ-207)	EPA 1668A	10129405	NELAP	LA
9103 - 2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ-195)	EPA 1668A	10129405	NELAP	LA
9065 - 2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ-170)	EPA 1668A	10129405	NELAP	LA
9104 - 2,2',3,3',4,4',6,6'-Octachlorobiphenyl (BZ-197)	EPA 1668A	10129405	NELAP	LA
9106 - 2,2',3,3',4,4',6-Heptachlorobiphenyl (BZ-171)	EPA 1668A	10129405	NELAP	LA
9020 - 2,2',3,3',4,4'-Hexachlorobiphenyl (BZ-128)	EPA 1668A	10129405	NELAP	LA
9114 - 2,2',3,3',4,5',6'-Heptachlorobiphenyl (BZ-177)	EPA 1668A	10129405	NELAP	LA
9112 - 2,2',3,3',4,5',6,6'-Octachlorobiphenyl (BZ-201)	EPA 1668A	10129405	NELAP	LA
9115 - 2,2',3,3',4,5',6-Heptachlorobiphenyl (BZ-175)	EPA 1668A	10129405	NELAP	LA
9117 - 2,2',3,3',4,5'-Hexachlorobiphenyl (BZ-130)	EPA 1668A	10129405	NELAP	LA
9108 - 2,2',3,3',4,5,5',6'-Octachlorobiphenyl (BZ-199)	EPA 1668A	10129405	NELAP	LA
9107 - 2,2',3,3',4,5,5',6,6'-	EPA 1668A	10129405	NELAP	LA

Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
Nonachlorobiphenyl (BZ-208)				
9109 - 2,2',3,3',4,5,5',6-Octachlorobiphenyl (BZ-198)	EPA 1668A	10129405	NELAP	LA
9110 - 2,2',3,3',4,5,5'-Heptachlorobiphenyl (BZ-172)	EPA 1668A	10129405	NELAP	LA
9116 - 2,2',3,3',4,5,6'-Heptachlorobiphenyl (BZ-174)	EPA 1668A	10129405	NELAP	LA
9111 - 2,2',3,3',4,5,6,6'-Octachlorobiphenyl (BZ-200)	EPA 1668A	10129405	NELAP	LA
9113 - 2,2',3,3',4,5,6-Heptachlorobiphenyl (BZ-173)	EPA 1668A	10129405	NELAP	LA
9118 - 2,2',3,3',4,5-Hexachlorobiphenyl (BZ-129)	EPA 1668A	10129405	NELAP	LA
9120 - 2,2',3,3',4,6'-Hexachlorobiphenyl (BZ-132)	EPA 1668A	10129405	NELAP	LA
9119 - 2,2',3,3',4,6,6'-Heptachlorobiphenyl (BZ-176)	EPA 1668A	10129405	NELAP	LA
9121 - 2,2',3,3',4,6-Hexachlorobiphenyl (BZ-131)	EPA 1668A	10129405	NELAP	LA
9122 - 2,2',3,3',4-Pentachlorobiphenyl (BZ-82)	EPA 1668A	10129405	NELAP	LA
9123 - 2,2',3,3',5,5',6,6'-Octachlorobiphenyl (BZ-202)	EPA 1668A	10129405	NELAP	LA
9124 - 2,2',3,3',5,5',6-Heptachlorobiphenyl (BZ-178)	EPA 1668A	10129405	NELAP	LA
9125 - 2,2',3,3',5,5'-Hexachlorobiphenyl (BZ-133)	EPA 1668A	10129405	NELAP	LA
9127 - 2,2',3,3',5,6'-Hexachlorobiphenyl (BZ-135)	EPA 1668A	10129405	NELAP	LA
9126 - 2,2',3,3',5,6,6'-Heptachlorobiphenyl (BZ-179)	EPA 1668A	10129405	NELAP	LA
9128 - 2,2',3,3',5,6-Hexachlorobiphenyl (BZ-134)	EPA 1668A	10129405	NELAP	LA
9129 - 2,2',3,3',5-Pentachlorobiphenyl (BZ-83)	EPA 1668A	10129405	NELAP	LA
9130 - 2,2',3,3',6,6'-Hexachlorobiphenyl (BZ-136)	EPA 1668A	10129405	NELAP	LA
9131 - 2,2',3,3',6-Pentachlorobiphenyl (BZ-84)	EPA 1668A	10129405	NELAP	LA
9132 - 2,2',3,3'-Tetrachlorobiphenyl (BZ-40)	EPA 1668A	10129405	NELAP	LA
9151 - 2,2',3,4',5',6-Hexachlorobiphenyl (BZ-149)	EPA 1668A	10129405	NELAP	LA
9154 - 2,2',3,4',5'-Pentachlorobiphenyl (BZ-97)	EPA 1668A	10129405	NELAP	LA
9080 - 2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ-187)	EPA 1668A	10129405	NELAP	LA
9144 - 2,2',3,4',5,5'-Hexachlorobiphenyl (BZ-146)	EPA 1668A	10129405	NELAP	LA
9147 - 2,2',3,4',5,6'-Hexachlorobiphenyl (BZ-148)	EPA 1668A	10129405	NELAP	LA
9146 - 2,2',3,4',5,6,6'-Heptachlorobiphenyl (BZ-188)	EPA 1668A	10129405	NELAP	LA
9149 - 2,2',3,4',5,6-Hexachlorobiphenyl (BZ-147)	EPA 1668A	10129405	NELAP	LA

Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
9155 - 2,2',3,4',5-Pentachlorobiphenyl (BZ-90)	EPA 1668A	10129405	NELAP	LA
9159 - 2,2',3,4',6'-Pentachlorobiphenyl (BZ-98)	EPA 1668A	10129405	NELAP	LA
9157 - 2,2',3,4',6,6'-Hexachlorobiphenyl (BZ-150)	EPA 1668A	10129405	NELAP	LA
9160 - 2,2',3,4',6-Pentachlorobiphenyl (BZ-91)	EPA 1668A	10129405	NELAP	LA
9162 - 2,2',3,4'-Tetrachlorobiphenyl (BZ-42)	EPA 1668A	10129405	NELAP	LA
9075 - 2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ-183)	EPA 1668A	10129405	NELAP	LA
9025 - 2,2',3,4,4',5'-Hexachlorobiphenyl (BZ-138)	EPA 1668A	10129405	NELAP	LA
9133 - 2,2',3,4,4',5,5',6-Octachlorobiphenyl (BZ-203)	EPA 1668A	10129405	NELAP	LA
9134 - 2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ-180)	EPA 1668A	10129405	NELAP	LA
9136 - 2,2',3,4,4',5,6'-Heptachlorobiphenyl (BZ-182)	EPA 1668A	10129405	NELAP	LA
9135 - 2,2',3,4,4',5,6,6'-Octachlorobiphenyl (BZ-204)	EPA 1668A	10129405	NELAP	LA
9137 - 2,2',3,4,4',5,6-Heptachlorobiphenyl (BZ-181)	EPA 1668A	10129405	NELAP	LA
9138 - 2,2',3,4,4',5-Hexachlorobiphenyl (BZ-137)	EPA 1668A	10129405	NELAP	LA
9140 - 2,2',3,4,4',6'-Hexachlorobiphenyl (BZ-140)	EPA 1668A	10129405	NELAP	LA
9139 - 2,2',3,4,4',6,6'-Heptachlorobiphenyl (BZ-184)	EPA 1668A	10129405	NELAP	LA
9141 - 2,2',3,4,4',6-Hexachlorobiphenyl (BZ-139)	EPA 1668A	10129405	NELAP	LA
9142 - 2,2',3,4,4'-Pentachlorobiphenyl (BZ-85)	EPA 1668A	10129405	NELAP	LA
9150 - 2,2',3,4,5',6-Hexachlorobiphenyl (BZ-144)	EPA 1668A	10129405	NELAP	LA
8975 - 2,2',3,4,5'-Pentachlorobiphenyl (BZ-87)	EPA 1668A	10129405	NELAP	LA
9143 - 2,2',3,4,5,5',6-Heptachlorobiphenyl (BZ-185)	EPA 1668A	10129405	NELAP	LA
9030 - 2,2',3,4,5,5'-Hexachlorobiphenyl (BZ-141)	EPA 1668A	10129405	NELAP	LA
9152 - 2,2',3,4,5,6'-Hexachlorobiphenyl (BZ-143)	EPA 1668A	10129405	NELAP	LA
9145 - 2,2',3,4,5,6,6'-Heptachlorobiphenyl (BZ-186)	EPA 1668A	10129405	NELAP	LA
9148 - 2,2',3,4,5,6-Hexachlorobiphenyl (BZ-142)	EPA 1668A	10129405	NELAP	LA
9153 - 2,2',3,4,5-Pentachlorobiphenyl (BZ-86)	EPA 1668A	10129405	NELAP	LA
9161 - 2,2',3,4,6'-Pentachlorobiphenyl (BZ-89)	EPA 1668A	10129405	NELAP	LA
9156 - 2,2',3,4,6,6'-Hexachlorobiphenyl (BZ-145)	EPA 1668A	10129405	NELAP	LA
9158 - 2,2',3,4,6-Pentachlorobiphenyl (BZ-	EPA 1668A	10129405	NELAP	LA

Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
88)				
9163 - 2,2',3,4-Tetrachlorobiphenyl (BZ-41)	EPA 1668A	10129405	NELAP	LA
9166 - 2,2',3,5',6-Pentachlorobiphenyl (BZ-95)	EPA 1668A	10129405	NELAP	LA
8945 - 2,2',3,5'-Tetrachlorobiphenyl (BZ-44)	EPA 1668A	10129405	NELAP	LA
9035 - 2,2',3,5,5',6-Hexachlorobiphenyl (BZ-151)	EPA 1668A	10129405	NELAP	LA
9164 - 2,2',3,5,5'-Pentachlorobiphenyl (BZ-92)	EPA 1668A	10129405	NELAP	LA
9167 - 2,2',3,5,6'-Pentachlorobiphenyl (BZ-94)	EPA 1668A	10129405	NELAP	LA
9165 - 2,2',3,5,6,6'-Hexachlorobiphenyl (BZ-152)	EPA 1668A	10129405	NELAP	LA
9168 - 2,2',3,5,6-Pentachlorobiphenyl (BZ-93)	EPA 1668A	10129405	NELAP	LA
9169 - 2,2',3,5-Tetrachlorobiphenyl (BZ-43)	EPA 1668A	10129405	NELAP	LA
9171 - 2,2',3,6'-Tetrachlorobiphenyl (BZ-46)	EPA 1668A	10129405	NELAP	LA
9170 - 2,2',3,6,6'-Pentachlorobiphenyl (BZ-96)	EPA 1668A	10129405	NELAP	LA
9172 - 2,2',3,6-Tetrachlorobiphenyl (BZ-45)	EPA 1668A	10129405	NELAP	LA
9173 - 2,2',3-Trichlorobiphenyl (BZ-16)	EPA 1668A	10129405	NELAP	LA
9040 - 2,2',4,4',5,5'-Hexachlorobiphenyl (BZ-153)	EPA 1668A	10129405	NELAP	LA
9174 - 2,2',4,4',5,6'-Hexachlorobiphenyl (BZ-154)	EPA 1668A	10129405	NELAP	LA
9175 - 2,2',4,4',5-Pentachlorobiphenyl (BZ-99)	EPA 1668A	10129405	NELAP	LA
9176 - 2,2',4,4',6,6'-Hexachlorobiphenyl (BZ-155)	EPA 1668A	10129405	NELAP	LA
9177 - 2,2',4,4',6-Pentachlorobiphenyl (BZ-100)	EPA 1668A	10129405	NELAP	LA
9178 - 2,2',4,4'-Tetrachlorobiphenyl (BZ-47)	EPA 1668A	10129405	NELAP	LA
9179 - 2,2',4,5',6-Pentachlorobiphenyl (BZ-103)	EPA 1668A	10129405	NELAP	LA
8950 - 2,2',4,5'-Tetrachlorobiphenyl (BZ-49)	EPA 1668A	10129405	NELAP	LA
8980 - 2,2',4,5,5'-Pentachlorobiphenyl (BZ-101)	EPA 1668A	10129405	NELAP	LA
9180 - 2,2',4,5,6'-Pentachlorobiphenyl (BZ-102)	EPA 1668A	10129405	NELAP	LA
9181 - 2,2',4,5-Tetrachlorobiphenyl (BZ-48)	EPA 1668A	10129405	NELAP	LA
9183 - 2,2',4,6'-Tetrachlorobiphenyl (BZ-51)	EPA 1668A	10129405	NELAP	LA
9182 - 2,2',4,6,6'-Pentachlorobiphenyl (BZ-104)	EPA 1668A	10129405	NELAP	LA
9184 - 2,2',4,6-Tetrachlorobiphenyl (BZ-50)	EPA 1668A	10129405	NELAP	LA
9185 - 2,2',4-Trichlorobiphenyl (BZ-17)	EPA 1668A	10129405	NELAP	LA

Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
8955 - 2,2',5,5'-Tetrachlorobiphenyl (BZ-52)	EPA 1668A	10129405	NELAP	LA
9186 - 2,2',5,6'-Tetrachlorobiphenyl (BZ-53)	EPA 1668A	10129405	NELAP	LA
8930 - 2,2',5-Trichlorobiphenyl (BZ-18)	EPA 1668A	10129405	NELAP	LA
9187 - 2,2',6,6'-Tetrachlorobiphenyl (BZ-54)	EPA 1668A	10129405	NELAP	LA
9188 - 2,2',6-Trichlorobiphenyl (BZ-19)	EPA 1668A	10129405	NELAP	LA
9189 - 2,2'-Dichlorobiphenyl (BZ-4)	EPA 1668A	10129405	NELAP	LA
9224 - 2,3',4',5',6-Pentachlorobiphenyl (BZ-125)	EPA 1668A	10129405	NELAP	LA
9229 - 2,3',4',5'-Tetrachlorobiphenyl (BZ-76)	EPA 1668A	10129405	NELAP	LA
9222 - 2,3',4',5,5'-Pentachlorobiphenyl (BZ-124)	EPA 1668A	10129405	NELAP	LA
9230 - 2,3',4',5-Tetrachlorobiphenyl (BZ-70)	EPA 1668A	10129405	NELAP	LA
9237 - 2,3',4',6-Tetrachlorobiphenyl (BZ-71)	EPA 1668A	10129405	NELAP	LA
9239 - 2,3',4'-Trichlorobiphenyl (BZ-33)	EPA 1668A	10129405	NELAP	LA
9218 - 2,3',4,4',5',6-Hexachlorobiphenyl (BZ-168)	EPA 1668A	10129405	NELAP	LA
9011 - 2,3',4,4',5'-Pentachlorobiphenyl (BZ-123)	EPA 1668A	10129405	NELAP	LA
9000 - 2,3',4,4',5'-Pentachlorobiphenyl (BZ-123)	EPA 1668A	10129405	NELAP	LA
9055 - 2,3',4,4',5,5'-Hexachlorobiphenyl (BZ-167)	EPA 1668A	10129405	NELAP	LA
8995 - 2,3',4,4',5-Pentachlorobiphenyl (BZ-118)	EPA 1668A	10129405	NELAP	LA
9220 - 2,3',4,4',6-Pentachlorobiphenyl (BZ-119)	EPA 1668A	10129405	NELAP	LA
8960 - 2,3',4,4'-Tetrachlorobiphenyl (BZ-66)	EPA 1668A	10129405	NELAP	LA
9226 - 2,3',4,5',6-Pentachlorobiphenyl (BZ-121)	EPA 1668A	10129405	NELAP	LA
9231 - 2,3',4,5'-Tetrachlorobiphenyl (BZ-68)	EPA 1668A	10129405	NELAP	LA
9223 - 2,3',4,5,5'-Pentachlorobiphenyl (BZ-120)	EPA 1668A	10129405	NELAP	LA
9232 - 2,3',4,5-Tetrachlorobiphenyl (BZ-67)	EPA 1668A	10129405	NELAP	LA
9235 - 2,3',4,6-Tetrachlorobiphenyl (BZ-69)	EPA 1668A	10129405	NELAP	LA
9240 - 2,3',4-Trichlorobiphenyl (BZ-25)	EPA 1668A	10129405	NELAP	LA
9244 - 2,3',5',6-Tetrachlorobiphenyl (BZ-73)	EPA 1668A	10129405	NELAP	LA
9246 - 2,3',5'-Trichlorobiphenyl (BZ-34)	EPA 1668A	10129405	NELAP	LA
9242 - 2,3',5,5'-Tetrachlorobiphenyl (BZ-72)	EPA 1668A	10129405	NELAP	LA
8935 - 2,3',5-Trichlorobiphenyl (BZ-26)	EPA 1668A	10129405	NELAP	LA
9248 - 2,3',6-Trichlorobiphenyl (BZ-27)	EPA 1668A	10129405	NELAP	LA
9249 - 2,3'-Dichlorobiphenyl (BZ-6)	EPA 1668A	10129405	NELAP	LA
9201 - 2,3,3',4',5',6-Hexachlorobiphenyl (BZ-164)	EPA 1668A	10129405	NELAP	LA

Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
9202 - 2,3,3',4',5'-Pentachlorobiphenyl (BZ-122)	EPA 1668A	10129405	NELAP	LA
9195 - 2,3,3',4',5,5',6-Heptachlorobiphenyl (BZ-193)	EPA 1668A	10129405	NELAP	LA
9197 - 2,3,3',4',5,5'-Hexachlorobiphenyl (BZ-162)	EPA 1668A	10129405	NELAP	LA
9199 - 2,3,3',4',5,6-Hexachlorobiphenyl (BZ-163)	EPA 1668A	10129405	NELAP	LA
9205 - 2,3,3',4',5-Pentachlorobiphenyl (BZ-107)	EPA 1668A	10129405	NELAP	LA
8990 - 2,3,3',4',6-Pentachlorobiphenyl (BZ-110)	EPA 1668A	10129405	NELAP	LA
9207 - 2,3,3',4'-Tetrachlorobiphenyl (BZ-56)	EPA 1668A	10129405	NELAP	LA
9192 - 2,3,3',4,4',5',6-Heptachlorobiphenyl (BZ-191)	EPA 1668A	10129405	NELAP	LA
9045 - 2,3,3',4,4',5'-Hexachlorobiphenyl (BZ-157)	EPA 1668A	10129405	NELAP	LA
9190 - 2,3,3',4,4',5,5',6-Octachlorobiphenyl (BZ-205)	EPA 1668A	10129405	NELAP	LA
9085 - 2,3,3',4,4',5,5'-Heptachlorobiphenyl (BZ-189)	EPA 1668A	10129405	NELAP	LA
9191 - 2,3,3',4,4',5,6-Heptachlorobiphenyl (BZ-190)	EPA 1668A	10129405	NELAP	LA
9050 - 2,3,3',4,4',5-Hexachlorobiphenyl (BZ-156)	EPA 1668A	10129405	NELAP	LA
9193 - 2,3,3',4,4',6-Hexachlorobiphenyl (BZ-158)	EPA 1668A	10129405	NELAP	LA
8985 - 2,3,3',4,4'-Pentachlorobiphenyl (BZ-105)	EPA 1668A	10129405	NELAP	LA
9200 - 2,3,3',4,5',6-Hexachlorobiphenyl (BZ-161)	EPA 1668A	10129405	NELAP	LA
9203 - 2,3,3',4,5'-Pentachlorobiphenyl (BZ-108)	EPA 1668A	10129405	NELAP	LA
9194 - 2,3,3',4,5,5',6-Heptachlorobiphenyl (BZ-192)	EPA 1668A	10129405	NELAP	LA
9196 - 2,3,3',4,5,5'-Hexachlorobiphenyl (BZ-159)	EPA 1668A	10129405	NELAP	LA
9198 - 2,3,3',4,5,6-Hexachlorobiphenyl (BZ-160)	EPA 1668A	10129405	NELAP	LA
9204 - 2,3,3',4,5-Pentachlorobiphenyl (BZ-106)	EPA 1668A	10129405	NELAP	LA
9206 - 2,3,3',4,6-Pentachlorobiphenyl (BZ-109)	EPA 1668A	10129405	NELAP	LA
9208 - 2,3,3',4-Tetrachlorobiphenyl (BZ-55)	EPA 1668A	10129405	NELAP	LA
9212 - 2,3,3',5',6-Pentachlorobiphenyl (BZ-113)	EPA 1668A	10129405	NELAP	LA
9213 - 2,3,3',5'-Tetrachlorobiphenyl (BZ-58)	EPA 1668A	10129405	NELAP	LA
9209 - 2,3,3',5,5',6-Hexachlorobiphenyl (BZ-165)	EPA 1668A	10129405	NELAP	LA
9210 - 2,3,3',5,5'-Pentachlorobiphenyl (BZ-111)	EPA 1668A	10129405	NELAP	LA
9211 - 2,3,3',5,6-Pentachlorobiphenyl (BZ-	EPA 1668A	10129405	NELAP	LA

Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
112)				
9214 - 2,3,3',5-Tetrachlorobiphenyl (BZ-57)	EPA 1668A	10129405	NELAP	LA
9215 - 2,3,3',6-Tetrachlorobiphenyl (BZ-59)	EPA 1668A	10129405	NELAP	LA
9216 - 2,3,3'-Trichlorobiphenyl (BZ-20)	EPA 1668A	10129405	NELAP	LA
9227 - 2,3,4',5,6-Pentachlorobiphenyl (BZ-117)	EPA 1668A	10129405	NELAP	LA
9233 - 2,3,4',5-Tetrachlorobiphenyl (BZ-63)	EPA 1668A	10129405	NELAP	LA
9236 - 2,3,4',6-Tetrachlorobiphenyl (BZ-64)	EPA 1668A	10129405	NELAP	LA
9241 - 2,3,4'-Trichlorobiphenyl (BZ-22)	EPA 1668A	10129405	NELAP	LA
9217 - 2,3,4,4',5,6-Hexachlorobiphenyl (BZ-166)	EPA 1668A	10129405	NELAP	LA
9005 - 2,3,4,4',5-Pentachlorobiphenyl (BZ-114)	EPA 1668A	10129405	NELAP	LA
9219 - 2,3,4,4',6-Pentachlorobiphenyl (BZ-115)	EPA 1668A	10129405	NELAP	LA
9221 - 2,3,4,4'-Tetrachlorobiphenyl (BZ-60)	EPA 1668A	10129405	NELAP	LA
9225 - 2,3,4,5,6-Pentachlorobiphenyl (BZ-116)	EPA 1668A	10129405	NELAP	LA
9228 - 2,3,4,5-Tetrachlorobiphenyl (BZ-61)	EPA 1668A	10129405	NELAP	LA
9234 - 2,3,4,6-Tetrachlorobiphenyl (BZ-62)	EPA 1668A	10129405	NELAP	LA
9238 - 2,3,4-Trichlorobiphenyl (BZ-21)	EPA 1668A	10129405	NELAP	LA
9243 - 2,3,5,6-Tetrachlorobiphenyl (BZ-65)	EPA 1668A	10129405	NELAP	LA
9245 - 2,3,5-Trichlorobiphenyl (BZ-23)	EPA 1668A	10129405	NELAP	LA
9247 - 2,3,6-Trichlorobiphenyl (BZ-24)	EPA 1668A	10129405	NELAP	LA
8920 - 2,3-Dichlorobiphenyl (BZ-5)	EPA 1668A	10129405	NELAP	LA
8940 - 2,4',5-Trichlorobiphenyl (BZ-31)	EPA 1668A	10129405	NELAP	LA
9255 - 2,4',6-Trichlorobiphenyl (BZ-32)	EPA 1668A	10129405	NELAP	LA
9256 - 2,4'-Dichlorobiphenyl (BZ-8)	EPA 1668A	10129405	NELAP	LA
9250 - 2,4,4',5-Tetrachlorobiphenyl (BZ-74)	EPA 1668A	10129405	NELAP	LA
9251 - 2,4,4',6-Tetrachlorobiphenyl (BZ-75)	EPA 1668A	10129405	NELAP	LA
9252 - 2,4,4'-Trichlorobiphenyl (BZ-28)	EPA 1668A	10129405	NELAP	LA
9253 - 2,4,5-Trichlorobiphenyl (BZ-29)	EPA 1668A	10129405	NELAP	LA
9254 - 2,4,6-Trichlorobiphenyl (BZ-30)	EPA 1668A	10129405	NELAP	LA
9257 - 2,4-Dichlorobiphenyl (BZ-7)	EPA 1668A	10129405	NELAP	LA
9258 - 2,5-Dichlorobiphenyl (BZ-9)	EPA 1668A	10129405	NELAP	LA
9259 - 2,6-Dichlorobiphenyl (BZ-10)	EPA 1668A	10129405	NELAP	LA
8915 - 2-Chlorobiphenyl (BZ-1)	EPA 1668A	10129405	NELAP	LA
9060 - 3,3',4,4',5,5'-Hexachlorobiphenyl (BZ-169)	EPA 1668A	10129405	NELAP	LA
9015 - 3,3',4,4',5-Pentachlorobiphenyl (BZ-126)	EPA 1668A	10129405	NELAP	LA
8965 - 3,3',4,4'-Tetrachlorobiphenyl (BZ-77)	EPA 1668A	10129405	NELAP	LA
9261 - 3,3',4,5'-Tetrachlorobiphenyl (BZ-79)	EPA 1668A	10129405	NELAP	LA

Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
9260 - 3,3',4,5,5'-Pentachlorobiphenyl (BZ-127)	EPA 1668A	10129405	NELAP	LA
9262 - 3,3',4,5-Tetrachlorobiphenyl (BZ-78)	EPA 1668A	10129405	NELAP	LA
9263 - 3,3',4-Trichlorobiphenyl (BZ-35)	EPA 1668A	10129405	NELAP	LA
9264 - 3,3',5,5'-Tetrachlorobiphenyl (BZ-80)	EPA 1668A	10129405	NELAP	LA
9265 - 3,3',5-Trichlorobiphenyl (BZ-36)	EPA 1668A	10129405	NELAP	LA
8925 - 3,3'-Dichlorobiphenyl (BZ-11)	EPA 1668A	10129405	NELAP	LA
9268 - 3,4',5-Trichlorobiphenyl (BZ-39)	EPA 1668A	10129405	NELAP	LA
9269 - 3,4'-Dichlorobiphenyl (BZ-13)	EPA 1668A	10129405	NELAP	LA
8970 - 3,4,4',5-Tetrachlorobiphenyl (BZ-81)	EPA 1668A	10129405	NELAP	LA
9266 - 3,4,4'-Trichlorobiphenyl (BZ-37)	EPA 1668A	10129405	NELAP	LA
9267 - 3,4,5-Trichlorobiphenyl (BZ-38)	EPA 1668A	10129405	NELAP	LA
9270 - 3,4-Dichlorobiphenyl (BZ-12)	EPA 1668A	10129405	NELAP	LA
9271 - 3,5-Dichlorobiphenyl (BZ-14)	EPA 1668A	10129405	NELAP	LA
9272 - 3-Chlorobiphenyl (BZ-2)	EPA 1668A	10129405	NELAP	LA
9273 - 4,4'-Dichlorobiphenyl (BZ-15)	EPA 1668A	10129405	NELAP	LA
9274 - 4-Chlorobiphenyl (BZ-3)	EPA 1668A	10129405	NELAP	LA
8580 - 2,4'-DDD	EPA 1699	10133105	NELAP	LA
8585 - 2,4'-DDE	EPA 1699	10133105	NELAP	LA
8590 - 2,4'-DDT	EPA 1699	10133105	NELAP	LA
7355 - 4,4'-DDD	EPA 1699	10133105	NELAP	LA
7360 - 4,4'-DDE	EPA 1699	10133105	NELAP	LA
7361 - 4,4'-DDMU	EPA 1699	10133105	NELAP	LA
7365 - 4,4'-DDT	EPA 1699	10133105	NELAP	LA
7025 - Aldrin	EPA 1699	10133105	NELAP	LA
7470 - Dieldrin	EPA 1699	10133105	NELAP	LA
7510 - Endosulfan I	EPA 1699	10133105	NELAP	LA
7515 - Endosulfan II	EPA 1699	10133105	NELAP	LA
7520 - Endosulfan sulfate	EPA 1699	10133105	NELAP	LA
7540 - Endrin	EPA 1699	10133105	NELAP	LA
7530 - Endrin aldehyde	EPA 1699	10133105	NELAP	LA
7535 - Endrin ketone	EPA 1699	10133105	NELAP	LA
7685 - Heptachlor	EPA 1699	10133105	NELAP	LA
7690 - Heptachlor epoxide	EPA 1699	10133105	NELAP	LA
7810 - Methoxychlor	EPA 1699	10133105	NELAP	LA
7870 - Mirex	EPA 1699	10133105	NELAP	LA
7110 - alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 1699	10133105	NELAP	LA
7240 - alpha-Chlordane	EPA 1699	10133105	NELAP	LA
7115 - beta-BHC (beta-Hexachlorocyclohexane)	EPA 1699	10133105	NELAP	LA
7925 - cis-Nonachlor	EPA 1699	10133105	NELAP	LA
7105 - delta-BHC	EPA 1699	10133105	NELAP	LA
7120 - gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 1699	10133105	NELAP	LA
7245 - gamma-Chlordane	EPA 1699	10133105	NELAP	LA
7910 - trans-Nonachlor	EPA 1699	10133105	NELAP	LA
1444 - Separatory Funnel Liquid-liquid extraction	EPA 3510C	10138202	NELAP	LA
1452 - Soxhlet Extraction	EPA 3540C	10140202	NELAP	LA
1030 - Cadmium	EPA 6020	10156000	NELAP	LA
1040 - Chromium	EPA 6020	10156000	NELAP	LA

Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
1050 - Cobalt	EPA 6020	10156000	NELAP	LA
1055 - Copper	EPA 6020	10156000	NELAP	LA
1070 - Iron	EPA 6020	10156000	NELAP	LA
1075 - Lead	EPA 6020	10156000	NELAP	LA
1090 - Manganese	EPA 6020	10156000	NELAP	LA
1095 - Mercury	EPA 6020	10156000	NELAP	LA
1100 - Molybdenum	EPA 6020	10156000	NELAP	LA
1105 - Nickel	EPA 6020	10156000	NELAP	LA
1140 - Selenium	EPA 6020	10156000	NELAP	LA
1150 - Silver	EPA 6020	10156000	NELAP	LA
1165 - Thallium	EPA 6020	10156000	NELAP	LA
1175 - Tin	EPA 6020	10156000	NELAP	LA
1910 - Total Phosphorus	EPA 6020	10156000	NELAP	LA
1185 - Vanadium	EPA 6020	10156000	NELAP	LA
1190 - Zinc	EPA 6020	10156000	NELAP	LA
1030 - Cadmium	EPA 6020	10156204	NELAP	LA
1040 - Chromium	EPA 6020	10156204	NELAP	LA
1050 - Cobalt	EPA 6020	10156204	NELAP	LA
1055 - Copper	EPA 6020	10156204	NELAP	LA
1070 - Iron	EPA 6020	10156204	NELAP	LA
1075 - Lead	EPA 6020	10156204	NELAP	LA
1090 - Manganese	EPA 6020	10156204	NELAP	LA
1095 - Mercury	EPA 6020	10156204	NELAP	LA
1100 - Molybdenum	EPA 6020	10156204	NELAP	LA
1105 - Nickel	EPA 6020	10156204	NELAP	LA
1140 - Selenium	EPA 6020	10156204	NELAP	LA
1150 - Silver	EPA 6020	10156204	NELAP	LA
1165 - Thallium	EPA 6020	10156204	NELAP	LA
1175 - Tin	EPA 6020	10156204	NELAP	LA
1910 - Total Phosphorus	EPA 6020	10156204	NELAP	LA
1185 - Vanadium	EPA 6020	10156204	NELAP	LA
1190 - Zinc	EPA 6020	10156204	NELAP	LA
1000 - Aluminum	EPA 6020A	10156408	NELAP	LA
1005 - Antimony	EPA 6020A	10156408	NELAP	LA
1010 - Arsenic	EPA 6020A	10156408	NELAP	LA
1015 - Barium	EPA 6020A	10156408	NELAP	LA
1020 - Beryllium	EPA 6020A	10156408	NELAP	LA
1030 - Cadmium	EPA 6020A	10156408	NELAP	LA
1040 - Chromium	EPA 6020A	10156408	NELAP	LA
1050 - Cobalt	EPA 6020A	10156408	NELAP	LA
1055 - Copper	EPA 6020A	10156408	NELAP	LA
1070 - Iron	EPA 6020A	10156408	NELAP	LA
1075 - Lead	EPA 6020A	10156408	NELAP	LA
1090 - Manganese	EPA 6020A	10156408	NELAP	LA
1100 - Molybdenum	EPA 6020A	10156408	NELAP	LA
1105 - Nickel	EPA 6020A	10156408	NELAP	LA
1909 - Phosphorus	EPA 6020A	10156408	NELAP	LA
1140 - Selenium	EPA 6020A	10156408	NELAP	LA
1150 - Silver	EPA 6020A	10156408	NELAP	LA
1165 - Thallium	EPA 6020A	10156408	NELAP	LA
1175 - Tin	EPA 6020A	10156408	NELAP	LA
1910 - Total Phosphorus	EPA 6020A	10156408	NELAP	LA
1185 - Vanadium	EPA 6020A	10156408	NELAP	LA
1190 - Zinc	EPA 6020A	10156408	NELAP	LA
1000 - Aluminum	EPA 6020A, Rev.1	10156419	NELAP	LA

Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
1005 - Antimony	EPA 6020A, Rev.1	10156419	NELAP	LA
1010 - Arsenic	EPA 6020A, Rev.1	10156419	NELAP	LA
1015 - Barium	EPA 6020A, Rev.1	10156419	NELAP	LA
1020 - Beryllium	EPA 6020A, Rev.1	10156419	NELAP	LA
1030 - Cadmium	EPA 6020A, Rev.1	10156419	NELAP	LA
1040 - Chromium	EPA 6020A, Rev.1	10156419	NELAP	LA
1050 - Cobalt	EPA 6020A, Rev.1	10156419	NELAP	LA
1055 - Copper	EPA 6020A, Rev.1	10156419	NELAP	LA
1070 - Iron	EPA 6020A, Rev.1	10156419	NELAP	LA
1075 - Lead	EPA 6020A, Rev.1	10156419	NELAP	LA
1090 - Manganese	EPA 6020A, Rev.1	10156419	NELAP	LA
1100 - Molybdenum	EPA 6020A, Rev.1	10156419	NELAP	LA
1105 - Nickel	EPA 6020A, Rev.1	10156419	NELAP	LA
1140 - Selenium	EPA 6020A, Rev.1	10156419	NELAP	LA
1150 - Silver	EPA 6020A, Rev.1	10156419	NELAP	LA
1165 - Thallium	EPA 6020A, Rev.1	10156419	NELAP	LA
1175 - Tin	EPA 6020A, Rev.1	10156419	NELAP	LA
1185 - Vanadium	EPA 6020A, Rev.1	10156419	NELAP	LA
1190 - Zinc	EPA 6020A, Rev.1	10156419	NELAP	LA
5160 - 1,1,1-Trichloroethane	EPA 8260B	10184802	NELAP	LA
5110 - 1,1,2,2-Tetrachloroethane	EPA 8260B	10184802	NELAP	LA
5165 - 1,1,2-Trichloroethane	EPA 8260B	10184802	NELAP	LA
4630 - 1,1-Dichloroethane	EPA 8260B	10184802	NELAP	LA
5180 - 1,2,3-Trichloropropane	EPA 8260B	10184802	NELAP	LA
4635 - 1,2-Dichloroethane (Ethylene dichloride)	EPA 8260B	10184802	NELAP	LA
4655 - 1,2-Dichloropropane	EPA 8260B	10184802	NELAP	LA
4410 - 2-Butanone (Methyl ethyl ketone, MEK)	EPA 8260B	10184802	NELAP	LA
4860 - 2-Hexanone	EPA 8260B	10184802	NELAP	LA
4315 - Acetone	EPA 8260B	10184802	NELAP	LA
4375 - Benzene	EPA 8260B	10184802	NELAP	LA
4395 - Bromodichloromethane	EPA 8260B	10184802	NELAP	LA
4400 - Bromoform	EPA 8260B	10184802	NELAP	LA
4450 - Carbon disulfide	EPA 8260B	10184802	NELAP	LA
4455 - Carbon tetrachloride	EPA 8260B	10184802	NELAP	LA
4475 - Chlorobenzene	EPA 8260B	10184802	NELAP	LA
4575 - Chlorodibromomethane	EPA 8260B	10184802	NELAP	LA
4485 - Chloroethane (Ethyl chloride)	EPA 8260B	10184802	NELAP	LA
4505 - Chloroform	EPA 8260B	10184802	NELAP	LA
4595 - Dibromomethane (Methylene bromide)	EPA 8260B	10184802	NELAP	LA
4765 - Ethylbenzene	EPA 8260B	10184802	NELAP	LA
4950 - Methyl bromide (Bromomethane)	EPA 8260B	10184802	NELAP	LA
4960 - Methyl chloride (Chloromethane)	EPA 8260B	10184802	NELAP	LA
4975 - Methylene chloride (Dichloromethane)	EPA 8260B	10184802	NELAP	LA
5100 - Styrene	EPA 8260B	10184802	NELAP	LA
5115 - Tetrachloroethylene (Perchloroethylene)	EPA 8260B	10184802	NELAP	LA
5140 - Toluene	EPA 8260B	10184802	NELAP	LA
5170 - Trichloroethene (Trichloroethylene)	EPA 8260B	10184802	NELAP	LA
5175 - Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	EPA 8260B	10184802	NELAP	LA
5235 - Vinyl chloride	EPA 8260B	10184802	NELAP	LA

Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
4705 - cis & trans-1,2-Dichloroethene	EPA 8260B	10184802	NELAP	LA
4645 - cis-1,2-Dichloroethylene	EPA 8260B	10184802	NELAP	LA
4680 - cis-1,3-Dichloropropene	EPA 8260B	10184802	NELAP	LA
5240 - m+p-xylene	EPA 8260B	10184802	NELAP	LA
5245 - m-Xylene	EPA 8260B	10184802	NELAP	LA
5250 - o-Xylene	EPA 8260B	10184802	NELAP	LA
5255 - p-Xylene	EPA 8260B	10184802	NELAP	LA
4700 - trans-1,2-Dichloroethylene	EPA 8260B	10184802	NELAP	LA
4685 - trans-1,3-Dichloropropylene	EPA 8260B	10184802	NELAP	LA
6703 - 1,1'-Biphenyl (BZ-0)	EPA 8270D	10186002	NELAP	LA
6715 - 1,2,4,5-Tetrachlorobenzene	EPA 8270D	10186002	NELAP	LA
5155 - 1,2,4-Trichlorobenzene	EPA 8270D	10186002	NELAP	LA
4610 - 1,2-Dichlorobenzene	EPA 8270D	10186002	NELAP	LA
6885 - 1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8270D	10186002	NELAP	LA
4615 - 1,3-Dichlorobenzene	EPA 8270D	10186002	NELAP	LA
6160 - 1,3-Dinitrobenzene (1,3-DNB)	EPA 8270D	10186002	NELAP	LA
4835 - 1,3-Hexachlorobutadiene	EPA 8270D	10186002	NELAP	LA
4620 - 1,4-Dichlorobenzene	EPA 8270D	10186002	NELAP	LA
5790 - 1-Chloronaphthalene	EPA 8270D	10186002	NELAP	LA
6425 - 1-Naphthylamine	EPA 8270D	10186002	NELAP	LA
6735 - 2,3,4,6-Tetrachlorophenol	EPA 8270D	10186002	NELAP	LA
6835 - 2,4,5-Trichlorophenol	EPA 8270D	10186002	NELAP	LA
6840 - 2,4,6-Trichlorophenol	EPA 8270D	10186002	NELAP	LA
6000 - 2,4-Dichlorophenol	EPA 8270D	10186002	NELAP	LA
6130 - 2,4-Dimethylphenol	EPA 8270D	10186002	NELAP	LA
6175 - 2,4-Dinitrophenol	EPA 8270D	10186002	NELAP	LA
6185 - 2,4-Dinitrotoluene (2,4-DNT)	EPA 8270D	10186002	NELAP	LA
6005 - 2,6-Dichlorophenol	EPA 8270D	10186002	NELAP	LA
6190 - 2,6-Dinitrotoluene (2,6-DNT)	EPA 8270D	10186002	NELAP	LA
5515 - 2-Acetylaminofluorene	EPA 8270D	10186002	NELAP	LA
5795 - 2-Chloronaphthalene	EPA 8270D	10186002	NELAP	LA
5800 - 2-Chlorophenol	EPA 8270D	10186002	NELAP	LA
6360 - 2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	EPA 8270D	10186002	NELAP	LA
5145 - 2-Methylaniline (o-Toluidine)	EPA 8270D	10186002	NELAP	LA
6385 - 2-Methylnaphthalene	EPA 8270D	10186002	NELAP	LA
6400 - 2-Methylphenol (o-Cresol)	EPA 8270D	10186002	NELAP	LA
6430 - 2-Naphthylamine	EPA 8270D	10186002	NELAP	LA
6460 - 2-Nitroaniline	EPA 8270D	10186002	NELAP	LA
6490 - 2-Nitrophenol	EPA 8270D	10186002	NELAP	LA
6355 - 3-Methylcholanthrene	EPA 8270D	10186002	NELAP	LA
6405 - 3-Methylphenol (m-Cresol)	EPA 8270D	10186002	NELAP	LA
6465 - 3-Nitroaniline	EPA 8270D	10186002	NELAP	LA
5540 - 4-Aminobiphenyl	EPA 8270D	10186002	NELAP	LA
5660 - 4-Bromophenyl phenyl ether	EPA 8270D	10186002	NELAP	LA
5700 - 4-Chloro-3-methylphenol	EPA 8270D	10186002	NELAP	LA
5745 - 4-Chloroaniline	EPA 8270D	10186002	NELAP	LA
5825 - 4-Chlorophenyl phenylether	EPA 8270D	10186002	NELAP	LA
6410 - 4-Methylphenol (p-Cresol)	EPA 8270D	10186002	NELAP	LA
6470 - 4-Nitroaniline	EPA 8270D	10186002	NELAP	LA
6500 - 4-Nitrophenol	EPA 8270D	10186002	NELAP	LA
6115 - 7,12-Dimethylbenz(a) anthracene	EPA 8270D	10186002	NELAP	LA
9417 - 7h-Dibenzo(c,g) carbazole	EPA 8270D	10186002	NELAP	LA
5500 - Acenaphthene	EPA 8270D	10186002	NELAP	LA
5505 - Acenaphthylene	EPA 8270D	10186002	NELAP	LA

Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
5510 - Acetophenone	EPA 8270D	10186002	NELAP	LA
5545 - Aniline	EPA 8270D	10186002	NELAP	LA
5555 - Anthracene	EPA 8270D	10186002	NELAP	LA
5575 - Benz(a)anthracene	EPA 8270D	10186002	NELAP	LA
5580 - Benzo(a)pyrene	EPA 8270D	10186002	NELAP	LA
5585 - Benzo(b)fluoranthene	EPA 8270D	10186002	NELAP	LA
5590 - Benzo(g,h,i)perylene	EPA 8270D	10186002	NELAP	LA
5600 - Benzo(k)fluoranthene	EPA 8270D	10186002	NELAP	LA
5630 - Benzyl alcohol	EPA 8270D	10186002	NELAP	LA
5670 - Butyl benzyl phthalate	EPA 8270D	10186002	NELAP	LA
5855 - Chrysene	EPA 8270D	10186002	NELAP	LA
6065 - Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate, DEHP)	EPA 8270D	10186002	NELAP	LA
5925 - Di-n-butyl phthalate	EPA 8270D	10186002	NELAP	LA
6200 - Di-n-octyl phthalate	EPA 8270D	10186002	NELAP	LA
9354 - Dibenz(a, h) acridine	EPA 8270D	10186002	NELAP	LA
5900 - Dibenz(a, j) acridine	EPA 8270D	10186002	NELAP	LA
5895 - Dibenz(a,h)anthracene	EPA 8270D	10186002	NELAP	LA
5890 - Dibenzo(a,e) pyrene	EPA 8270D	10186002	NELAP	LA
9348 - Dibenzo(a,h) pyrene	EPA 8270D	10186002	NELAP	LA
9351 - Dibenzo(a,i) pyrene	EPA 8270D	10186002	NELAP	LA
5905 - Dibenzofuran	EPA 8270D	10186002	NELAP	LA
6070 - Diethyl phthalate	EPA 8270D	10186002	NELAP	LA
6135 - Dimethyl phthalate	EPA 8270D	10186002	NELAP	LA
8620 - Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 8270D	10186002	NELAP	LA
6205 - Diphenylamine	EPA 8270D	10186002	NELAP	LA
6260 - Ethyl methanesulfonate	EPA 8270D	10186002	NELAP	LA
6265 - Fluoranthene	EPA 8270D	10186002	NELAP	LA
6270 - Fluorene	EPA 8270D	10186002	NELAP	LA
6275 - Hexachlorobenzene	EPA 8270D	10186002	NELAP	LA
6285 - Hexachlorocyclopentadiene	EPA 8270D	10186002	NELAP	LA
4840 - Hexachloroethane	EPA 8270D	10186002	NELAP	LA
6295 - Hexachloropropene	EPA 8270D	10186002	NELAP	LA
6315 - Indeno(1,2,3-cd)pyrene	EPA 8270D	10186002	NELAP	LA
6320 - Isophorone	EPA 8270D	10186002	NELAP	LA
6325 - Isosafrole	EPA 8270D	10186002	NELAP	LA
6375 - Methyl methanesulfonate	EPA 8270D	10186002	NELAP	LA
5005 - Naphthalene	EPA 8270D	10186002	NELAP	LA
6590 - Pentachlorobenzene	EPA 8270D	10186002	NELAP	LA
5035 - Pentachloroethane	EPA 8270D	10186002	NELAP	LA
6600 - Pentachloronitrobenzene	EPA 8270D	10186002	NELAP	LA
6605 - Pentachlorophenol	EPA 8270D	10186002	NELAP	LA
6610 - Phenacetin	EPA 8270D	10186002	NELAP	LA
6615 - Phenanthrene	EPA 8270D	10186002	NELAP	LA
6625 - Phenol	EPA 8270D	10186002	NELAP	LA
6665 - Pyrene	EPA 8270D	10186002	NELAP	LA
6685 - Safrole	EPA 8270D	10186002	NELAP	LA
5760 - bis(2-Chloroethoxy)methane	EPA 8270D	10186002	NELAP	LA
5765 - bis(2-Chloroethyl) ether	EPA 8270D	10186002	NELAP	LA
5780 - bis(2-Chloroisopropyl) ether	EPA 8270D	10186002	NELAP	LA
5025 - n-Nitroso-di-n-butylamine	EPA 8270D	10186002	NELAP	LA
6545 - n-Nitrosodi-n-propylamine	EPA 8270D	10186002	NELAP	LA
6525 - n-Nitrosodiethylamine	EPA 8270D	10186002	NELAP	LA
6530 - n-Nitrosodimethylamine	EPA 8270D	10186002	NELAP	LA

Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
6535 - n-Nitrosodiphenylamine	EPA 8270D	10186002	NELAP	LA
6550 - n-Nitrosomethylethylamine	EPA 8270D	10186002	NELAP	LA
6555 - n-Nitrosomorpholine	EPA 8270D	10186002	NELAP	LA
6560 - n-Nitrosopiperidine	EPA 8270D	10186002	NELAP	LA
6565 - n-Nitrosopyrrolidine	EPA 8270D	10186002	NELAP	LA
6105 - p-Dimethylaminoazobenzene	EPA 8270D	10186002	NELAP	LA
9519 - 1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	EPA 8290	10187209	NELAP	LA
9516 - 1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	EPA 8290	10187209	NELAP	LA
9426 - 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)	EPA 8290	10187209	NELAP	LA
9420 - 1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)	EPA 8290	10187209	NELAP	LA
9423 - 1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)	EPA 8290	10187209	NELAP	LA
9453 - 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd)	EPA 8290	10187209	NELAP	LA
9471 - 1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-Hxcdf)	EPA 8290	10187209	NELAP	LA
9456 - 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin(1,2,3,6,7,8-Hxcdd)	EPA 8290	10187209	NELAP	LA
9474 - 1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf)	EPA 8290	10187209	NELAP	LA
9459 - 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd)	EPA 8290	10187209	NELAP	LA
9477 - 1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf)	EPA 8290	10187209	NELAP	LA
9540 - 1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd)	EPA 8290	10187209	NELAP	LA
9543 - 1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf)	EPA 8290	10187209	NELAP	LA
9480 - 2,3,4,6,7,8-Hexachlorodibenzofuran	EPA 8290	10187209	NELAP	LA
9549 - 2,3,4,7,8-Pentachlorodibenzofuran	EPA 8290	10187209	NELAP	LA
9618 - 2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD)	EPA 8290	10187209	NELAP	LA
9612 - 2,3,7,8-Tetrachlorodibenzofuran	EPA 8290	10187209	NELAP	LA
9438 - Total Hpcdd	EPA 8290	10187209	NELAP	LA
9444 - Total Hpcdf	EPA 8290	10187209	NELAP	LA
9468 - Total Hxcdd	EPA 8290	10187209	NELAP	LA
9483 - Total Hxcdf	EPA 8290	10187209	NELAP	LA
9555 - Total Pecdd	EPA 8290	10187209	NELAP	LA
9552 - Total Pecdf	EPA 8290	10187209	NELAP	LA
9609 - Total TCDD	EPA 8290	10187209	NELAP	LA
9615 - Total TCDF	EPA 8290	10187209	NELAP	LA
9618 - 2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD)	EPA 1613B	10257600	NELAP	LA
9105 - 2,2',3,3',4,4',5,5',6,6'-Decachlorobiphenyl (BZ-209)	EPA 1668C	10262109	NELAP	LA
9095 - 2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ-206)	EPA 1668C	10262109	NELAP	LA
9090 - 2,2',3,3',4,4',5,5'-Octachlorobiphenyl (BZ-194)	EPA 1668C	10262109	NELAP	LA

Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
9102 - 2,2',3,3',4,4',5,6'-Octachlorobiphenyl (BZ-196)	EPA 1668C	10262109	NELAP	LA
9101 - 2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl (BZ-207)	EPA 1668C	10262109	NELAP	LA
9103 - 2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ-195)	EPA 1668C	10262109	NELAP	LA
9065 - 2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ-170)	EPA 1668C	10262109	NELAP	LA
9104 - 2,2',3,3',4,4',6,6'-Octachlorobiphenyl (BZ-197)	EPA 1668C	10262109	NELAP	LA
9106 - 2,2',3,3',4,4',6-Heptachlorobiphenyl (BZ-171)	EPA 1668C	10262109	NELAP	LA
9020 - 2,2',3,3',4,4'-Hexachlorobiphenyl (BZ-128)	EPA 1668C	10262109	NELAP	LA
9114 - 2,2',3,3',4,5',6'-Heptachlorobiphenyl (BZ-177)	EPA 1668C	10262109	NELAP	LA
9112 - 2,2',3,3',4,5',6,6'-Octachlorobiphenyl (BZ-201)	EPA 1668C	10262109	NELAP	LA
9115 - 2,2',3,3',4,5',6-Heptachlorobiphenyl (BZ-175)	EPA 1668C	10262109	NELAP	LA
9117 - 2,2',3,3',4,5'-Hexachlorobiphenyl (BZ-130)	EPA 1668C	10262109	NELAP	LA
9108 - 2,2',3,3',4,5,5',6'-Octachlorobiphenyl (BZ-199)	EPA 1668C	10262109	NELAP	LA
9107 - 2,2',3,3',4,5,5',6,6'-Nonachlorobiphenyl (BZ-208)	EPA 1668C	10262109	NELAP	LA
9109 - 2,2',3,3',4,5,5',6-Octachlorobiphenyl (BZ-198)	EPA 1668C	10262109	NELAP	LA
9110 - 2,2',3,3',4,5,5'-Heptachlorobiphenyl (BZ-172)	EPA 1668C	10262109	NELAP	LA
9116 - 2,2',3,3',4,5,6'-Heptachlorobiphenyl (BZ-174)	EPA 1668C	10262109	NELAP	LA
9111 - 2,2',3,3',4,5,6,6'-Octachlorobiphenyl (BZ-200)	EPA 1668C	10262109	NELAP	LA
9113 - 2,2',3,3',4,5,6-Heptachlorobiphenyl (BZ-173)	EPA 1668C	10262109	NELAP	LA
9118 - 2,2',3,3',4,5-Hexachlorobiphenyl (BZ-129)	EPA 1668C	10262109	NELAP	LA
9120 - 2,2',3,3',4,6'-Hexachlorobiphenyl (BZ-132)	EPA 1668C	10262109	NELAP	LA
9119 - 2,2',3,3',4,6,6'-Heptachlorobiphenyl (BZ-176)	EPA 1668C	10262109	NELAP	LA
9121 - 2,2',3,3',4,6-Hexachlorobiphenyl (BZ-131)	EPA 1668C	10262109	NELAP	LA
9122 - 2,2',3,3',4-Pentachlorobiphenyl (BZ-82)	EPA 1668C	10262109	NELAP	LA
9123 - 2,2',3,3',5,5',6,6'-Octachlorobiphenyl (BZ-202)	EPA 1668C	10262109	NELAP	LA
9124 - 2,2',3,3',5,5',6-Heptachlorobiphenyl (BZ-178)	EPA 1668C	10262109	NELAP	LA
9125 - 2,2',3,3',5,5'-Hexachlorobiphenyl (BZ-133)	EPA 1668C	10262109	NELAP	LA
9127 - 2,2',3,3',5,6'-Hexachlorobiphenyl (BZ-135)	EPA 1668C	10262109	NELAP	LA
9126 - 2,2',3,3',5,6,6'-Heptachlorobiphenyl	EPA 1668C	10262109	NELAP	LA

Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
(BZ-179)				
9128 - 2,2',3,3',5,6-Hexachlorobiphenyl (BZ-134)	EPA 1668C	10262109	NELAP	LA
9129 - 2,2',3,3',5-Pentachlorobiphenyl (BZ-83)	EPA 1668C	10262109	NELAP	LA
9130 - 2,2',3,3',6,6'-Hexachlorobiphenyl (BZ-136)	EPA 1668C	10262109	NELAP	LA
9131 - 2,2',3,3',6-Pentachlorobiphenyl (BZ-84)	EPA 1668C	10262109	NELAP	LA
9132 - 2,2',3,3'-Tetrachlorobiphenyl (BZ-40)	EPA 1668C	10262109	NELAP	LA
9151 - 2,2',3,4',5',6-Hexachlorobiphenyl (BZ-149)	EPA 1668C	10262109	NELAP	LA
9154 - 2,2',3,4',5'-Pentachlorobiphenyl (BZ-97)	EPA 1668C	10262109	NELAP	LA
9080 - 2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ-187)	EPA 1668C	10262109	NELAP	LA
9144 - 2,2',3,4',5,5'-Hexachlorobiphenyl (BZ-146)	EPA 1668C	10262109	NELAP	LA
9147 - 2,2',3,4',5,6'-Hexachlorobiphenyl (BZ-148)	EPA 1668C	10262109	NELAP	LA
9146 - 2,2',3,4',5,6,6'-Heptachlorobiphenyl (BZ-188)	EPA 1668C	10262109	NELAP	LA
9149 - 2,2',3,4',5,6-Hexachlorobiphenyl (BZ-147)	EPA 1668C	10262109	NELAP	LA
9155 - 2,2',3,4',5-Pentachlorobiphenyl (BZ-90)	EPA 1668C	10262109	NELAP	LA
9159 - 2,2',3,4',6'-Pentachlorobiphenyl (BZ-98)	EPA 1668C	10262109	NELAP	LA
9157 - 2,2',3,4',6,6'-Hexachlorobiphenyl (BZ-150)	EPA 1668C	10262109	NELAP	LA
9160 - 2,2',3,4',6-Pentachlorobiphenyl (BZ-91)	EPA 1668C	10262109	NELAP	LA
9162 - 2,2',3,4'-Tetrachlorobiphenyl (BZ-42)	EPA 1668C	10262109	NELAP	LA
9075 - 2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ-183)	EPA 1668C	10262109	NELAP	LA
9025 - 2,2',3,4,4',5'-Hexachlorobiphenyl (BZ-138)	EPA 1668C	10262109	NELAP	LA
9133 - 2,2',3,4,4',5,5',6-Octachlorobiphenyl (BZ-203)	EPA 1668C	10262109	NELAP	LA
9134 - 2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ-180)	EPA 1668C	10262109	NELAP	LA
9136 - 2,2',3,4,4',5,6'-Heptachlorobiphenyl (BZ-182)	EPA 1668C	10262109	NELAP	LA
9135 - 2,2',3,4,4',5,6,6'-Octachlorobiphenyl (BZ-204)	EPA 1668C	10262109	NELAP	LA
9137 - 2,2',3,4,4',5,6-Heptachlorobiphenyl (BZ-181)	EPA 1668C	10262109	NELAP	LA
9138 - 2,2',3,4,4',5-Hexachlorobiphenyl (BZ-137)	EPA 1668C	10262109	NELAP	LA
9140 - 2,2',3,4,4',6'-Hexachlorobiphenyl (BZ-140)	EPA 1668C	10262109	NELAP	LA
9139 - 2,2',3,4,4',6,6'-Heptachlorobiphenyl (BZ-184)	EPA 1668C	10262109	NELAP	LA

Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
9141 - 2,2',3,4,4',6-Hexachlorobiphenyl (BZ-139)	EPA 1668C	10262109	NELAP	LA
9142 - 2,2',3,4,4'-Pentachlorobiphenyl (BZ-85)	EPA 1668C	10262109	NELAP	LA
9150 - 2,2',3,4,5',6-Hexachlorobiphenyl (BZ-144)	EPA 1668C	10262109	NELAP	LA
8975 - 2,2',3,4,5'-Pentachlorobiphenyl (BZ-87)	EPA 1668C	10262109	NELAP	LA
9143 - 2,2',3,4,5,5',6-Heptachlorobiphenyl (BZ-185)	EPA 1668C	10262109	NELAP	LA
9030 - 2,2',3,4,5,5'-Hexachlorobiphenyl (BZ-141)	EPA 1668C	10262109	NELAP	LA
9152 - 2,2',3,4,5,6'-Hexachlorobiphenyl (BZ-143)	EPA 1668C	10262109	NELAP	LA
9145 - 2,2',3,4,5,6,6'-Heptachlorobiphenyl (BZ-186)	EPA 1668C	10262109	NELAP	LA
9148 - 2,2',3,4,5,6-Hexachlorobiphenyl (BZ-142)	EPA 1668C	10262109	NELAP	LA
9153 - 2,2',3,4,5-Pentachlorobiphenyl (BZ-86)	EPA 1668C	10262109	NELAP	LA
9161 - 2,2',3,4,6'-Pentachlorobiphenyl (BZ-89)	EPA 1668C	10262109	NELAP	LA
9156 - 2,2',3,4,6,6'-Hexachlorobiphenyl (BZ-145)	EPA 1668C	10262109	NELAP	LA
9158 - 2,2',3,4,6-Pentachlorobiphenyl (BZ-88)	EPA 1668C	10262109	NELAP	LA
9163 - 2,2',3,4-Tetrachlorobiphenyl (BZ-41)	EPA 1668C	10262109	NELAP	LA
9166 - 2,2',3,5',6-Pentachlorobiphenyl (BZ-95)	EPA 1668C	10262109	NELAP	LA
8945 - 2,2',3,5'-Tetrachlorobiphenyl (BZ-44)	EPA 1668C	10262109	NELAP	LA
9035 - 2,2',3,5,5',6-Hexachlorobiphenyl (BZ-151)	EPA 1668C	10262109	NELAP	LA
9164 - 2,2',3,5,5'-Pentachlorobiphenyl (BZ-92)	EPA 1668C	10262109	NELAP	LA
9167 - 2,2',3,5,6'-Pentachlorobiphenyl (BZ-94)	EPA 1668C	10262109	NELAP	LA
9165 - 2,2',3,5,6,6'-Hexachlorobiphenyl (BZ-152)	EPA 1668C	10262109	NELAP	LA
9168 - 2,2',3,5,6-Pentachlorobiphenyl (BZ-93)	EPA 1668C	10262109	NELAP	LA
9169 - 2,2',3,5-Tetrachlorobiphenyl (BZ-43)	EPA 1668C	10262109	NELAP	LA
9171 - 2,2',3,6'-Tetrachlorobiphenyl (BZ-46)	EPA 1668C	10262109	NELAP	LA
9170 - 2,2',3,6,6'-Pentachlorobiphenyl (BZ-96)	EPA 1668C	10262109	NELAP	LA
9172 - 2,2',3,6-Tetrachlorobiphenyl (BZ-45)	EPA 1668C	10262109	NELAP	LA
9173 - 2,2',3-Trichlorobiphenyl (BZ-16)	EPA 1668C	10262109	NELAP	LA
9040 - 2,2',4,4',5,5'-Hexachlorobiphenyl (BZ-153)	EPA 1668C	10262109	NELAP	LA
9174 - 2,2',4,4',5,6'-Hexachlorobiphenyl (BZ-154)	EPA 1668C	10262109	NELAP	LA

Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
9175 - 2,2',4,4',5-Pentachlorobiphenyl (BZ-99)	EPA 1668C	10262109	NELAP	LA
9176 - 2,2',4,4',6,6'-Hexachlorobiphenyl (BZ-155)	EPA 1668C	10262109	NELAP	LA
9177 - 2,2',4,4',6-Pentachlorobiphenyl (BZ-100)	EPA 1668C	10262109	NELAP	LA
9178 - 2,2',4,4'-Tetrachlorobiphenyl (BZ-47)	EPA 1668C	10262109	NELAP	LA
9179 - 2,2',4,5',6-Pentachlorobiphenyl (BZ-103)	EPA 1668C	10262109	NELAP	LA
8950 - 2,2',4,5'-Tetrachlorobiphenyl (BZ-49)	EPA 1668C	10262109	NELAP	LA
8980 - 2,2',4,5,5'-Pentachlorobiphenyl (BZ-101)	EPA 1668C	10262109	NELAP	LA
9180 - 2,2',4,5,6'-Pentachlorobiphenyl (BZ-102)	EPA 1668C	10262109	NELAP	LA
9181 - 2,2',4,5-Tetrachlorobiphenyl (BZ-48)	EPA 1668C	10262109	NELAP	LA
9183 - 2,2',4,6'-Tetrachlorobiphenyl (BZ-51)	EPA 1668C	10262109	NELAP	LA
9182 - 2,2',4,6,6'-Pentachlorobiphenyl (BZ-104)	EPA 1668C	10262109	NELAP	LA
9184 - 2,2',4,6-Tetrachlorobiphenyl (BZ-50)	EPA 1668C	10262109	NELAP	LA
9185 - 2,2',4-Trichlorobiphenyl (BZ-17)	EPA 1668C	10262109	NELAP	LA
8955 - 2,2',5,5'-Tetrachlorobiphenyl (BZ-52)	EPA 1668C	10262109	NELAP	LA
9186 - 2,2',5,6'-Tetrachlorobiphenyl (BZ-53)	EPA 1668C	10262109	NELAP	LA
8930 - 2,2',5-Trichlorobiphenyl (BZ-18)	EPA 1668C	10262109	NELAP	LA
9187 - 2,2',6,6'-Tetrachlorobiphenyl (BZ-54)	EPA 1668C	10262109	NELAP	LA
9188 - 2,2',6-Trichlorobiphenyl (BZ-19)	EPA 1668C	10262109	NELAP	LA
9189 - 2,2'-Dichlorobiphenyl (BZ-4)	EPA 1668C	10262109	NELAP	LA
9224 - 2,3',4',5',6-Pentachlorobiphenyl (BZ-125)	EPA 1668C	10262109	NELAP	LA
9229 - 2,3',4',5'-Tetrachlorobiphenyl (BZ-76)	EPA 1668C	10262109	NELAP	LA
9222 - 2,3',4',5,5'-Pentachlorobiphenyl (BZ-124)	EPA 1668C	10262109	NELAP	LA
9230 - 2,3',4',5-Tetrachlorobiphenyl (BZ-70)	EPA 1668C	10262109	NELAP	LA
9237 - 2,3',4',6-Tetrachlorobiphenyl (BZ-71)	EPA 1668C	10262109	NELAP	LA
9239 - 2,3',4'-Trichlorobiphenyl (BZ-33)	EPA 1668C	10262109	NELAP	LA
9218 - 2,3',4,4',5',6-Hexachlorobiphenyl (BZ-168)	EPA 1668C	10262109	NELAP	LA
9000 - 2,3',4,4',5'-Pentachlorobiphenyl (BZ-123)	EPA 1668C	10262109	NELAP	LA
9011 - 2,3',4,4',5'-Pentachlorobiphenyl (BZ-123)	EPA 1668C	10262109	NELAP	LA
9055 - 2,3',4,4',5,5'-Hexachlorobiphenyl (BZ-167)	EPA 1668C	10262109	NELAP	LA
8995 - 2,3',4,4',5-Pentachlorobiphenyl (BZ-118)	EPA 1668C	10262109	NELAP	LA

Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
9220 - 2,3',4,4',6-Pentachlorobiphenyl (BZ-119)	EPA 1668C	10262109	NELAP	LA
8960 - 2,3',4,4'-Tetrachlorobiphenyl (BZ-66)	EPA 1668C	10262109	NELAP	LA
9226 - 2,3',4,5',6-Pentachlorobiphenyl (BZ-121)	EPA 1668C	10262109	NELAP	LA
9231 - 2,3',4,5'-Tetrachlorobiphenyl (BZ-68)	EPA 1668C	10262109	NELAP	LA
9223 - 2,3',4,5,5'-Pentachlorobiphenyl (BZ-120)	EPA 1668C	10262109	NELAP	LA
9232 - 2,3',4,5-Tetrachlorobiphenyl (BZ-67)	EPA 1668C	10262109	NELAP	LA
9235 - 2,3',4,6-Tetrachlorobiphenyl (BZ-69)	EPA 1668C	10262109	NELAP	LA
9240 - 2,3',4-Trichlorobiphenyl (BZ-25)	EPA 1668C	10262109	NELAP	LA
9244 - 2,3',5',6-Tetrachlorobiphenyl (BZ-73)	EPA 1668C	10262109	NELAP	LA
9246 - 2,3',5'-Trichlorobiphenyl (BZ-34)	EPA 1668C	10262109	NELAP	LA
9242 - 2,3',5,5'-Tetrachlorobiphenyl (BZ-72)	EPA 1668C	10262109	NELAP	LA
8935 - 2,3',5-Trichlorobiphenyl (BZ-26)	EPA 1668C	10262109	NELAP	LA
9248 - 2,3',6-Trichlorobiphenyl (BZ-27)	EPA 1668C	10262109	NELAP	LA
9249 - 2,3'-Dichlorobiphenyl (BZ-6)	EPA 1668C	10262109	NELAP	LA
9201 - 2,3,3',4',5',6-Hexachlorobiphenyl (BZ-164)	EPA 1668C	10262109	NELAP	LA
9202 - 2,3,3',4',5'-Pentachlorobiphenyl (BZ-122)	EPA 1668C	10262109	NELAP	LA
9195 - 2,3,3',4',5,5',6-Heptachlorobiphenyl (BZ-193)	EPA 1668C	10262109	NELAP	LA
9197 - 2,3,3',4',5,5'-Hexachlorobiphenyl (BZ-162)	EPA 1668C	10262109	NELAP	LA
9199 - 2,3,3',4',5,6-Hexachlorobiphenyl (BZ-163)	EPA 1668C	10262109	NELAP	LA
9205 - 2,3,3',4',5-Pentachlorobiphenyl (BZ-107)	EPA 1668C	10262109	NELAP	LA
8990 - 2,3,3',4',6-Pentachlorobiphenyl (BZ-110)	EPA 1668C	10262109	NELAP	LA
9207 - 2,3,3',4'-Tetrachlorobiphenyl (BZ-56)	EPA 1668C	10262109	NELAP	LA
9192 - 2,3,3',4,4',5',6-Heptachlorobiphenyl (BZ-191)	EPA 1668C	10262109	NELAP	LA
9045 - 2,3,3',4,4',5'-Hexachlorobiphenyl (BZ-157)	EPA 1668C	10262109	NELAP	LA
9190 - 2,3,3',4,4',5,5',6-Octachlorobiphenyl (BZ-205)	EPA 1668C	10262109	NELAP	LA
9085 - 2,3,3',4,4',5,5'-Heptachlorobiphenyl (BZ-189)	EPA 1668C	10262109	NELAP	LA
9191 - 2,3,3',4,4',5,6-Heptachlorobiphenyl (BZ-190)	EPA 1668C	10262109	NELAP	LA
9050 - 2,3,3',4,4',5-Hexachlorobiphenyl (BZ-156)	EPA 1668C	10262109	NELAP	LA
9193 - 2,3,3',4,4',6-Hexachlorobiphenyl (BZ-158)	EPA 1668C	10262109	NELAP	LA
8985 - 2,3,3',4,4'-Pentachlorobiphenyl (BZ-105)	EPA 1668C	10262109	NELAP	LA

Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
9200 - 2,3,3',4,5',6-Hexachlorobiphenyl (BZ-161)	EPA 1668C	10262109	NELAP	LA
9203 - 2,3,3',4,5'-Pentachlorobiphenyl (BZ-108)	EPA 1668C	10262109	NELAP	LA
9194 - 2,3,3',4,5,5',6-Heptachlorobiphenyl (BZ-192)	EPA 1668C	10262109	NELAP	LA
9196 - 2,3,3',4,5,5'-Hexachlorobiphenyl (BZ-159)	EPA 1668C	10262109	NELAP	LA
9198 - 2,3,3',4,5,6-Hexachlorobiphenyl (BZ-160)	EPA 1668C	10262109	NELAP	LA
9204 - 2,3,3',4,5-Pentachlorobiphenyl (BZ-106)	EPA 1668C	10262109	NELAP	LA
9206 - 2,3,3',4,6-Pentachlorobiphenyl (BZ-109)	EPA 1668C	10262109	NELAP	LA
9208 - 2,3,3',4-Tetrachlorobiphenyl (BZ-55)	EPA 1668C	10262109	NELAP	LA
9212 - 2,3,3',5',6-Pentachlorobiphenyl (BZ-113)	EPA 1668C	10262109	NELAP	LA
9213 - 2,3,3',5'-Tetrachlorobiphenyl (BZ-58)	EPA 1668C	10262109	NELAP	LA
9209 - 2,3,3',5,5',6-Hexachlorobiphenyl (BZ-165)	EPA 1668C	10262109	NELAP	LA
9210 - 2,3,3',5,5'-Pentachlorobiphenyl (BZ-111)	EPA 1668C	10262109	NELAP	LA
9211 - 2,3,3',5,6-Pentachlorobiphenyl (BZ-112)	EPA 1668C	10262109	NELAP	LA
9214 - 2,3,3',5-Tetrachlorobiphenyl (BZ-57)	EPA 1668C	10262109	NELAP	LA
9215 - 2,3,3',6-Tetrachlorobiphenyl (BZ-59)	EPA 1668C	10262109	NELAP	LA
9216 - 2,3,3'-Trichlorobiphenyl (BZ-20)	EPA 1668C	10262109	NELAP	LA
9227 - 2,3,4',5,6-Pentachlorobiphenyl (BZ-117)	EPA 1668C	10262109	NELAP	LA
9233 - 2,3,4',5-Tetrachlorobiphenyl (BZ-63)	EPA 1668C	10262109	NELAP	LA
9236 - 2,3,4',6-Tetrachlorobiphenyl (BZ-64)	EPA 1668C	10262109	NELAP	LA
9241 - 2,3,4'-Trichlorobiphenyl (BZ-22)	EPA 1668C	10262109	NELAP	LA
9217 - 2,3,4,4',5,6-Hexachlorobiphenyl (BZ-166)	EPA 1668C	10262109	NELAP	LA
9005 - 2,3,4,4',5-Pentachlorobiphenyl (BZ-114)	EPA 1668C	10262109	NELAP	LA
9219 - 2,3,4,4',6-Pentachlorobiphenyl (BZ-115)	EPA 1668C	10262109	NELAP	LA
9221 - 2,3,4,4'-Tetrachlorobiphenyl (BZ-60)	EPA 1668C	10262109	NELAP	LA
9225 - 2,3,4,5,6-Pentachlorobiphenyl (BZ-116)	EPA 1668C	10262109	NELAP	LA
9228 - 2,3,4,5-Tetrachlorobiphenyl (BZ-61)	EPA 1668C	10262109	NELAP	LA
9234 - 2,3,4,6-Tetrachlorobiphenyl (BZ-62)	EPA 1668C	10262109	NELAP	LA
9238 - 2,3,4-Trichlorobiphenyl (BZ-21)	EPA 1668C	10262109	NELAP	LA
9243 - 2,3,5,6-Tetrachlorobiphenyl (BZ-65)	EPA 1668C	10262109	NELAP	LA

Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
9245 - 2,3,5-Trichlorobiphenyl (BZ-23)	EPA 1668C	10262109	NELAP	LA
9247 - 2,3,6-Trichlorobiphenyl (BZ-24)	EPA 1668C	10262109	NELAP	LA
8920 - 2,3-Dichlorobiphenyl (BZ-5)	EPA 1668C	10262109	NELAP	LA
8940 - 2,4',5-Trichlorobiphenyl (BZ-31)	EPA 1668C	10262109	NELAP	LA
9255 - 2,4',6-Trichlorobiphenyl (BZ-32)	EPA 1668C	10262109	NELAP	LA
9256 - 2,4'-Dichlorobiphenyl (BZ-8)	EPA 1668C	10262109	NELAP	LA
9250 - 2,4,4',5-Tetrachlorobiphenyl (BZ-74)	EPA 1668C	10262109	NELAP	LA
9251 - 2,4,4',6-Tetrachlorobiphenyl (BZ-75)	EPA 1668C	10262109	NELAP	LA
9252 - 2,4,4'-Trichlorobiphenyl (BZ-28)	EPA 1668C	10262109	NELAP	LA
9253 - 2,4,5-Trichlorobiphenyl (BZ-29)	EPA 1668C	10262109	NELAP	LA
9254 - 2,4,6-Trichlorobiphenyl (BZ-30)	EPA 1668C	10262109	NELAP	LA
9257 - 2,4-Dichlorobiphenyl (BZ-7)	EPA 1668C	10262109	NELAP	LA
9258 - 2,5-Dichlorobiphenyl (BZ-9)	EPA 1668C	10262109	NELAP	LA
9259 - 2,6-Dichlorobiphenyl (BZ-10)	EPA 1668C	10262109	NELAP	LA
8915 - 2-Chlorobiphenyl (BZ-1)	EPA 1668C	10262109	NELAP	LA
9060 - 3,3',4,4',5,5'-Hexachlorobiphenyl (BZ-169)	EPA 1668C	10262109	NELAP	LA
9015 - 3,3',4,4',5-Pentachlorobiphenyl (BZ-126)	EPA 1668C	10262109	NELAP	LA
8965 - 3,3',4,4'-Tetrachlorobiphenyl (BZ-77)	EPA 1668C	10262109	NELAP	LA
9261 - 3,3',4,5'-Tetrachlorobiphenyl (BZ-79)	EPA 1668C	10262109	NELAP	LA
9260 - 3,3',4,5,5'-Pentachlorobiphenyl (BZ-127)	EPA 1668C	10262109	NELAP	LA
9262 - 3,3',4,5-Tetrachlorobiphenyl (BZ-78)	EPA 1668C	10262109	NELAP	LA
9263 - 3,3',4-Trichlorobiphenyl (BZ-35)	EPA 1668C	10262109	NELAP	LA
9264 - 3,3',5,5'-Tetrachlorobiphenyl (BZ-80)	EPA 1668C	10262109	NELAP	LA
9265 - 3,3',5-Trichlorobiphenyl (BZ-36)	EPA 1668C	10262109	NELAP	LA
8925 - 3,3'-Dichlorobiphenyl (BZ-11)	EPA 1668C	10262109	NELAP	LA
9268 - 3,4',5-Trichlorobiphenyl (BZ-39)	EPA 1668C	10262109	NELAP	LA
9269 - 3,4'-Dichlorobiphenyl (BZ-13)	EPA 1668C	10262109	NELAP	LA
8970 - 3,4,4',5-Tetrachlorobiphenyl (BZ-81)	EPA 1668C	10262109	NELAP	LA
9266 - 3,4,4'-Trichlorobiphenyl (BZ-37)	EPA 1668C	10262109	NELAP	LA
9267 - 3,4,5-Trichlorobiphenyl (BZ-38)	EPA 1668C	10262109	NELAP	LA
9270 - 3,4-Dichlorobiphenyl (BZ-12)	EPA 1668C	10262109	NELAP	LA
9271 - 3,5-Dichlorobiphenyl (BZ-14)	EPA 1668C	10262109	NELAP	LA
9272 - 3-Chlorobiphenyl (BZ-2)	EPA 1668C	10262109	NELAP	LA
9273 - 4,4'-Dichlorobiphenyl (BZ-15)	EPA 1668C	10262109	NELAP	LA
9274 - 4-Chlorobiphenyl (BZ-3)	EPA 1668C	10262109	NELAP	LA

Biological Tissue

Analyte	Method Name	Method Code	Type	AB
NONE	NONE	NONE	NONE	NONE

ALS Canada Environmental
Life Sciences Division
National Quality Manual

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National Authorizations

Authorized By: Linda Neimor — Date: March 1, 2018
National Quality Manager, Canada

Authorized By: Mark Hugdahl — Date: March 1, 2018
Technical Director, Canada

Local Authorization

_____
Laboratory Location

Authorized By: _____ Effective Date: _____
Laboratory Manager

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1.0 SCOPE

This Quality Manual describes the Quality Management System operated by the ALS Canada Environmental locations. Where appropriate, it refers to other documents for additional information. Throughout this manual, whenever ALS is used alone, it refers to the ALS Environmental locations in Canada.

The policies and procedures described in this manual comply with ISO/IEC 17025:2017 and ISO/IEC 17025:2005. Maintaining compliance to both versions of the Standard is necessary until all ALS locations and their Accrediting Bodies have transitioned to the 2017 version.

In addition, the policies in this manual comply with the requirements of clients, of ALS corporate goals, and of the current and applicable accreditation bodies and recognition agencies.

2.0 LOCATIONS, ACCREDITATIONS AND RECOGNITIONS

ALS operates several environmental testing laboratories across Canada. Addresses and contact information are available by following the location links at our web site: www.alsglobal.com.

Locations within the ALS Canada network hold accreditations for all routinely offered tests from various agencies as listed on their scopes of accreditation, and/or hold certifications or licenses provided by regional regulators, as appropriate to their fields of testing, client requirements, and geographic sectors. For example, the requirements of the following agencies and programs are currently relevant to specific locations and tests offered by ALS Canada.

- The Canadian Association for Laboratory Accreditation (CALA).
- Perry Johnson Laboratory Accreditation (PJLA).
- The NELAC Institute (TNI).
- The USA Department of Defense (DOD).
- British Columbia Enhanced Water Quality Assurance Program (EWQA).
- Ontario Safe Drinking Water ACT (OSDWA).

Current scopes and certificates for each location are publically available at www.alsglobal.com under the Environmental Downloads section. They are also available from ALS Account Managers or from the Quality Department on request. The scopes and certificates contain details on the accredited tests in each ALS locations as well as the Standard of compliance and expiry date.

The Quality Department ensures the website information is current by providing verified updates to the National Quality Manager within 48 hours of receiving the update.

3.0 TERMS AND DEFINITIONS

Refer to NA-FM-0001a Definitions of Key Terms for details.

The terms and definitions relevant to the national quality management system have been standardized and are described in a national document.

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4.1 ORGANIZATION AND RESPONSIBLITIES

4.1.1 ALS is a global laboratory organization which is solely owned by the Australian publicly traded company ALS Limited. In Canada, ALS operates environmental testing laboratories under the legal name ALS Canada Ltd., and the general business name ALS Environmental.

ALS Canada provincial business registrations are maintained on the network at N:\Life Sciences\Environmental\QA\ALS Canada Business Registrations.

ALS offers the following testing services through our Environmental lab network:

- Inorganic Analysis (including Metals).
- Organic Analysis.
- Pesticide and Herbicide Analysis.
- Dioxin Testing.
- Toxicological Testing.
- Biological Examination Analysis.
- Microbiological Testing.
- Industrial Hygiene Testing.

Matrices tested include drinking water, ground and surface water, effluent, soil, sediment, solid waste, air, food and biota, including vegetation, animal, and fish tissue.

ALS Canada clients include private individuals, consultants, government, and industry.

4.1.2 ALS accepts the responsibility to carry out its testing activities in such a way as to meet the requirements of clients, regulatory authorities, ISO/IEC 17025:2005, ISO/IEC 17025:2017, and organizations providing accreditation and recognition relevant to each location, including the program requirements of CALA, PJLA, TNI and the US DOD.

Cases of voluntary or involuntary loss of accreditation or needed recognitions are resolved by evaluating the impact to customers and taking appropriate action. Such actions may include subcontracting (refer to section 4.5), or analysis by another accredited test method.

To ensure the terms and conditions of accrediting body publicity policies are met, all publications or advertisements that refer to accreditation, proficiency testing performance, or compliance to regulations are reviewed prior to release by the Technical Director and/or the National Quality Manager.

4.1.3 This Quality Manual covers the laboratory management system for work carried out in the ALS Environmental permanent facilities and associated mobile facilities in Canada.

ALS locations do not differentiate between accredited and non-accredited testing activities. The Quality Management System described in this document applies to all testing activities performed by ALS.

4.1.4 The responsibilities of key corporate personnel that have an involvement and influence on testing activities have been defined to identify potential conflicts of interest. Refer to the Organization and Management Structure in section 4.1.5.

4.1.5 ALS has the following organizational practices:

a) Managerial and technical personnel have the authority and resources needed to carry out the duties assigned to them. Such duties include the implementation, maintenance, and improvement of the management system, and where applicable, the identification of departures from the management system or procedures for conducting tests. Managerial

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personnel also have the ability to initiate actions to prevent or minimize such departures. Refer to Organization and Management Structure below.

b) Arrangements are in place to ensure management and personnel are free from undue internal and external commercial, financial, and other pressures and influences that may adversely affect the quality of their work. Refer to section 5.2.1 for details on the ALS Code of Conduct Policy.

c) Policies and procedures are in place to ensure the protection of customers' confidential information and proprietary rights. Refer to policy objectives in section 4.2 and section 5.2.1 for details on the Code of Conduct Policy.

d) Policies and procedures are in place to avoid involvement in activities that would diminish confidence in the competence, impartiality, judgment or operational integrity of an ALS Laboratory or its staff. Refer to section 5.2.1 for the Code of Conduct and Data Integrity Policies.

e) The organizational and management structure is well defined, including the relationships between quality management, technical operations and support services. Refer to Organization and Management Structure below. Organizational charts are available from the Human Resources Department on request.

f) Responsibilities, authorities and interrelationships are specified for all personnel who manage, perform or verify work affecting the quality of tests. Refer to Organization and Management Structure below.

g) Adequate supervision is provided to all staff and trainees by persons familiar with test methods and procedures, the purpose of these tests and the assessment of test results. Refer to Organization and Management Structure below, and section 5.2.

h) Senior management has overall responsibility for the technical operations and provision of resources needed to ensure the quality of laboratory operations. Refer to Organization and Management Structure below.

i) The National Quality Manager has defined responsibility and authority for ensuring that the management system related to quality is maintained, implemented, improved, and followed at all times. This individual ensures that personnel understand their contribution to the quality system, quality system tools are evaluated objectively, and the effectiveness of the quality system is communicated to all levels of the organization. This individual is independent from laboratory operations and has direct access to the highest levels of ALS management. Refer to Organization and Management Structure below.

j) Personnel are appointed to substitute as needed in the absence of key managerial personnel. Such substitutions must be flexible due to the variety of demands on individuals. The Organization and Management Structure table below summarizes routine practices. Substitution details are available at each location where needed.

k) Personnel are aware of the relevance and importance of their activities and how they contribute to the achievement of the objectives of the management system – refer to section 5.2 for additional information.

ORGANIZATION AND MANAGEMENT STRUCTURE

The management system in Canada is divided between laboratory specific, regional and national functions. An appropriate number of managerial positions support the management system. The responsibility, authority and interrelationships of key positions are defined and outlined in the table

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below. Corporate cross-divisional roles (not specifically listed below) include human resources, finance, accounting, compliance and management of information technology.

KEY ENVIRONMENTAL DIVISION ROLES AND ALTERNATES

Title	Role and Alternate Where Applicable
General Manager, Life Sciences, Americas	Responsibility for and authority over operations at all locations within North and South America. Reports to the ALS CEO.
Regional Operations Directors	Responsibility for and authority over operations within designated regions (Western Canada, the Prairies, Eastern Canada). Report to the General Manager. Fills other regional roles as needed during absences.
Regional Business Development Managers	Responsibility for oversight and management of the sales and marketing division within designated regions (Western Canada, the Prairies and Eastern Canada). Reports to the Regional Operations Directors.
North America Purchasing Department	Responsibility for oversight and operation of the purchasing system. Reports to the Director of Finance, North America.
Technical Director, Canada (TD)	Responsibility for oversight and management of technology, best practices, and nationally harmonized test methods, and for the ALS Canada Quality Management System. Reports to the General Manager. Fills NTM and NQM roles as needed.
National Technical Manager, Canada (NTM)	Responsibility for managing a group of national technical specialists and for overseeing the development, documentation, and implementation of nationally harmonized best practices and technical and LIMS initiatives. Reports to the TD. Fills the TD role for technical issues as designated.
National Quality Manager, Canada (NQM)	Responsibility for managing the ALS Canada Quality Department staff and for overseeing the development, documentation, implementation, and oversight of a harmonized quality management system. Reports to the TD. Fills the TD role for quality issues as designated. Fills QSC roles as needed.
Laboratory Managers	Responsibility for and authority over operations for a single location, including the provision of resources needed to ensure the quality and compliance of laboratory operations. Reports to a Regional Operations Director. Fills other local managerial and supervisory roles as needed.
Laboratory Dept. Managers, Client Services Managers, Supervisors, and Team Leaders	Responsibility for and authority over selected operations and for providing adequate supervision of a department or section within a single location. Reports to the Laboratory Manager or Supervisor. Fills local management and supervisory roles as designated.
Quality Systems Coordinators (QA)	Responsibility for the organization, implementation, maintenance and monitoring of the national, defined quality management system in one or more locations. Reports to the NQM for quality related duties. Fills the NQM role as designated.
Analysts, Support Staff, Administrative Staff, Sales and Marketing Staff	Responsibility for and authority over assigned work. Reports to Department Manager or Supervisor. May be designated to fill local Supervisor or Manager roles.

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4.1.6 Senior management communicates the ongoing effectiveness of the management system to all staff throughout the network. This is primarily accomplished through staff meetings and reports communicated as appropriate to all levels of the organization. Management system goals related to quality are developed by the management team and communicated to all affected division personnel. The status of management system is reported monthly to national, divisional and location management through National Quality Reports. National Quality Reports are posted on the ALS network and are accessible to all staff at: N:\Life Sciences\Environmental\QA\National Quality Reports and Template.

4.1.7 For TNI/DOD accreditations:

The individuals identified as technical managers in the program applications are members of staff that exercise day-to-day supervision of laboratory operations for the applicable fields of accreditation and reporting of results.

They are experienced in the applicable fields, and monitor the standards of performance and the validity of the analyses to ensure reliable data. They will not fill the technical

manager role at more than one laboratory location without authorization from the primary Accreditation Body.

If an individual identified as a technical manager will be absent for a period of time exceeding fifteen consecutive calendar days, they will designate another staff member meeting the qualifications to temporarily perform their function. If their absence exceeds thirty-five consecutive calendar days, the primary Accreditation Body must be notified in writing.

4.2 MANAGEMENT SYSTEM

4.2.1 The ALS management system is appropriate to the type, range, and volume of environmental testing activities undertaken at each location. Policies, systems, programs, procedures, and instructions are documented to the degree necessary to assure the quality of test results. ALS ensures all staff understands the quality management system and that all required documentation is available to and implemented by staff.

4.2.2 MANAGEMENT SYSTEM POLICIES, POLICY STATEMENT AND OBJECTIVES

ALS management is committed to good professional practice, and to providing a superior level of service and quality in its testing activities that exceeds the industry norm. Our management system is designed to comply with the requirements of ISO/IEC 17025:2005, ISO/IEC 17025:2017, the program requirements of all applicable accrediting bodies, ALS corporate goals, and to satisfy the needs of clients, regulatory authorities, and organizations providing recognition. All staff are required to be familiar with ALS quality system documentation and to implement its policies and procedures in their work. ALS management is committed to complying with these policies and to continually improve the effectiveness of the management system.

This policy statement and the entire Quality Manual are issued under the authority of senior management in Canada.

The policy objectives of the management system are listed below. Their implementation and effectiveness is evaluated during management reviews:

- ALS protects its customers' confidential information and proprietary rights. We require all employees to review and sign the Code of Conduct agreement that communicates the ALS expectations for employee conduct, including the confidentiality policy (refer to section 5.2.1). The electronic storage of information is protected by a national computer network protection system (refer to section 5.1). Test results are protected during communication and transmission by ensuring only the correct individual receives results, and by identifying transmissions as confidential (refer to section 5.10).
- ALS employees avoid involvement in activities that would diminish confidence in their competence, impartiality, judgement or operational integrity by complying with the ALS Code of Conduct agreement and the Data Integrity Policy (refer to section 5.2.1).
- The quality policy statement heading this section is issued under the authority of senior management. The policy statement includes measurable objectives that are monitored through operation of the quality management system, as identified in the following points.

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- Involuntary loss of accreditation results in an evaluation of the impact to the customer and determination of appropriate action (refer to section 4.1.2).
- Procedures pertaining to the quality management system and testing activities are documented and controlled to ensure the most current work instructions are available to staff. Responsibilities are defined for monitoring documents of both internal and external origin for currency and continued suitability. Updates to external documents are reviewed to determine if changes to internal processes are needed (refer to section 4.3).
- Appropriate personnel are involved with the provision of quotations and contracts to the degree necessary to understand our clients' needs, to determine if a location can manage projected workloads, to identify the correct test methods to be used, and to maintain appropriate communications with the client during testing. Records of client communications are maintained and all changes to work plans are communicated to those involved (refer to section 4.4).
- Tests are subcontracted to laboratories that have demonstrated competency for the targeted test in a manner acceptable to the applicable accreditation and recognition agencies, and that meet the customers testing needs and ALS corporate compliance requirements (refer to section 4.5).
- Suppliers of goods and services are pre-approved using national protocols where they affect the quality of test results. The national purchasing system provides control over selection and purchasing of goods and services, while systems for reception, storage, and handling of supplies ensure we receive what was ordered, that appropriate storage is provided, and that records of verification are maintained where needed (refer to section 4.6).
- Complaints, whether received by direct communication or during survey activities, are managed and resolved. Records are maintained of the complaint, including discussions with the client, and its resolution (refer to section 4.8).
- When any of our services fail to conform to ALS policies or procedures or to the requirements of our customer, a nonconformance is recorded. Procedures define the responsibilities and authorities for handling nonconformances, including documentation, work stoppage, work resumption, and for evaluating the significance of the nonconformance. Correction, evaluation, and customer notification are initiated where applicable (refer to section 4.9).
- Cause analysis is performed where nonconforming work is identified and where corrective action is needed. Corrective actions that will prevent recurrence are selected and implemented as appropriate to the magnitude and risk of the problem. Procedures describe documentation requirements, national and local monitoring, and the provision of additional audits as needed (refer to section 4.11).
- New employees receive an orientation and job-specific training. Training needs are reviewed on an on-going and as-needed basis to ensure cross-training is provided and that work can be reassigned when needed. Longer term training plans are developed during annual performance evaluations. The effectiveness of training actions is evaluated using direct observation and monitoring of quality system tools. Additional training can be requested by anyone at any time for LIMS, quality systems or specific technical topics (refer to section 5.2).

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- ALS Quality Control practices monitor the validity of tests performed by its laboratories. Technical records are maintained to allow evaluation and interpretation of original test conditions and test results. Technical records are organized to support test result, inter-parameter, and test report validation by qualified, authorized, and independent individuals (refer to section 5.9).

4.2.3 Evidence of commitment to the development and implementation of the management system and to its continual improvement is available in the procedures and records referred to throughout this document, and include the approval and implementation of the systems described in this manual.

4.2.4 ALS senior management's communication of the importance of meeting customer, statutory and regulatory requirements is provided in various ways such as during staff meetings as described in section 4.1.6, through employment policies, business goals, and the training program (refer to section 5.2). In addition, goals set during management reviews (as described in section 4.15), and various planning meetings are communicated as appropriate.

4.2.5 This Quality Manual includes or references relevant support and technical procedures and outlines the structure of documentation used in the management system.

4.2.6 Roles and responsibilities of technical and quality management staff are summarized in section 4.1.5. Responsibilities for ensuring compliance with International Standards and the program requirements of accreditation and recognition agencies are defined as:

- The Technical Director is responsible for the direction and technical authorization of the national quality management system.
- The National Quality Manager is responsible for building a national quality management system in compliance with the current International Standards and the relevant program requirements of accrediting and recognition agencies, and for reporting on the status of national and local implementation to the management team.
- Local quality staff are responsible for implementing the national quality management system under the direction of the NQM in the locations under their responsibility, and for reporting on the status to the local Lab Manager and National Quality Manager.
- Local Lab Managers are responsible for ensuring implementation of the national quality management system in their locations, and for addressing reported deficiencies.
- Regional Directors are responsible for supporting and enforcing compliance to the national quality management system.

4.2.7 Senior management ensures the integrity of the management system is maintained when changes to the system are planned and implemented. This is achieved by assigning the planning and implementation of changes to staff that have the appropriate knowledge, training, qualifications, and authority to manage the changes, and by ensuring planned changes have adequate review and oversight by personnel who understand the implications. Planned changes to the management system are reported to and discussed with the national management team as needed, prior to authorization and implementation.

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4.3 DOCUMENT CONTROL

Refer to NA-SP-0425 Document Control for Internal and External Documents for details.

4.3.1 STRUCTURE OF MANAGEMENT SYSTEM DOCUMENTATION

ALS controls all procedures that form part of its quality management system, including those of internal and external origins.

Internal documents are those originating within ALS. Some internal documents are national in scope and are intended to be used at multiple locations. Others are local and are intended to be used at one specific location. The documentation structure is outlined below:

Document Type	Application	Origin
Quality Manual	High-level Policies	National
Support Procedure	Quality System Policies and Procedures	National or Local
Test Method	Testing Activity	National or Local
Test Procedure	Testing Activity	National or Local
Work Instruction	Testing Activity	National or Local
Form	Can Apply to Any Level of Document	National or Local
Variance	Can Apply to Any Level of Document	National or Local

In the rare case where local and national Support Procedure documents both describe similar activities or information, the local document takes precedence only when the policies specified in the national document are fulfilled as intended.

Templates for the above documents are provided to ensure consistency of technical content and presentation across the ALS Environmental Division locations. Templates are provided for documents of both national and local origin.

External documents originate from sources external to ALS. External documents that are important to the operation of our laboratories include, for example, instrument manuals, software manuals, reference methods, regulations, standards, and accrediting body policies. When external documents are used directly to perform work, supplemental internal documents will relate the additional information required by the ALS document templates.

4.3.2 DOCUMENT APPROVAL AND ISSUE

4.3.2.1 Documents used in the laboratory as part of the management system are reviewed and approved for use by authorized personnel prior to issue. These authorities are personnel with knowledge appropriate to the content of the document.

Master lists are maintained for the authorization and distribution of national documents in the common computer network drive at:

N:\Life Sciences\Environmental\QA\Documentation\National Documents.

Master Lists are also maintained for each location. They include documents from internal and external, and local and national origins that have been authorized for local use. Master Lists are available for viewing by all staff.

4.3.2.2 Authorized documents are available at all work stations where essential to the effective functioning of the laboratory.

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Internal documents and any related forms are reviewed on a cycle corresponding to the internal audit schedule to ensure continuing suitability and compliance with requirements. Refer to section 4.14 for additional information regarding internal audit schedules.

External documents such as applicable regulations, reference methods, and documents issued by accrediting and recognition bodies are monitored by individuals responsible for the work. Changes to internal processes and documentation are identified and occur when needed to ensure continued suitability and compliance.

Invalid or obsolete documents are removed from use. The original electronic file and the original signed hard copy are transferred to clearly identified archive files and maintained as historical quality system records.

4.3.2.3 Documents generated by ALS Laboratories are uniquely identified, including:

- Document identification number and name.
- Version number.
- Header Date (date of the last change made to the version).
- Signing authorities and dates for Quality and Technical authorizations.
- Local signing authority and effective date (date the documented procedure was authorized for implementation at the location).
- Page numbering and total number of pages.

Authorizations and date conventions are simplified for forms. If it becomes necessary to amend an authorized national document for local use, procedures describe the editing process and the Technical authorization is provided by the national signing authority.

4.3.3 DOCUMENT CHANGES

4.3.3.1 Changes to internal documents are reviewed and approved by the same authorities as the original document, unless otherwise delegated. All involved in this process have access to pertinent information upon which to base their approval.

4.3.3.2 A summary of revisions is provided in each document to relate significant alterations or new text.

4.3.3.3 Where hand-written amendments are made pending re-issue of the documents, the following apply:

- Hand written amendments are authorized by both quality and technical staff, as per the original document.
- Amendments are clearly legible, initialed and dated.
- Formally re-issue the document no later than the next scheduled internal audit.

Hand written amendments are not made to national documents.

4.3.3.4 Procedures are established to describe how changes to documents maintained in computerized systems are made and controlled.

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4.4 REVIEW OF AGREEMENTS, QUOTATIONS AND CONTRACTS

Refer to NA-SP-0650 Quotations and Contracts, and NA-SP-0651 Credit Policy and Procedure for details.

4.4.1 Agreements, quotations and contracts are reviewed to ensure understanding of defined and documented requirements. The customer's status is evaluated and Information is shared to ensure the location has the capability, resource availability, and the appropriate test methods to meet applicable requirements. Differences that occur between a quotation and the final contract are resolved prior to commencing work.

4.4.2 Records of reviews, including communications and significant changes to the customer's requirements or the laboratory's capabilities are maintained.

For routine and simple tasks, the date and initials of the laboratory staff responsible for carrying out the work is an adequate record of review. For repetitive routine tasks, a review at the initial inquiry stage is adequate as long as the requirements do not change. For new or complex testing requirements, a more comprehensive record is maintained.

Records are also maintained of all pertinent discussions with clients during the life span of the contracted work.

4.4.3 The reviews performed include reviews of tests subcontracted by ALS. Refer to section 4.5.

4.4.4 The customer is informed of any proposed deviation from the contract.

4.4.5 If changes are made during the contract, the new requirements are subject to the same review process as the original contract. Any amendments are communicated to all affected personnel. If, due to unforeseen circumstances, the laboratory is unable to comply with a condition of the contract (e.g. turnaround time, equipment failure), the client is notified as soon as possible and contingency plans are developed.

4.5 SUBCONTRACTING TESTS

Refer to NA-SP-0325 Sample Receipt and Subcontracting for details.

4.5.1 Testing is subcontracted to another ALS location or external organization when it cannot be carried out at the receiving location. ALS has policies and procedures that govern the qualification of subcontract labs and the handling and transfer of subcontracted samples. ALS selects subcontractors through a qualification process that includes an evaluation of the test method, detection limits, accreditation status, agreement to notify of status changes, and corporate insurance policy compliance.

When subcontracting samples for accredited tests, ALS chooses subcontract labs that are accredited to either ISO/IEC 17025:2005 or ISO/IEC 17025:2017 during the transition phase, for the specific tests by agencies recognized by the applicable accrediting body, and who also meet the client and corporate ALS criteria. Labs holding accreditation by a recognized accrediting body for the tests in question are given first consideration when subcontracting non-accredited tests whenever the client and corporate ALS requirements are also fulfilled. If an accredited lab is unavailable, impractical or does not meet testing or corporate criteria, ALS will choose laboratories that at minimum fulfill the other components of the qualification process.

4.5.2 The client is notified in writing of subcontract arrangements. Client written approval is obtained whenever possible, and records of approval are kept. When notified of

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subcontracting by quote, the submission of samples is deemed as acceptance of the subcontract laboratory.

4.5.3 ALS is responsible for all subcontracted work. Although clients or regulatory authorities sometimes specify the subcontractor to be used, the ALS qualification procedure applies to these subcontractors as well.

4.5.4 ALS laboratories maintain lists of approved subcontract lab tests and records of their qualifications.

4.6 PURCHASING AND HANDLING SUPPLIES AND SERVICES

Refer to NA-SP-0050 Purchasing and Vendor Approval for details.

4.6.1 ALS controls the procurement of supplies and services where there is a potential impact to the quality of test results. Documented procedures exist for the purchasing, reception, and storage of materials relevant to the tests performed at each location.

4.6.2 Supplies that affect the quality of test results are not used until they are inspected to verify the received items conform to the specifications or requirements as ordered. Upon receipt, supplies are compared to the packing slip to establish the order was filled correctly. The packing slip is initialed and dated as a record of the receipt and verification.

Certificates of traceability and/or analysis are maintained for certified supplies such as certified reference materials and standards, stock cultures and other consumables where specifications are critical. When additional verification is needed such as testing, procedures at the location describe the testing performed and records maintained.

Critical supplies and their storage conditions are specified in test methods wherever needed to protect the quality of test results.

4.6.3 Purchasing requisitions are reviewed for technical content at each location to ensure required specifications are met. Requisitions are further reviewed by purchasing staff to ensure correctness, and to determine the most appropriate supplier.

4.6.4 ALS works closely with vendors of critical supplies to ensure they understand our requirements and specifications, and can consistently meet them. The ALS Purchasing Department maintains the purchasing system that limits access to only approved supplies from approved vendors for North American ALS labs. A list of current approved vendors is available from the Purchasing Department upon request. Approved supplies and vendors are those that have been demonstrated through validations and through experience to be fit for specific usage. In cases where a supply or vendor fails to consistently meet our quality specifications, corrective action is taken that is relevant to the event. Corrective action can include for example, national notification to user labs, identification of replacement supplies and blocking the questionable supply in the purchasing system to prevent future orders.

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4.7 SERVICE TO THE CUSTOMER

4.7.1 ALS cooperates closely with its customers to ensure their testing needs are understood, and allows them reasonable access to relevant areas of the laboratories to audit the management system or to witness test work being undertaken on their behalf.

ALS assists customers to develop audit objectives when appropriate. An ALS staff member reviews the External Auditor Confidentiality Agreement with the client and invites them to sign it. An ALS staff member accompanies any client while on-site and ensures steps are taken to protect the confidentiality of other customers' information in accordance with the ALS ethics, confidentiality, and privacy policies (refer to 5.2.1). ALS records and addresses all customer audit findings. Also refer to section 4.14 regarding external audits.

ALS has assigned staff the task of ensuring good communication with customers regarding technical issues and the status of testing being conducted on their behalf. Customers are informed of delays or deviations in the conduct of their tests. Communications with customers are documented as needed to ensure continuity of service.

4.7.2 Periodically, ALS prepares and distributes or commissions surveys to its customers. The purpose of these surveys is to evaluate services, to ensure ALS continues to meet clients' needs and to identify areas for improvement. Copies are maintained at: N:\Life Sciences\Environmental\QA\Client Surveys. The surveys are evaluated by national and regional management teams and are used to define initiatives for improvements. In addition to various senior management planning meetings, survey results are communicated during Management Reviews (refer to section 4.15).

4.7.3 The Technical Director and National Quality Manager maintain summaries of ALS Quality System and Quality Control protocols to provide customers with an understanding of ALS practices. The summaries are provided in both Word and PDF format. The Word format text is intended to be copied into larger documents while the PDF file can be emailed directly to customers. Copies are accessed on SharePoint.

4.8 COMPLAINTS

Refer to NA-SP-0125 CARS and PARs for details.

ALS is committed to providing a superior level of service to its customers. As a result, every complaint received from customers or other parties, whether received by direct communication or during survey activities, is important and receives follow-up.

To ensure adequate oversight and resolution, all complaints received by ALS are initially recorded as nonconformances, and follow the usual investigation, resolution, and client notification processes.

Information on the ALS process for handling complaints is readily provided to interested parties on request.

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4.9 CONTROL OF NONCONFORMANCES

Refer to NA-SP-0125 CARS and PARs for details.

When any work conducted by ALS does not conform to a requirement, including noncompliance with ALS policies and procedures or the requirements of our customers, the nonconformance is recorded and reviewed by an appropriate authority.

Nonconformance procedures define responsibilities and authorities for:

- Halting work and withholding reports where appropriate.
- The evaluation of the significance (risk) of the nonconformance.
- Ensuring immediate correction / remedial actions.
- Customer notification where applicable.
- Authorizing the resumption of work.

Where the evaluation indicates it is appropriate to prevent recurrence, root cause analysis and corrective action are implemented – refer to section 4.11.

Single event data quality objective failures or other isolated occurrences during testing activities are initially recorded on a test method nonconformance record which includes corrective action or technical justification and authorization. When recurrence is observed, the issue is transferred to the LIMS System for Corrective Action Reports (CARs).

Nonconformances identified during audits and assessments are recorded in reports that are used to track the issues through the steps listed above and to resolution. Any issues that require immediate action are entered into the LIMS CAR system – refer to section 4.14.

All other sources of nonconformance are recorded directly into the LIMS CAR system.

4.10 IMPROVEMENT

Management's commitment to continuously improving the effectiveness of the management system is demonstrated by the use of various management system tools to identify areas of needed improvement. Regular evaluations of each of the following are used to identify areas for improvement: internal and external audits, corrective and preventive action reports, management reviews and various management reports and meetings, client feedback, proficiency test results, reviews of test method performance and data quality objectives, client surveys, and input from personnel. Documentation and follow-up is defined in the Quality Manual sections specific to these functions and activities.

4.11 CORRECTIVE ACTION

Refer to NA-SP-0125 CARS and PARs for details.

Appropriate corrective actions are evaluated whenever investigation of a nonconformance indicates prevention of recurrence is needed. Responsibilities and authorities are defined for implementing and documenting corrective actions based on an analysis of the causes and identification of the root cause where possible.

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Corrective actions that are most likely to prevent recurrence of the nonconformance are initiated, as appropriate to the magnitude and risk of the problem. Actions taken are monitored for effectiveness where appropriate.

When a serious risk is identified, or when otherwise deemed appropriate, additional audits are performed when the nonconformance casts doubt on compliance with ALS policies and procedures or compliance with regulations or with accreditation requirements.

4.12 PREVENTIVE ACTION

Refer to NA-SP-0125 CARS and PARs for details.

Needed improvements and potential sources of nonconformance for technical and management systems are identified from various sources (see also section 4.10).

When improvement opportunities are identified or when preventive actions are needed, action plans are developed, implemented and monitored to reduce the likelihood of a nonconformance. The investigation and record keeping system is the same as for nonconformance and corrective action. Refer to sections 4.9 and 4.11.

4.13 CONTROL OF RECORDS

Refer to NA-SP-0175 Data Validation of Test Data, NA-SP-0252 Protection and Storage of Sample Testing Records, and NA-SP-0850 Electronic Data Control and Security for details.

4.13.1 General

4.13.1.1 ALS controls records through defined procedures for identifying, collecting, indexing, accessing, filing, storing, maintaining and disposing of quality and technical records.

Quality records include but are not limited to reports from site assessments, customer audits, internal audits, management reviews, corrective actions, preventive actions, proficiency testing reports, initial method validations, and revalidations. Storage of quality records is described in the SOPs that describe these programs.

Refer to 4.13.2 for information regarding technical records.

4.13.1.2 All records are legible, readily retrievable and stored in an environment that protects them from damage or deterioration for a minimum of five years, unless regulatory or contractual obligations dictate a longer retention period. Records may be recorded and stored on paper or using an electronic medium.

4.13.1.3 All records are held secure and in confidence, in compliance with policies for confidentiality and non-disclosure - refer to section 5.2.

4.13.1.4 Procedures exist for the back-up and protection of records stored electronically, and to prevent unauthorized access to or amendment of these records.

4.13.1.5 For records related to TNI / DOD accreditation:

When accreditation is transferred in the case of new ownership or a change in legal status, quality and technical records pertaining to accreditation will be maintained

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for a minimum of five years and will be subject to inspection by the accrediting authority without prior notification to the lab.

Where required by the accrediting authority, and in the event of a transfer of ownership or closure, the lab will ensure records of analysis are maintained or transferred according to its customers instructions. This information will be collected from customers when needed. In cases of bankruptcy, all regulatory and legal requirements concerning laboratory records will be followed.

4.13.2 Technical Records

4.13.2.1 Technical records include all original observations and derived data recorded at the time they are made. Technical records include sufficient information to establish an audit trail, such as equipment records, calibration records, method validation records, reagent and standard preparation records, unique sample preparation and analysis instructions and records, staff records, copies of each test report issued, and the identities of the individuals responsible for performing each test and for checking results. Records for each test contain enough information to identify factors affecting uncertainty and to enable the test to be repeated under conditions as close as possible to the original.

4.13.2.2 All observations, data and calculations are recorded at the time they are made in a manner identifiable to the specific task.

4.13.2.3 When a mistake is identified in a hard copy record, the original record is left legible with a line drawn through it, and hand-written corrections are recorded alongside, together with the date and initials of the person making the change. Where not intuitive, all reasons for corrections are documented in the pertinent analytical record. Data changes in LIMS are tracked using a Good Automated Laboratory Practice (GALP) function that includes the identity of the individual and the reason for the modification.

4.14 INTERNAL AUDITS

Refer to NA-SP-0400 Audits – Internal and External for details.

4.14.1 Internal audits are performed at each facility following pre-determined schedules and procedures to ensure operations comply with the requirements of the management system, the program requirements of all applicable accrediting and recognition bodies, ISO/IEC 17025:2005, and ISO/IEC17025:2017. Audits are managed by the Quality Department.

Management system audits are managed nationally and scheduled annually. Schedules and records are maintained in network folders. Technical audits of testing activities are coordinated locally. They are scheduled on a cycle that complies with accreditation program requirements. Test method revalidation and document review are part of the ALS audit protocol. Schedules and records are maintained for all audits.

Audit schedules record the accreditation program relevant to each laboratory and test to ensure program-specific requirements are included in each audit.

Audits are coordinated and conducted by individuals who have received training on audit objectives and techniques and who are independent of the activity being audited wherever possible.

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Technical audits can require a group effort to ensure a technical review is performed that will identify needed improvements and ensure implementation of best practices. Draft audit reports and supporting documents and data are reviewed and released by QA to ensure impartiality.

4.14.2 ALS takes timely corrective action when audit findings cast doubt on the effectiveness of operations or the validity of test results. ALS notifies customers in writing if investigations show test results may have been adversely affected, as soon as the scope and impact of the event is understood.

4.14.3 Records of internal audits performed, identified nonconformances, root cause analysis and where needed, selection of corrective actions that will prevent recurrence are recorded in audit reports. A LIMS CAR is issued for any nonconformances that require immediate action.

4.14.4 Follow-up audits verify the implementation and effectiveness of corrective actions taken due to audit findings.

4.15 MANAGEMENT REVIEWS

Refer to NA-SP-0401 Management Review for details.

4.15.1 At least annually, Management conducts a review to ensure the management system is effective, continues to be suitable for its operations, and to identify necessary changes or improvements. Senior management is included in the review process for all locations.

The review may be a series of events or meetings that percolate up through the management structure that are summarized at year-end, or may be an annual event or meeting. Determining the format and setting the schedule is the responsibility of the local Laboratory Manager. The schedule is maintained and the review facilitated by Quality staff.

The intent is to evaluate the status and adequacy of national and local policies and systems by examining the following items for the time period between reviews:

- Status of actions from previous management reviews.
- Changes in internal and external issues that are relevant to the laboratory.
- Fulfillment of objectives.
- Suitability of the Quality Policy Statement, policy objectives, and procedures.
- Reports from managers and supervisors, and feedback from personnel.
- Outcomes of internal and external audits and assessments.
- Corrective and preventive action reports.
- Proficiency testing results and other interlaboratory comparisons.
- Changes in the volume and type of work or in the range of laboratory activities.
- Adequacy of resources.
- Complaints and other client feedback from all sources including surveys.
- Effectiveness of any implemented improvements.
- Results of risk identification.

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- Outcomes of the assurance of the validity of results.
- Recommendations for improvement.
- Other relevant topics such as management objectives related in lab metrics and key performance indicators or other monitoring activities, new tests under development, new recognition programs being sought, staff training, etc.

4.15.2 Findings from the reviews and identified decisions and actions are recorded and carried out in an appropriate and agreed upon timeframe.

4.15.3 In addition, the Quality Department provides status reports each month to local and senior management. These reports include reviews of internal and external audits and assessments, proficiency testing programs, nonconformances, corrective and preventive actions, training initiatives, and any other information needed to inform management of the status of the quality system.

4.16 ACTIONS TO ADDRESS RISKS AND OPPORTUNITIES

Refer to ALS Limited Risk Management Policy and Framework CAR-GL-GRP-POL-007 and Risk Appetite and Tolerance Statement CAR-GL-POL-011 for details.

ALS views risk management as a key component of its corporate governance responsibilities and an essential process in achieving and mandating a viable organization. ALS is committed to enterprise-wide risk management to ensure its corporate governance responsibilities are met and its strategic goals are realized.

Risk is defined at ALS as the effect of uncertainty on objectives. Objectives for the organization have different attributes and aspects, such as financial, health and safety, and environmental goals, and are considered at different levels, such as enterprise-wide, operational, and project levels. ALS interprets risk as anything that could impact meeting its corporate strategic objectives, and believes risks can provide positive opportunities as well as having negative impacts.

Tools and reporting mechanisms vary from immediate action and immediate notification of the ALS CEO in extreme cases, to management through routine procedures such as Corrective Action Reports, audits, and routine reporting mechanisms for lower risk situations.

Regardless of the mechanism used, the policies and tools provide a framework for categorizing, assessing, analyzing, and addressing risk, as well as monitoring and reviewing actions taken. Roles and responsibilities are defined in the relevant procedures.

5.0 TECHNICAL PROTOCOLS

5.1 COMPUTER SYSTEM MANAGEMENT

Refer to ALS Limited Data and IT Usage Policy IT-GL-GRP-POL-001, NA-SP-0850 Electronic Data Control and Security and NA-SP-0150 Creation and Validation of LIMS Products for details.

A network of computers and information management systems interface specific workstations into Local Area Networks (LANs) that are coordinated and managed by the North American IT Group under the authority of the Chief Information Officer.

Security is achieved through a combination of passwords, permissions, firewalls and Virtual Private Network (VPN) systems.

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System access and monitoring for system failures, data back-up, archival, protection and retrieval are strictly controlled.

Software development in North America is performed under the authority of the General Manager, Life Sciences. Development and changes to the Laboratory Information Management System (LIMS), is controlled by the LIMS Steering Committee. Extensive testing is performed prior to introduction of changes to the operational modules of LIMS.

Test data is managed in LIMS through product codes that can only be created by specifically delegated individuals. Specifications for new codes and changes to existing codes are documented. New codes are fully validated prior to release from sample login through to data reporting to verify the correct functionality of all components including data calculations and data transfers.

5.2 PERSONNEL

Refer to the Orientation Training Record FRM 710, the ALS Code of Conduct HR-GL-GRP-POL-001, the Data Integrity Policy NA-FM-200a and the Whistleblower Policy ADM 205 for details.

5.2.1 ALS ensures the competence of all personnel who operate specific equipment, perform specific tests, evaluate procedures, sign test reports, and supervise or manage lab operations, and to evaluate the significance of deviations. Staff are qualified on the basis of education, training, experience, and/or demonstrated skills necessary for performing assigned functions. Staff undergoing training are supervised by assigned trainers.

Position descriptions are used to communicate to personnel their duties, responsibilities and authorities. Position descriptions specify the qualifications for each position, and are generally a combination of education and experience appropriate for the role. Records of educational backgrounds are maintained in personnel files.

Upon hiring, all staff are provided an orientation to safety programs, employment policies, and management system policies. Each section of the orientation is managed by appropriate staff in each location, under the authority of the local Laboratory Manager.

ALS is committed to achieving the highest standards of ethical conduct. Acceptance of employment is an implicit commitment to observe the company's standards of conduct and performance.

The Code of Conduct provides a framework for decisions and actions in relation to conduct in employment. It underpins commitment to a duty of care to all employees and to customers receiving our services. The agreement covers a wide range of topics including personal and professional behavior, conflicts of interest, gifts, confidentiality, legal compliance, and security of information, among others. The Code of Conduct is administered in Canada by the North American Human Resources Department as part of an orientation provided to newly hired staff. The orientation is provided locally under the responsibility of the local Laboratory Manager. Records are forwarded to the Human Resources (HR) Department for maintenance in secure personnel files.

The Data Integrity Policy expands on the Code of Conduct agreement regarding personal and professional behavior that directly impacts test results and information. Specific expectations are identified for ALS and its employees.

The Data Integrity Policy is administered by the National Quality Department as part of a Quality System orientation provided to newly hired staff. Quality staff ensures the original

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signed policies are forwarded to HR for maintenance. In addition, all employees are required to attend annual Data Integrity refresher sessions. Attendance records are maintained.

Together, these agreements ensure freedom from undue internal and external commercial, financial, and other pressures or influences that could adversely affect the quality of work. They protect customers' confidential information and the proprietary rights of ALS. They ensure avoidance of activities that would diminish confidence in the competence, impartiality, judgement, or integrity of any ALS staff.

Any breach or suspected breach of the Code of Conduct or the Data Integrity Policy can be reported to any manager, or to any HR or QA representative. In addition, ALS provides an Integrity and Compliance Helpline on SharePoint as a confidential and independent guidance and reporting service that is accessible to all staff. Any cases of theft, fraud, dishonesty, risks to impartiality, harassment, unethical behavior, and/or workplace safety hazards can be confidentially and anonymously reported to an independent party. An investigation procedure details the process and notifications. In addition, the ALS Whistleblower Policy protects staff that make honest and genuine reports from all forms of retaliation.

For activities related to DOD accreditation, any instances of inappropriate and prohibited laboratory practices must be reported to the Accrediting Body within 15 business days of discovery. Discovery includes findings of such inappropriate practices by laboratory staff or customer stakeholders. Laboratories must submit records of associated corrections taken or proposed corrective actions to their Accrediting Body within 30 business days of discovery.

5.2.2 ALS generally identifies long term training needs and plans for the provision of training to personnel during annual performance reviews, based on present and anticipated future responsibilities. The effectiveness of training is evaluated during a six-month follow-up where applicable.

Training is also undertaken at any time the need is identified, whether to ensure adequate cross-training so work can be reassigned if needed, or to update knowledge and skills. The effectiveness of as-needed training is evaluated by the assigned trainer or by the manager responsible for the work. Evaluation tools include direct observation, quality control samples, performance testing samples, technical audits, and corrective action reports.

Training is provided for every job function and may include but not be limited to quality systems, LIMS applications, management, leadership, customer service, safety, test method or equipment specific training, and issuing test reports. Staff may request additional training at any time.

The process for demonstrating analyst proficiency for specific tests is documented and complies with applicable accrediting body policies regarding training duration, content, and record keeping, where specified. On-going proficiency is monitored through using proficiency testing samples with additional training provided as needed. Analysts who predate current competency and training procedures are grandfathered into the current system.

5.2.3 Periodically, contract personnel may be hired to fulfill specific project requirements. Contract personnel are subject to the same qualifications, supervision, orientation, and training procedures as permanent staff.

5.2.4 The Human Resources Department maintains position descriptions for managerial, technical, and key support personnel. Position descriptions are used for job postings to ensure prospective employees are aware of position requirements prior to applying.

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5.2.5 Records are maintained for all staff and include the relevant authorizations, educational and professional qualifications, training, skills and experience. Records include dates of authorization and confirmed competence.

5.2.5 For TNI / DOD Accreditations:

Individuals identified as Technical Managers must meet specific qualifications identified in the program documents.

5.3 ACCOMMODATIONS AND ENVIRONMENTAL CONDITIONS

ALS facilities and their environmental conditions, including energy sources, lighting, and temperatures are appropriate for the correct performance of tests conducted at each location.

All instrumentation and electrical equipment used within ALS facilities must meet or exceed the relevant Canadian Standards Association (CSA) or Underwriters Laboratory (UL) requirements. Any equipment or instrumentation containing a radioactive source must meet or exceed the safety and licensing requirements specified by the Canadian Nuclear Safety Commission.

Environmental requirements necessary for the performance of specific tests are site-specific and are documented, monitored, and recorded. When such requirements are out of compliance, appropriate action is taken that may include suspension of testing where applicable, in accordance with the local documents.

Incompatible activities are separated and steps are taken to prevent cross-contamination. Refer to site-specific floor plans.

Each ALS location has procedures to ensure that access to laboratory and office areas is monitored and restricted to authorized individuals only.

Housekeeping is conducted to maintain appropriate environmental conditions within each facility.

SAFETY

ALS has an extensive safety program managed by the Corporate Compliance Department for ALS North America. The program is designed to meet corporate, federal, and regional regulations as applicable. The Safety Program includes task specific safety requirements, regular safety meetings and audits, and compliance and incident reporting mechanisms. Management and staff are responsible for implementing and adhering to the Safety Program, Safety Policies, and related procedures. Safety information is available on SharePoint.

All fire safety equipment within the ALS Environmental Division facilities meets or exceeds local fire safety regulations.

All shipments of supplies and samples are carried out in accordance with the appropriate local, regional, federal, or international ordinances, including the Transportation of Dangerous Goods (TDG) Regulation. Staff responsible for the shipment of Dangerous Goods have received TDG training.

WASTE MANAGEMENT

Waste management procedures are developed by each ALS location for all wastes designated as hazardous, and to ensure that all waste disposal practices meet local regulatory requirements. Refer to site-specific procedures.

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FUME HOODS

Fume hoods are available in all laboratory sections where required to meet safety needs. Fume hood face velocities are regularly monitored. Refer to site-specific procedures and/or records.

5.4 TEST METHODS AND METHOD VALIDATION

Refer to NA-SP-0100 Initial Method Validation – Chemistry, NA-SP-0101 MU Principles and NA-SP-0102 Method Revalidation and MU – Chemistry for details. Local procedures apply to other disciplines where needed.

5.4.1 General

ALS locations use appropriate, documented methods for all tests performed. Templates for national and local test methods specify the minimum documentation requirements. Test method instructions and support information is kept current and accessible where the work is performed.

Deviations from test methods occur only if the deviation has been documented, technically justified, authorized, and accepted by the customer where applicable. Analytical department supervisors and managers have the authority to approve method deviations for the analysis of samples and to impose appropriate quality control into the analysis. If the deviation is judged to alter the outcome of a test, client acceptance of the deviation will be obtained prior to approval. These isolated occurrences can be documented using the record keeping system established for single event test method nonconformances. Refer to section 4.9.

5.4.2 Selection of Methods

Customers rely on ALS to select test methods that are scientifically valid, defensible, and appropriate to meet their needs. Where possible, ALS uses the latest versions of published standard methods developed by organizations such as the American Public Health Association, the United States Environmental Protection Agency, the National Institute for Occupational Safety and Health, Environment Canada, and other international, regional, or regulatory organizations, or equipment manufacturers. When needed, standard methods are supplemented with additional instructions to ensure consistency of application and performance and to comply with the content requirements of ALS document templates. Where an appropriate standard method is not available, ALS may develop and validate an in-house test method, or may adopt a third-party validated method. ALS provides method information to clients on test reports and upon request.

For published reference methods, each ALS location confirms it can properly operate the standard method before introducing the test into the laboratory. If a future revision of the standard method causes it to change in a manner that may affect test results, the confirmation is repeated.

Unique circumstances may occur where a customer specifies the methodology to be used. The customer will be notified if ALS deems the recommended method to be inappropriate or out of date.

5.4.3 Laboratory Developed Methods

When in-house development of a test procedure is needed, qualified individuals are assigned to the planning and development stages of the project. The plan is updated as

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development progresses and all changes are effectively communicated to everyone involved to ensure that objectives are met.

5.4.4 Non-standard Methods

If it is necessary to use methods not covered by standard methods, customer agreement will be obtained. The test methods will include or reference clear specification of the requirements and the purpose of the test. The developed method will be appropriately validated before use.

5.4.5 Validation of Methods

Method validations are conducted to confirm that the developed methods are fit for their intended use. The validations are as extensive as necessary to meet the needs of the given application. The extent depends on the source of the method. For example, standard methods used for their intended application require a less extensive validation than non-standard methods or standard methods used outside of the intended scope.

All results relating to the validation of a given method, including the procedure used for validation and a statement of whether the method is fit for its intended use are retained in method validation records.

As appropriate, validation studies performed will verify the range and accuracy of the test method, including measurement uncertainty, detection limit, selectivity (i.e. sensitivity to interference), linearity, repeatability and/or reproducibility, and robustness. Measurement uncertainty values are reviewed to ensure they are sufficient to meet customers' needs.

Chemistry test methods are revalidated periodically to ensure continued suitability and fitness for purpose. Revalidation is routinely scheduled as part of the internal audit process. Revalidation frequency is based on test method performance and the requirements of applicable accrediting bodies. Refer to section 4.14 for additional information regarding internal audit schedules. Revalidation may also occur at any time when the performance of a test method is under investigation. At minimum, revalidation includes an examination of precision and bias data, an evaluation of detection limits and limits of reporting and an estimation of measurement uncertainty.

5.4.6 Estimation of Measurement Uncertainty

The ALS procedure for estimating measurement uncertainty is based on accepted practices of identifying components contributing to uncertainty, compiling data that represents or includes these components, evaluating the data using appropriate statistical calculations, and reporting in a manner that prevents misunderstanding of the result.

In those cases where the nature of the test precludes calculation of uncertainty, ALS will at minimum identify the components of uncertainty and make a reasonable estimation where needed. This estimation will be based on available validation data and other sources of information about the test method's performance.

5.4.7 Control of Data

Refer to NA-SP-0850 Electronic Data Control and Security and NA-SP-0150 Creation and Validation of LIMS Products for details.

Automated calculations and data transfer systems are checked in a systematic manner when first programmed and are re-verified appropriately when changes are made.

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When computers and automated equipment are used for the acquisition, processing, recording, reporting, storage, or retrieval of test data, ALS ensures:

- In-house developed software is sufficiently documented and validated.
- Procedures are implemented for protecting data, including integrity and confidentiality of entry, collection, storage, transmission, and processing – refer to sections 4.13, 5.1 and 5.10.
- Computers and automated equipment are maintained to ensure proper functioning and adequate environmental conditions – refer to section 5.1.

5.5 EQUIPMENT

Refer to NA-SP-0051 Equipment Maintenance Contracts and NA-SP-0078 Equipment Inventory for details.

5.5.1 ALS laboratories use appropriate sampling and testing equipment and instrumentation to ensure test method performance meets client needs. If ALS locations use equipment that is outside of their permanent control, the laboratories are responsible for ensuring the equipment meets the requirements of this section.

5.5.2 All equipment and its software needed for testing meets required performance specifications. Equipment is calibrated at the frequency stated in specific test methods and is confirmed to achieve required accuracy. Calibration and verification programs are established where appropriate.

5.5.3 Authorized staff use documented test methods and procedures to operate, calibrate and maintain equipment. Relevant operating manuals or other work instructions are available where needed.

All proposals for maintenance contracts are reviewed and authorized nationally by the TD.

5.5.4 Equipment and its software are uniquely identified where practical. Inventory lists are maintained of all equipment with a new or replacement value of greater than $750.00 CAD, excluding consumables, vehicles, and furniture.

5.5.5 Instrument logbooks and/or maintenance records contain the following information relating to instrumentation and software:

- Equipment and software identification.
- Manufacturer's name, model and serial number.
- Performance check records.
- Current location where appropriate.
- Manufacturer instructions (alternatively referenced in test method).
- Calibration history, adjustments, acceptance criteria (alternatively referenced in test method), and due date of next calibration (except for equipment calibrated on an as-used basis).
- Maintenance schedules (alternatively referenced in test methods), and records of maintenance.
- Records of damage, malfunction, repair, or modification.

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5.5.6 Documented instructions describe the management of measuring equipment and instrumentation, including:

- Safe handling, transport where applicable, storage and use.
- Planned maintenance.
- Intermediate calibration checks.
- The application of correction factors and updating of software or other records, where applicable.

5.5.7 Any equipment known or suspected to be defective is removed from service, isolated where practical, and clearly labeled as being out of service. The equipment is not returned into use until it is examined, necessary repairs have been completed, and it has been verified to meet performance specifications. Records are maintained in equipment logbooks. Where the defect calls reported analytical results into question, corrective action will be implemented – refer to sections 4.9 and 4.11.

5.5.8 Where practical, equipment under the control of the laboratory will be labeled to identify its calibration status. The label will include the date last calibrated and the expiration criteria or other indication of when re-calibration is due. Labels are not practical when the equipment is calibrated on a daily basis or when labels will interfere with the operation of the equipment. In such cases, other tracking mechanisms are implemented.

5.5.9 When it is necessary for equipment to go outside of the direct control of a laboratory, it will not be returned to service until it is demonstrated to meet performance specifications. Records are maintained in equipment logbooks or maintenance records.

5.5.10 When intermediary checks are needed to maintain confidence in the calibration status, the checks are carried out according to documented procedures. Refer to section 5.5.6.

5.5.11 Where calibrations result in correction factors, procedures for applying the corrections are documented. Refer to section 5.5.6.

5.5.12 Equipment is situated in the lab in a manner that will protect it from inadvertent adjustments. Specific equipment settings are documented where these settings can affect analytical results. Correct equipment adjustment is included in the training provided to individuals working with equipment.

5.6 MEASUREMENT TRACEABILITY

Refer to local procedures for details.

5.6.1 Wherever possible, ALS measurement and testing equipment that can have a significant effect on the accuracy or validity of test results is calibrated using established procedures. Calibration procedures ensure traceability through an unbroken chain of calibrations or by comparison to national measurement standards.

When using external calibration services, traceability of measurement is assured where applicable by the use of laboratories that can demonstrate competence, measurement capability, and traceability through accreditation to ISO/IEC 17025:2005 or ISO/IEC 17025:2017 during the transition phase. The calibration certificates issued by these laboratories relate their accreditation status and contain the measurement results,

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measurement uncertainty, and a statement of compliance with an identified metrological specification.

5.6.2 Where traceability of measurements to SI units is not possible and/or not relevant, traceability is provided by the use certified reference materials and/or consensus standards.

5.6.3 Reference Standards and Reference Materials

5.6.3.1 Reference Standards

Reference standards such as reference thermometers are calibrated by service providers that have demonstrated competence by being accredited to ISO/IEC 17025:2005 or ISO/IEC 17025:2017 for the required calibrations. This equipment is used for no purpose other than demonstrating that equipment is within calibration specifications, unless it can be demonstrated that their performance is not invalidated by the other uses. Where adjustments are needed, re-calibration is performed.

5.6.3.2 Reference Materials

Reference materials purchased by ALS are traceable to SI units where possible or to other certified reference materials. Where available, they are purchased from ISO/IEC 17025:2005 or ISO/IEC 17025:2017 accredited suppliers. Internally prepared reference materials are checked as far as technically and economically feasible. Refer to individual test methods for information on the use of reference materials.

5.6.3.3 Intermediate Checks

Where checks are needed to maintain confidence in the calibration status of reference standards, primary standards, working standards, or reference materials, such checks will be carried out according to defined procedures and schedules.

5.6.3.4 Transportation and Storage

Reference standards and materials are handled, stored, and transported in a manner that protects their integrity and operation. Local procedures relate criteria for the transportation and storage of reference standards where needed. Refer to individual test methods for handling and storage of reference materials. ALS laboratories do not normally transport reference materials. If needed by specific locations, transportation procedures will be available on-site.

5.7 SAMPLING

5.7.1 ALS Canada locations do not collect field samples.

Subsampling from submitted sample containers is conducted in a manner to obtain representative sub-samples. The error associated with subsampling is statistically monitored by collecting duplicate sub-samples for test procedures where subsampling occurs. Sub-sampling instructions are included or referenced in test methods where applicable.

5.7.2 Where a client requires deviations, additions, or exclusions from our documented sampling procedures, they are recorded in detail with the appropriate sampling data, are communicated to all appropriate personnel, and are indicated in final test reports.

5.7.3 Where applicable, ALS laboratories record relevant data and operations related to sub-sampling. The records include for example, identification of the sampler, date of sampling, applicable weights or volumes, deviations, and other information where relevant.

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5.8 HANDLING OF SAMPLES

Refer to NA-SP-0325 Sample Receipt and Subcontracting for details.

ALS sample handling procedures include transportation conditions, receipt, handling, protection, storage, retention, and disposal. Sampling and Handling Guides are provided to customers where needed. The procedures are designed to protect the integrity of the test samples and the interests of the customer and ALS.

ALS requests that our customers use our Chain of Custody (COC) form for every shipment of samples. The form includes sufficient space to record field sampling date, time and location of sampling, sample ID, and information relating to the integrity of the sample as collected. COCs are shipped with field supplies, and are also available on the alsglobal.com web site.

Samples are given a unique identification upon receipt. The identification is retained by the sample throughout its life in the laboratory, and ensures samples are not confused either physically or in records or reports. Where appropriate, the system allows for subdivision of test items and transfer within and between laboratories.

Abnormalities or other departures from specified sampling or transportation procedures are documented. Where there is doubt concerning the integrity of the sample, its identification or suitability for testing, or the requested tests, the customer is consulted for further instructions before proceeding, and the discussion is documented.

All ALS locations have appropriate facilities to securely maintain sample integrity, both before testing and where archiving for future testing is required. Sample storage and handling criteria are identified in test methods. Where important to protecting sample integrity, storage conditions are monitored and recorded.

5.9 ASSURING THE QUALITY OF TEST RESULTS

Refer to NA-SP-0104 Quality Control, NA-SP-0109 Creating, Maintaining and Monitoring Control Charts, NA-SP-0175 Data Validation of Test Data and supplemental procedures describing the proficiency testing program for details.

The ALS quality control (QC) protocols monitor the validity of tests performed by its laboratories. Individual test methods specify quality control requirements, including frequency of use and data quality objectives (DQOs) that trigger corrective action when exceeded. DQOs are based on a combination of reference method objectives, customer requirements, and historical test method performance. Where applicable, regulatory requirements or prescriptive elements of reference methods take precedence over internal DQOs.

QC elements utilized include but are not limited to functional checks of measuring and testing equipment, calibration standards, reference samples, control samples, verification standards, blanks, sample duplicates, surrogate compounds, and matrix spikes as appropriate to the field of testing.

Where appropriate, QC results are recorded on control charts. Control limits and statistical techniques are used to monitor test method performance for important trends. Planned action is taken to correct problems and to prevent incorrect results from being reported.

ALS laboratories participate in an extensive range of proficiency testing (PT) programs. PT samples are treated and analyzed on-site in a manner as similar to customer samples as possible, to ensure the test results represent customer test results. PT samples often require handling steps that are

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unique to the PT samples that differ from the steps in authorized test procedures. In these cases the unique steps are communicated to the applicable analytical departments by QA staff through Mobilization Meetings in order to minimize preventable errors. When various locations analyze the same PT samples, test results are not discussed or compared in any manner prior to the publication of the PT evaluation. Each accrediting body has specific policies regarding the analysis and reporting of proficiency testing samples. Local procedures describe the approaches used to meet the requirements.

Where possible, ALS will store samples for the following durations to accommodate retesting, measured from date of sample submission: 45 days for Soil and Water samples; 6 months for Tissue/Biota samples; 14 days for air samples collected on re-usable media; and 3 days for water samples submitted for microbiological testing. Where retesting identifies a nonconformance to policies and/or procedures, a nonconformance and corrective action is initiated – refer to section 4.9 and 4.11).

All ALS test results proceed through several validation steps by qualified individuals prior to the release of final test reports. The data validation process includes test result validation, inter-parameter validation, and report validation. Where data validation steps are prescribed by accrediting bodies, local procedures will provide details on responsibilities and processes.

The reporting of PT sample results to PT agencies requires unique manual data conversion and manual data entry steps after the report validation step is complete. A self-transcription check of the additional reporting steps is required at minimum, and a peer review is performed as needed. A record is maintained in either case.

5.10 REPORTING RESULTS

All information listed below is either included in the final report or kept on file at ALS in the case of abbreviated or customized reports, and can be provided to clients upon request:

- Title of report.
- Name and address of the laboratory issuing the report.
- Location where each test was conducted.
- Unique identification of the test report on each page, and the total number of pages.
- Customer name and address.
- Identification of test method(s) used.
- Unique identification of each sample, description of the sample such as matrix and customer identification, and condition where applicable.
- Date of sample receipt.
- Date of analysis.
- Test results and units.
- Report qualifiers.
- Name, function, and signature of the person authorizing the report.
- Statement that the results relate only to the samples identified in the report.

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Other information necessary for the interpretation of results or requested by the customer may also be included in reports, such as test method deviations or exclusions, specific test conditions, measurement uncertainty estimates, date of sampling, location of sampling, and other sampling information.

Statements of compliance, opinions, and interpretations may be included on test reports for specific analyses. In all such cases, the basis on which they have been made will be documented and clearly identified in the test report.

ALS obtains subcontract laboratory results in hard or electronic reports. When these results are presented to the customer in ALS reports, the identification of the subcontractor is clearly indicated on the final report.

When test reports are transmitted by telephone, facsimile, e-mail or other electronic means, the procedure for protecting the integrity and confidentiality of data includes:

- Only providing results to those individuals specified by the client for each sample submission.
- Use of a standardized facsimile cover page or email footer that relates the procedures to follow if received in error.

It is ALS practice to never disclose information about a client's test results to a third party without the prior consent of the client, or unless compelled to by law. If ALS is obligated by law to disclose such information, the client will be informed prior to doing so.

Test report formats are designed to accommodate each type of test and customer specifications. In all cases, ALS ensures that final results are reported in a manner that minimizes the possibility of misunderstanding or misuse.

Test report amendments are made by issuing a replacement report, identifying that a revision was made, and describing all changes in the cover page comment section.

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6.0 REFERENCES

Documents are available on the ALS network at: N:\Life Sciences\Environmental\Technical\Regulations & Standards\STANDARDS FOR ACCREDITATION, unless otherwise noted.

6.1 PRIMARY REFERENCES

ISO/IEC 17025:2005 General Requirements for the competence of testing and calibration laboratories, Second Edition, 2005-05-15.

ISO/IEC 17025:2017 General Requirements for the competence of testing and calibration laboratories, Second Edition, 2017:11.

The NELAC Institute (TNI) Standard ELV1-2016-Rev2.1.

The USA Department of Defense (DOD) Quality Systems Manual Version 5.1.1 2018.

6.2 SECONDARY REFERENCES

The Canadian Association for Laboratory Accreditation (CALA) program requirements at: cala.ca.

Perry Johnson Laboratory Accreditation (PJLA) program requirements at: pjla.com.

7.0 VERSION HISTORY

Doc ID	Version No.	Version Date	Author(s)	Summary of Changes
NAQM1	01	18-Feb-2007	L. Neimor / P. Mueller	Defining the harmonized ALS management system.
NAQM1	02	07-Sep-2007	L. Neimor	Refer to v02 for details.
NA-QM-1	03	01-Jun-2009	L. Neimor	Refer to v03 for details.
NA-QM-0001	04	22-Nov-2011	L. Neimor	Refer to v04 for details.
NA-QM-0002	01	01-Mar-2018	L. Neimor	- General updates throughout the document where applicable. - Addition of ISO/IEC 17025:2017 where applicable. - Updated referenced policies and SPs as needed. - 4.1.1: added location of copies of business licenses. - 4.1.3: added that the quality system applies to both accredited and non-accredited tests. - 4.1.5 e) added that org charts are available from HR. - 4.1.5 Table: updated information for key roles. - 4.1.6: added network location of national quality reports. - 4.1.7: added for TNI/DOD accreditations. - 4.2.6: added for TD responsibilities. - 4.3.1: added Variance to the documentation structure. - 4.6.4: updated regarding working with vendors to identify specifications and taking action when needed. - 4.8: added that complaint handling processes will be shared with clients on request. - 4.13.1.5: added the header for TNI/DOD accreditations. - 4.14.1: added audit schedules identify the accreditation agencies for each test. - 4.15: added additional review points from ISO/IEC 17025:2017. - 4.16: new section on risk & opportunity management from ISO/IEC 17025:2017. - 5.1: edited re information now in NA-SP-0350, included authorities and the LIMS Steering Committee. - 5.2.1: added the Helpline for confidential reporting. Added last paragraph for TNI/DOD accreditations. - 5.2.5: add for TNI/DOD accreditations re technical manager qualifications. - 5.5.3: added that proposed equipment maintenance contracts are reviewed & authorized by the TD. - 5.7: updated that ALS locations do not field sample. - 5.9: added Mobilization Meetings, sample storage policy & ABs may prescribe validation processes. - 6.0: updated references. - 8.0: new section for TNI / DOD requirements for address, phone number and responsible parties.

8.0 TNI / DOD ADDITIONAL LABORATORY INFORMATION

Only locations that hold TNI or DOD accreditations are to complete this section. Note that this manual applies to all organizational units as described within the document.

LABORATORY ADDRESS AND PHONE NUMBER	
Street Address:	
City, Province, Postal Code:	
Phone Number:	

RESPONSIBLE PARTIES			
Title	**Name**	**Signature**	**Date**
General Manager:			
Technical Manager:			
Quality Coordinator:			

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Environmental Laboratory Accreditation Program

NELAP Recognized

Analytical Resources Inc.

WA100006

4611 S. 134th Place, Suite 100

Tukwila, WA 98168-3240

IS GRANTED APPROVAL BY ORELAP UNDER THE 2009 TNI STANDARDS, TO PERFORM ANALYSES ON ENVIRONMENTAL SAMPLES IN MATRICES AS LISTED BELOW :

Air	*Drinking Water*	*Non Potable Water*	*Solids and Chem. Waste*	*Tissue*
		Chemistry	Chemistry	Chemistry

AND AS RECORDED IN THE LIST OF APPROVED ANALYTES, METHODS, ANALYTICAL TECHNIQUES, AND FIELDS OF TESTING ISSUED CONCURRENTLY WITH THIS CERTIFICATE AND REVISED AS NECESSARY.

ACCREDITED STATUS DEPENDS ON SUCCESSFUL ONGOING PARTICIPATION IN THE PROGRAM AND CONTINUED COMPLIANCE WITH THE STANDARDS.

CUSTOMERS ARE URGED TO VERIFY THE LABORATORY'S CURRENT ACCREDITATION STATUS IN OREGON.

Lizbeth Garcia

Lizbeth Garcia
Oregon State Public Health Laboratory
ORELAP Assessor
7202 NE Evergreen Parkway, Suite 100
Hillsboro, OR 97124

EFFECTIVE DATE : 05/12/2018

EXPIRATION DATE : 05/11/2019

Certificate No : WA100006 - 011

OREGON

Environmental Laboratory Accreditation Program

ORELAP Fields of Accreditation

ORELAP ID: WA100006

Analytical Resources Inc.

EPA CODE: WA00037

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Tukwila, WA 98168-3240

Issue Date: 5/12/2018 Expiration Date: 5/11/2019

As of 5/12/2018 this list supersedes all previous lists for this certificate number.

MATRIX	Reference	Code	Analyte	Code	Description
Biological Tissue					
	EPA 1613B			10120602	Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope Dilution GC/HRMS
		9516	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)		
		9519	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)		
		9420	1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)		
		9426	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)		
		9423	1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)		
		9471	1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-Hxcdf)		
		9453	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd)		
		9474	1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf)		
		9456	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,6,7,8-Hxcdd)		
		9477	1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf)		
		9459	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd)		
		9543	1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf)		
		9540	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd)		
		9480	2,3,4,6,7,8-Hexachlorodibenzofuran		
		9549	2,3,4,7,8-Pentachlorodibenzofuran		
		9618	2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD)		
		9612	2,3,7,8-Tetrachlorodibenzofuran		
		9438	Hpcdd, total		
		9444	Hpcdf, total		
		9468	Hxcdd, total		
		9483	Hxcdf, total		
		9555	Pecdd, total		
		9552	Pecdf, total		
		9609	TCDD, total		
		9615	TCDF, total		
	EPA 200.7 5			10014003	ICP - metals
		1000	Aluminum		
		1005	Antimony		

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Biological Tissue

EPA 200.7 5	1010	Arsenic	
	1015	Barium	
	1020	Beryllium	
	1025	Boron	
	1030	Cadmium	
	1035	Calcium	
	1040	Chromium	
	1050	Cobalt	
	1055	Copper	
	1070	Iron	
	1075	Lead	
	1085	Magnesium	
	1090	Manganese	
	1100	Molybdenum	
	1105	Nickel	
	1125	Potassium	
	1140	Selenium	
	1145	Silicon	
	1150	Silver	
	1155	Sodium	
	1160	Strontium	
	1165	Thallium	
	1175	Tin	
	1180	Titanium	
	1185	Vanadium	
	1190	Zinc	
EPA 200.8 5.5		10014809	Metals by ICP-MS
	1000	Aluminum	
	1005	Antimony	
	1010	Arsenic	
	1015	Barium	
	1020	Beryllium	
	1030	Cadmium	
	1035	Calcium	
	1040	Chromium	
	1050	Cobalt	
	1055	Copper	
	1070	Iron	
	1075	Lead	
	1085	Magnesium	
	1090	Manganese	
	1100	Molybdenum	
	1105	Nickel	

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EPA 200.8 5.5	1125	Potassium		
	1140	Selenium		
	1150	Silver		
	1155	Sodium		
	1165	Thallium		
	1185	Vanadium		
	1190	Zinc		
EPA 245.5			10037602	Mercury in Sediment by Cold Vapor Atomic Absorption
	1095	Mercury		
EPA 3050B			10135601	Acid Digestion of Sediments, Sludges, and soils
	8031	Extraction/Preparation		
EPA 3540C			10140202	Soxhlet Extraction
	9822	Extraction/Preparation		
EPA 3550C			10142004	Ultrasonic Extraction
	9822	Extraction/Preparation		
EPA 3580A			10143007	Waste Dilution
	9822	Extraction/Preparation		
EPA 3640A			10147203	Gel Preparation Cleanup
	9822	Extraction/Preparation		
EPA 3660B			10148400	Sulfur cleanup
	9822	Extraction/Preparation		
EPA 5000			10152600	Sample Preparation for Volatile Organics
	9822	Extraction/Preparation		
EPA 5035			10154004	Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples
	9822	Extraction/Preparation		
EPA 6010C 3			10155905	Inductively Coupled Plasma - Atomic Emission Spectrometry
	1000	Aluminum		
	1005	Antimony		
	1010	Arsenic		
	1015	Barium		
	1020	Beryllium		
	1025	Boron		
	1030	Cadmium		
	1035	Calcium		
	1040	Chromium		
	1050	Cobalt		
	1055	Copper		

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EPA 6010C 3	1070	Iron			
	1075	Lead			
	1085	Magnesium			
	1090	Manganese			
	1100	Molybdenum			
	1105	Nickel			
	1125	Potassium			
	1140	Selenium			
	1145	Silicon			
	1150	Silver			
	1155	Sodium			
	1160	Strontium			
	1165	Thallium			
	1175	Tin			
	1180	Titanium			
	1185	Vanadium			
	1190	Zinc			
EPA 6020A 1				10156419	Inductively Coupled Plasma -Mass Spectrometry
	1000	Aluminum			
	1005	Antimony			
	1010	Arsenic			
	1015	Barium			
	1020	Beryllium			
	1030	Cadmium			
	1035	Calcium			
	1040	Chromium			
	1050	Cobalt			
	1055	Copper			
	1070	Iron			
	1075	Lead			
	1085	Magnesium			
	1090	Manganese			
	1100	Molybdenum			
	1105	Nickel			
	1125	Potassium			
	1140	Selenium			
	1150	Silver			
	1155	Sodium			
	1165	Thallium			
	1185	Vanadium			
	1190	Zinc			

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Biological Tissue

EPA 7471B			10166402	Mercury by Cold Vapor Atomic Absorption
	1095	Mercury		
EPA 8081B			10178800	Organochlorine Pesticides by GC/ECD
	8580	2,4'-DDD		
	8585	2,4'-DDE		
	8590	2,4'-DDT		
	7355	4,4'-DDD		
	7360	4,4'-DDE		
	7365	4,4'-DDT		
	7025	Aldrin		
	7110	alpha-BHC (alpha-Hexachlorocyclohexane)		
	7115	beta-BHC (beta-Hexachlorocyclohexane)		
	7250	Chlordane (tech.)		
	7240	cis-chlordane (alpha-Chlordane)		
	7925	cis-Nonachlor		
	7105	delta-BHC		
	7470	Dieldrin		
	7510	Endosulfan I		
	7515	Endosulfan II		
	7520	Endosulfan sulfate		
	7540	Endrin		
	7530	Endrin aldehyde		
	7535	Endrin ketone		
	7120	gamma-BHC (Lindane, gamma-HexachlorocyclohexanE)		
	7685	Heptachlor		
	7690	Heptachlor epoxide		
	6275	Hexachlorobenzene		
	4835	Hexachlorobutadiene		
	7810	Methoxychlor		
	7870	Mirex		
	3890	Oxychlordane		
	8250	Toxaphene (Chlorinated camphene)		
	7245	trans-chlordane (gamma-Chlordane)		
	7910	trans-Nonachlor		
EPA 8082A			10179201	Polychlorinated Biphenyls (PCBs) by GC/ECD
	9902	2,2',3,3',4,4',5,5',6-Nonabromodiphenyl ether (BDE-206)		
	9890	2,2',3,3',4,4',5,5'-Octabromodiphenyl ether (BDE-194)		

Biological Tissue	EPA 8082A	9090	2,2',3,3',4,4',5,5'-Octachlorobiphenyl (BZ-194)
		9903	2,2',3,3',4,4',5,6,6'-Nonabromodiphenyl ether (BDE-207)
		9891	2,2',3,3',4,4',5,6-Octabromodiphenyl ether (BDE-195)
		9892	2,2',3,3',4,4',5,6'-Octabromodiphenyl ether (BDE-196)
		9103	2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ-195)
		9866	2,2',3,3',4,4',5-Heptabromodiphenyl ether (BDE-170)
		9065	2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ-170)
		9020	2,2',3,3',4,4'-Hexachlorobiphenyl (BZ-128)
		9112	2,2',3,3',4,5',6,6'-Octachlorobiphenyl (BZ-201)
		9873	2,2',3,3',4',5,6-Heptabromodiphenyl ether (BDE-177)
		9116	2,2',3,3',4,5,6'-Heptachlorobiphenyl (BZ-174)
		9114	2,2',3,3',4,5',6'-Heptachlorobiphenyl (BZ-177)
		9120	2,2',3,3',4,6'-Hexachlorobiphenyl (BZ-132)
		9133	2,2',3,4,4',5,5',6-Octachlorobiphenyl (BZ-203)
		9134	2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ-180)
		9878	2,2',3,4,4',5,6'-Heptabromodiphenyl ether (BDE-182)
		9075	2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ-183)
		9835	2,2',3,4,4',5'-Hexabromodiphenyl ether (BDE-138)
		9025	2,2',3,4,4',5'-Hexachlorobiphenyl (BZ-138)
		9784	2,2',3,4,4'-Pentabromodiphenyl ether (BDE-85)
		9080	2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ-187)
		9030	2,2',3,4,5,5'-Hexachlorobiphenyl (BZ-141)
		9151	2,2',3,4',5',6-Hexachlorobiphenyl (BZ-149)
		9796	2,2',3',4,5-Pentabromodiphenyl ether (BDE-97)
		8975	2,2',3,4,5'-Pentachlorobiphenyl (BZ-87)
		9154	2,2',3,4',5'-Pentachlorobiphenyl (BZ-97)

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Biological Tissue	EPA 8082A	9797	2,2',3',4,6-Pentabromodiphenyl ether (BDE-98)
		9035	2,2',3,5,5',6-Hexachlorobiphenyl (BZ-151)
		9166	2,2',3,5',6-Pentachlorobiphenyl (BZ-95)
		8945	2,2',3,5'-Tetrachlorobiphenyl (BZ-44)
		9569	2,2',4,4',5,5'-Hexabromodiphenyl ether (BDE-153)
		9040	2,2',4,4',5,5'-Hexachlorobiphenyl (BZ-153)
		9850	2,2',4,4',5',6-Hexabromodiphenyl ether (BDE-154)
		9571	2,2',4,4',5-Pentabromodiphenyl ether (BDE-99)
		9175	2,2',4,4',5-Pentachlorobiphenyl (BZ-99)
		9572	2,2',4,4',6-Pentabromodiphenyl ether (BDE-100)
		9773	2,2',4,4'-Tetrabromodiphenyl ether (BDE-47)
		8980	2,2',4,5,5'-Pentachlorobiphenyl (BZ-101)
		8950	2,2',4,5'-Tetrachlorobiphenyl (BZ-49)
		9716	2,2',4-Tribromodiphenyl ether (BDE-17)
		8955	2,2',5,5'-Tetrachlorobiphenyl (BZ-52)
		8930	2,2',5-Trichlorobiphenyl (BZ-18)
		9050	2,3,3',4,4',5-Hexachlorobiphenyl (BZ-156)
		9193	2,3,3',4,4',6-Hexachlorobiphenyl (BZ-158)
		8985	2,3,3',4,4'-Pentachlorobiphenyl (BZ-105)
		9819	2',3,3',4,5-Pentabromodiphenyl ether (BDE-122)
		8990	2,3,3',4',6-Pentachlorobiphenyl (BZ-110)
		9207	2,3,3',4'-Tetrachlorobiphenyl (BZ-56)
		9820	2',3,4,4',5-Pentabromodiphenyl ether (BDE-123)
		8995	2,3',4,4',5-Pentachlorobiphenyl (BZ-118)
		9758	2,3,4,4'-Tetrabromodiphenyl ether (BDE-60)
		9764	2,3',4,4'-Tetrabromodiphenyl ether (BDE-66)
		9221	2,3,4,4'-Tetrachlorobiphenyl (BZ-60)
		8960	2,3',4,4'-Tetrachlorobiphenyl (BZ-66)
		9821	2',3,4,5,5'-Pentabromodiphenyl ether (BDE-124)
		9822	2',3,4,5,6'-Pentabromodiphenyl ether (BDE-125)

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EPA 8082A	9775	2',3,4,5-Tetrabromodiphenyl ether (BDE-76)		
	9230	2,3',4',5-Tetrachlorobiphenyl (BZ-70)		
	9760	2,3,4,6-Tetrabromodiphenyl ether (BDE-62)		
	9769	2,3',4',6-Tetrabromodiphenyl ether (BDE-71)		
	9732	2',3,4-Tribromodiphenyl ether (BDE-33)		
	9239	2,3',4'-Trichlorobiphenyl (BZ-33)		
	9733	2',3,5-Tribromodiphenyl ether (BDE-34)		
	9250	2,4,4',5-Tetrachlorobiphenyl (BZ-74)		
	9727	2,4,4'-Tribromodiphenyl ether (BDE-28)		
	9252	2,4,4'-Trichlorobiphenyl (BZ-28)		
	8940	2,4',5-Trichlorobiphenyl (BZ-31)		
	9256	2,4'-Dichlorobiphenyl (BZ-8)		
	8880	Aroclor-1016 (PCB-1016)		
	8885	Aroclor-1221 (PCB-1221)		
	8890	Aroclor-1232 (PCB-1232)		
	8895	Aroclor-1242 (PCB-1242)		
	8900	Aroclor-1248 (PCB-1248)		
	8905	Aroclor-1254 (PCB-1254)		
	8910	Aroclor-1260 (PCB-1260)		
	8912	Aroclor-1262 (PCB-1262)		
	8913	Aroclor-1268 (PCB-1268)		
EPA 8260C			10307003	Volatile Organics: GC/MS (capillary column)
	5105	1,1,1,2-Tetrachloroethane		
	5160	1,1,1-Trichloroethane		
	5110	1,1,2,2-Tetrachloroethane		
	5195	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)		
	5165	1,1,2-Trichloroethane		
	4630	1,1-Dichloroethane		
	4640	1,1-Dichloroethylene		
	4670	1,1-Dichloropropene		
	5150	1,2,3-Trichlorobenzene		
	5180	1,2,3-Trichloropropane		
	5155	1,2,4-Trichlorobenzene		
	5210	1,2,4-Trimethylbenzene		
	4570	1,2-Dibromo-3-chloropropane (DBCP)		
	4585	1,2-Dibromoethane (EDB, Ethylene dibromide)		
	4610	1,2-Dichlorobenzene		
	4635	1,2-Dichloroethane (Ethylene dichloride)		
	4655	1,2-Dichloropropane		

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EPA 8260C

5215	1,3,5-Trimethylbenzene
4615	1,3-Dichlorobenzene
4660	1,3-Dichloropropane
4620	1,4-Dichlorobenzene
4665	2,2-Dichloropropane
4410	2-Butanone (Methyl ethyl ketone, MEK)
4500	2-Chloroethyl vinyl ether
4535	2-Chlorotoluene
4860	2-Hexanone (MBK)
4540	4-Chlorotoluene
4910	4-Isopropyltoluene (p-Cymene)
4995	4-Methyl-2-pentanone (MIBK)
4315	Acetone
4325	Acrolein (Propenal)
4340	Acrylonitrile
4375	Benzene
4385	Bromobenzene
4390	Bromochloromethane
4395	Bromodichloromethane
4397	Bromoethane (Ethyl Bromide)
4400	Bromoform
4450	Carbon disulfide
4455	Carbon tetrachloride
4475	Chlorobenzene
4575	Chlorodibromomethane
4485	Chloroethane (Ethyl chloride)
4505	Chloroform
4645	cis-1,2-Dichloroethylene
4680	cis-1,3-Dichloropropene
4595	Dibromomethane (Methylene bromide)
4625	Dichlorodifluoromethane (Freon-12)
4765	Ethylbenzene
4835	Hexachlorobutadiene
4870	Iodomethane (Methyl iodide)
4900	Isopropylbenzene (Cumene)
5240	m+p-xylene
4950	Methyl bromide (Bromomethane)
4960	Methyl chloride (Chloromethane)
5000	Methyl tert-butyl ether (MTBE)
4975	Methylene chloride (Dichloromethane)
5005	Naphthalene
4435	n-Butylbenzene
5090	n-Propylbenzene

Biological Tissue

EPA 8260C	5250	o-Xylene		
	4440	sec-Butylbenzene		
	5100	Styrene		
	4445	tert-Butylbenzene		
	5115	Tetrachloroethylene (Perchloroethylene)		
	5140	Toluene		
	4700	trans-1,2-Dichloroethylene		
	4685	trans-1,3-Dichloropropylene		
	4605	trans-1,4-Dichloro-2-butene		
	5170	Trichloroethene (Trichloroethylene)		
	5175	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)		
	5225	Vinyl acetate		
	5235	Vinyl chloride		
EPA 8270D			10186002	Semivolatile Organic compounds by GC/MS
	6715	1,2,4,5-Tetrachlorobenzene		
	5155	1,2,4-Trichlorobenzene		
	4610	1,2-Dichlorobenzene		
	4615	1,3-Dichlorobenzene		
	4620	1,4-Dichlorobenzene		
	4735	1,4-Dioxane (1,4- Diethyleneoxide)		
	6380	1-Methylnaphthalene		
	4659	2,2-Oxybis(1-chloropropane)		
	6835	2,4,5-Trichlorophenol		
	6840	2,4,6-Trichlorophenol		
	6000	2,4-Dichlorophenol		
	6130	2,4-Dimethylphenol		
	6175	2,4-Dinitrophenol		
	6185	2,4-Dinitrotoluene (2,4-DNT)		
	6190	2,6-Dinitrotoluene (2,6-DNT)		
	5795	2-Chloronaphthalene		
	5800	2-Chlorophenol		
	6360	2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)		
	6385	2-Methylnaphthalene		
	6400	2-Methylphenol (o-Cresol)		
	6460	2-Nitroaniline		
	6490	2-Nitrophenol		
	5945	3,3'-Dichlorobenzidine		
	6465	3-Nitroaniline		
	5660	4-Bromophenyl phenyl ether (BDE-3)		
	5700	4-Chloro-3-methylphenol		
	5745	4-Chloroaniline		

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EPA 8270D

5825	4-Chlorophenyl phenylether
4910	4-Isopropyltoluene (p-Cymene)
6410	4-Methylphenol (p-Cresol)
6470	4-Nitroaniline
6500	4-Nitrophenol
5500	Acenaphthene
5505	Acenaphthylene
5510	Acetophenone
7005	Alachlor
6700	alpha-Terpineol
5545	Aniline
5555	Anthracene
7075	Azinphos-methyl (Guthion)
5562	Azobenzene
5595	Benzidine
5575	Benzo(a)anthracene
5580	Benzo(a)pyrene
5605	Benzo(e)pyrene
5590	Benzo(g,h,i)perylene
5600	Benzo(k)fluoranthene
5585	Benzo[b]fluoranthene
5610	Benzoic acid
5630	Benzyl alcohol
5640	Biphenyl
5760	bis(2-Chloroethoxy)methane
5765	bis(2-Chloroethyl) ether
7125	Bolstar (Sulprofos)
5670	Butyl benzyl phthalate
5671	Butyl diphenyl Phosphate
5673	Butylated Hydroxy Toluene (BHT)
5680	Carbazole
7255	Chlorfenvinphos
7300	Chlorpyrifos
5855	Chrysene
7315	Coumaphos
7330	Crotoxyphos
7385	Demeton-s
6065	Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate, DEHP)
7410	Diazinon
5895	Dibenz(a,h) anthracene
5905	Dibenzofuran
5912	Dibutyl phenyl Phospahate
7465	Dicrotophos

Biological Tissue

EPA 8270D

6070	Diethyl phthalate
7475	Dimethoate
6135	Dimethyl phthalate
5925	Di-n-butyl phthalate
6200	Di-n-octyl phthalate
8625	Disulfoton
7550	EPN
7565	Ethion
7570	Ethoprop
7600	Fensulfothion
7605	Fenthion
6265	Fluoranthene
6270	Fluorene
6275	Hexachlorobenzene
4835	Hexachlorobutadiene
6285	Hexachlorocyclopentadiene
4840	Hexachloroethane
6315	Indeno(1,2,3-cd) pyrene
6320	Isophorone
7770	Malathion
7785	Merphos
7825	Methyl parathion (Parathion, methyl)
7850	Mevinphos
7880	Monocrotophos
7905	Naled
5005	Naphthalene
5015	Nitrobenzene
6530	n-Nitrosodimethylamine
6545	n-Nitrosodi-n-propylamine
6535	n-Nitrosodiphenylamine
7955	Parathion, ethyl
6605	Pentachlorophenol
6615	Phenanthrene
6625	Phenol
7985	Phorate
6665	Pyrene
5095	Pyridine
6683	Retene
8110	Ronnel
8155	Sulfotepp
8200	Tetrachlorvinphos (Stirophos, Gardona) Z-isomer
8245	Tokuthion (Prothiophos)
8262	Tributyl phosphate

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EPA 8270D	8275	Trichloronate		
	8282	Triphenyl phosphate		
EPA 8270D SIM			10242509	Semivolatile Organic compounds by GC/MS Selective Ion Monitoring
	6380	1-Methylnaphthalene		
	6385	2-Methylnaphthalene		
	5500	Acenaphthene		
	5505	Acenaphthylene		
	5555	Anthracene		
	5575	Benzo(a)anthracene		
	5580	Benzo(a)pyrene		
	5605	Benzo(e)pyrene		
	5590	Benzo(g,h,i)perylene		
	9309	Benzo(j)fluoranthene		
	5600	Benzo(k)fluoranthene		
	5585	Benzo[b]fluoranthene		
	5640	Biphenyl		
	5680	Carbazole		
	5855	Chrysene		
	5895	Dibenz(a,h) anthracene		
	5905	Dibenzofuran		
	6265	Fluoranthene		
	6270	Fluorene		
	6315	Indeno(1,2,3-cd) pyrene		
	5005	Naphthalene		
	6608	Perylene		
	6615	Phenanthrene		
	6665	Pyrene		
EPA 8290A			10187403	Polychlorinated Dibenzodioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) by GC/HRMS
	9516	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)		
	9519	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)		
	9420	1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)		
	9426	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)		
	9423	1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)		
	9471	1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-Hxcdf)		
	9453	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd)		

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EPA 8290A	9474	1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf)	
	9456	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,6,7,8-Hxcdd)	
	9477	1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf)	
	9459	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd)	
	9543	1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf)	
	9540	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd)	
	9480	2,3,4,6,7,8-Hexachlorodibenzofuran	
	9549	2,3,4,7,8-Pentachlorodibenzofuran	
	9618	2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD)	
	9612	2,3,7,8-Tetrachlorodibenzofuran	
	9438	Hpcdd, total	
	9444	Hpcdf, total	
	9468	Hxcdd, total	
	9483	Hxcdf, total	
	9555	Pecdd, total	
	9552	Pecdf, total	
	9609	TCDD, total	
	9615	TCDF, total	

Non-Potable Water

AK101 GRO-MS AK101 GRO-MS			90015159	Determination of Gasoline Range Organics by GC/MS - Alaska Department of Environmental Conservation
	9408	Gasoline range organics (GRO)		
AK102 DRO AK102 DRO			90015206	Determination of Diesel Range Organics - Alaska Department of Environmental Conservation
	9369	Diesel range organics (DRO)		
AK103 RRO			90015400	Determination of Residual Range Organics - Alaska Department of Environmental Conservation
	9499	Motor Oil		
EPA 120.1			10006209	Conductance - Specific @ 25 C
	1610	Conductivity		
EPA 1311			10118806	Toxicity Characteristic Leaching Procedure
	9822	Extraction/Preparation		
EPA 1312			10119003	Synthetic Precipitation Leaching Procedure
	9822	Extraction/Preparation		

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EPA 160.4			10010409	Total Volatile Solids, ignition @ 550 C.
	1970	Residue-volatile		
EPA 1613B			10120602	Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope Dilution GC/HRMS
	9516	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)		
	9519	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)		
	9420	1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)		
	9426	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)		
	9423	1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)		
	9471	1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-Hxcdf)		
	9453	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd)		
	9474	1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf)		
	9456	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,6,7,8-Hxcdd)		
	9477	1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf)		
	9459	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd)		
	9543	1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf)		
	9540	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd)		
	9480	2,3,4,6,7,8-Hexachlorodibenzofuran		
	9549	2,3,4,7,8-Pentachlorodibenzofuran		
	9618	2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD)		
	9612	2,3,7,8-Tetrachlorodibenzofuran		
	9438	Hpcdd, total		
	9444	Hpcdf, total		
	9468	Hxcdd, total		
	9483	Hxcdf, total		
	9555	Pecdd, total		
	9552	Pecdf, total		
	9609	TCDD, total		
	9615	TCDF, total		
EPA 1664B			10261617	N-Hexane Extractable Material (Oil and Grease) by Extraction and Gravimetry
	1803	n-Hexane Extractable Material (O&G)		

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Non-Potable Water

EPA 1664B (SGT-HEM)			10260628	Silica Gel Treated n-Hexane Extractable Material (Oil & Grease)
	2050	Total Petroleum Hydrocarbons (TPH)		
EPA 180.1 2			10011800	Turbidity - Nephelometric
	2055	Turbidity		
EPA 200.7 5			10014003	ICP - metals
	1000	Aluminum		
	1005	Antimony		
	1010	Arsenic		
	1015	Barium		
	1020	Beryllium		
	1025	Boron		
	1030	Cadmium		
	1035	Calcium		
	1040	Chromium		
	1050	Cobalt		
	1055	Copper		
	1070	Iron		
	1075	Lead		
	1085	Magnesium		
	1090	Manganese		
	1100	Molybdenum		
	1105	Nickel		
	1125	Potassium		
	1140	Selenium		
	1145	Silicon		
	1150	Silver		
	1155	Sodium		
	1160	Strontium		
	1165	Thallium		
	1175	Tin		
	1180	Titanium		
	1185	Vanadium		
	1190	Zinc		
EPA 200.8 5.5			10014809	Metals by ICP-MS
	1000	Aluminum		
	1005	Antimony		
	1010	Arsenic		
	1015	Barium		
	1020	Beryllium		
	1030	Cadmium		
	1035	Calcium		
	1040	Chromium		

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EPA 200.8 5.5				
	1050	Cobalt		
	1055	Copper		
	1070	Iron		
	1075	Lead		
	1085	Magnesium		
	1090	Manganese		
	1100	Molybdenum		
	1105	Nickel		
	1125	Potassium		
	1140	Selenium		
	1150	Silver		
	1155	Sodium		
	1165	Thallium		
	1185	Vanadium		
	1190	Zinc		
EPA 245.1 4.1			10271008	Mercury by Cold Vapor Atomic Absorption
	1095	Mercury		
EPA 300.0 2.1			10053200	Methods for the Determination of Inorganic Substances in Environmental Samples
	1540	Bromide		
	1575	Chloride		
	1730	Fluoride		
	1810	Nitrate as N		
	1840	Nitrite as N		
	1870	Orthophosphate as P		
	2000	Sulfate		
EPA 3005A			10133207	Acid Digestion of waters for Total Recoverable or Dissolved Metals
	9822	Extraction/Preparation		
EPA 3010A			10133605	Acid Digestion of Aqueous samples and Extracts for Total Metals
	9822	Extraction/Preparation		
EPA 3020A			10134404	Acid Digestion of Aqueous samples and Extracts for Total Metals for Analysis by GFAA
	9822	Extraction/Preparation		
EPA 335.4 1.0			10061402	Methods for the Determination of Inorganic Substances in Environmental Samples
	1510	Amenable cyanide		
	1635	Cyanide		
	1645	Total cyanide		

Non-Potable Water

EPA 351.2 2			10065404	Total Kjeldahl Nitrogen - Block Digest, Phenate
	1790	Kjeldahl nitrogen		
	1795	Kjeldahl nitrogen - total		
EPA 3510C			10138202	Separatory Funnel Liquid-liquid extraction
	9822	Extraction/Preparation		
EPA 3520C			10139001	Continuous Liquid-liquid extraction
	9822	Extraction/Preparation		
EPA 353.2 2			10067604	Nitrate/Nitrite Nitrogen - Automated, Cadmium
	1810	Nitrate as N		
	1820	Nitrate-nitrite		
	1840	Nitrite as N		
EPA 3550C			10142004	Ultrasonic Extraction
	9822	Extraction/Preparation		
EPA 3580A			10143007	Waste Dilution
	9822	Extraction/Preparation		
EPA 3611B			10145207	Alumina Column Cleanup and separation of petroleum wastes
	8031	Extraction/Preparation		
EPA 3620C			10146006	Florisil Cleanup
	8031	Extraction/Preparation		
EPA 3630C			10146802	Silica gel cleanup
	8031	Extraction/Preparation		
EPA 3640A			10147203	Gel Preparation Cleanup
	9822	Extraction/Preparation		
EPA 3650B			10147805	Acid base partition cleanup
	8031	Extraction/Preparation		
EPA 3660B			10148400	Sulfur cleanup
	9822	Extraction/Preparation		
EPA 3665A			10148808	Sulfuric Acid / permanganate Cleanup
	9822	Extraction/Preparation		
EPA 375.2 4			10073004	Sulfate - Colorimetric, Automated, Methylthymol.
	2000	Sulfate		
EPA 410.4 2			10077404	Chemical Oxygen Demand - Colorimetric, Automated.
	1565	Chemical oxygen demand		
EPA 420.1			10079400	Phenolics - Spectrophotometric, manual.
	1905	Total phenolics		

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EPA 5000			10152600	Sample Preparation for Volatile Organics
	9822	Extraction/Preparation		
EPA 5030B			10153409	Purge and trap for aqueous samples
	9822	Extraction/Preparation		
EPA 6010C 3			10155905	Inductively Coupled Plasma - Atomic Emission Spectrometry
	1000	Aluminum		
	1005	Antimony		
	1010	Arsenic		
	1015	Barium		
	1020	Beryllium		
	1025	Boron		
	1030	Cadmium		
	1035	Calcium		
	1040	Chromium		
	1050	Cobalt		
	1055	Copper		
	1070	Iron		
	1075	Lead		
	1085	Magnesium		
	1090	Manganese		
	1100	Molybdenum		
	1105	Nickel		
	1125	Potassium		
	1140	Selenium		
	1145	Silicon		
	1150	Silver		
	1155	Sodium		
	1165	Thallium		
	1175	Tin		
	1180	Titanium		
	1185	Vanadium		
	1190	Zinc		
EPA 6020A 1			10156419	Inductively Coupled Plasma -Mass Spectrometry
	1000	Aluminum		
	1005	Antimony		
	1010	Arsenic		
	1015	Barium		
	1020	Beryllium		
	1030	Cadmium		
	1035	Calcium		
	1040	Chromium		

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EPA 6020A 1	1050	Cobalt		
	1055	Copper		
	1070	Iron		
	1075	Lead		
	1085	Magnesium		
	1090	Manganese		
	1100	Molybdenum		
	1105	Nickel		
	1125	Potassium		
	1140	Selenium		
	1150	Silver		
	1155	Sodium		
	1165	Thallium		
	1185	Vanadium		
	1190	Zinc		
EPA 7196A			10162400	Chromium Hexavalent colorimetric
	1045	Chromium VI		
EPA 7470A			10165807	Mercury in Liquid Waste by Cold Vapor Atomic Absorption
	1095	Mercury		
EPA 8015C			10173805	Non-halogenated organics using GC/FID
	9369	Diesel range organics (DRO)		
	9408	Gasoline range organics (GRO)		
EPA 8015D			10305609	Nonhalogenated Organics Using GC/FID
	9506	Residual Range Organics (RRO)		
EPA 8021B			10174808	Aromatic and Halogenated Volatiles by GC with PID and/or ECD Purge & Trap
	4375	Benzene		
	4765	Ethylbenzene		
	5240	m+p-xylene		
	5000	Methyl tert-butyl ether (MTBE)		
	5250	o-Xylene		
	5140	Toluene		
EPA 8041A			10176804	Phenols by Gas Chromatography
	6730	2,3,4,5-Tetrachlorophenol		
	6735	2,3,4,6-Tetrachlorophenol		
	6740	2,3,5,6-Tetrachlorophenol		
	6830	2,3,6-Trichlorophenol (4C)		
	6835	2,4,5-Trichlorophenol		
	6605	Pentachlorophenol		

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EPA 8081B			10178800	Organochlorine Pesticides by GC/ECD
	8580	2,4'-DDD		
	8585	2,4'-DDE		
	8590	2,4'-DDT		
	7355	4,4'-DDD		
	7360	4,4'-DDE		
	7365	4,4'-DDT		
	7025	Aldrin		
	7110	alpha-BHC (alpha-Hexachlorocyclohexane)		
	7115	beta-BHC (beta-Hexachlorocyclohexane)		
	7250	Chlordane (tech.)		
	7240	cis-chlordane (alpha-Chlordane)		
	7925	cis-Nonachlor		
	7105	delta-BHC		
	7470	Dieldrin		
	7510	Endosulfan I		
	7515	Endosulfan II		
	7520	Endosulfan sulfate		
	7540	Endrin		
	7530	Endrin aldehyde		
	7535	Endrin ketone		
	7120	gamma-BHC (Lindane, gamma-HexachlorocyclohexanE)		
	7685	Heptachlor		
	7690	Heptachlor epoxide		
	6275	Hexachlorobenzene		
	4835	Hexachlorobutadiene		
	7810	Methoxychlor		
	7870	Mirex		
	3890	Oxychlordane		
	8250	Toxaphene (Chlorinated camphene)		
	7245	trans-chlordane (gamma-Chlordane)		
	7910	trans-Nonachlor		
EPA 8082A			10179201	Polychlorinated Biphenyls (PCBs) by GC/ECD
	9902	2,2',3,3',4,4',5,5',6-Nonabromodiphenyl ether (BDE-206)		
	9890	2,2',3,3',4,4',5,5'-Octabromodiphenyl ether (BDE-194)		
	9090	2,2',3,3',4,4',5,5'-Octachlorobiphenyl (BZ-194)		
	9903	2,2',3,3',4,4',5,6,6'-Nonabromodiphenyl ether (BDE-207)		

Non-Potable Water	EPA 8082A	9891	2,2',3,3',4,4',5,6-Octabromodiphenyl ether (BDE-195)
		9892	2,2',3,3',4,4',5,6'-Octabromodiphenyl ether (BDE-196)
		9103	2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ-195)
		9866	2,2',3,3',4,4',5-Heptabromodiphenyl ether (BDE-170)
		9065	2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ-170)
		9020	2,2',3,3',4,4'-Hexachlorobiphenyl (BZ-128)
		9112	2,2',3,3',4,5',6,6'-Octachlorobiphenyl (BZ-201)
		9873	2,2',3,3',4',5,6-Heptabromodiphenyl ether (BDE-177)
		9116	2,2',3,3',4,5,6'-Heptachlorobiphenyl (BZ-174)
		9114	2,2',3,3',4,5',6'-Heptachlorobiphenyl (BZ-177)
		9120	2,2',3,3',4,6'-Hexachlorobiphenyl (BZ-132)
		9133	2,2',3,4,4',5,5',6-Octachlorobiphenyl (BZ-203)
		9134	2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ-180)
		9878	2,2',3,4,4',5,6'-Heptabromodiphenyl ether (BDE-182)
		9075	2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ-183)
		9835	2,2',3,4,4',5'-Hexabromodiphenyl ether (BDE-138)
		9025	2,2',3,4,4',5'-Hexachlorobiphenyl (BZ-138)
		9784	2,2',3,4,4'-Pentabromodiphenyl ether (BDE-85)
		9080	2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ-187)
		9030	2,2',3,4,5,5'-Hexachlorobiphenyl (BZ-141)
		9151	2,2',3,4',5',6-Hexachlorobiphenyl (BZ-149)
		9796	2,2',3',4,5-Pentabromodiphenyl ether (BDE-97)
		8975	2,2',3,4,5'-Pentachlorobiphenyl (BZ-87)
		9154	2,2',3,4',5'-Pentachlorobiphenyl (BZ-97)
		9797	2,2',3',4,6-Pentabromodiphenyl ether (BDE-98)
		9035	2,2',3,5,5',6-Hexachlorobiphenyl (BZ-151)

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EPA 8082A	9166	2,2',3,5',6-Pentachlorobiphenyl (BZ-95)
	8945	2,2',3,5'-Tetrachlorobiphenyl (BZ-44)
	9569	2,2',4,4',5,5'-Hexabromodiphenyl ether (BDE-153)
	9040	2,2',4,4',5,5'-Hexachlorobiphenyl (BZ-153)
	9850	2,2',4,4',5',6-Hexabromodiphenyl ether (BDE-154)
	9571	2,2',4,4',5-Pentabromodiphenyl ether (BDE-99)
	9175	2,2',4,4',5-Pentachlorobiphenyl (BZ-99)
	9572	2,2',4,4',6-Pentabromodiphenyl ether (BDE-100)
	9773	2,2',4,4'-Tetrabromodiphenyl ether (BDE-47)
	8980	2,2',4,5,5'-Pentachlorobiphenyl (BZ-101)
	8950	2,2',4,5'-Tetrachlorobiphenyl (BZ-49)
	9716	2,2',4-Tribromodiphenyl ether (BDE-17)
	8955	2,2',5,5'-Tetrachlorobiphenyl (BZ-52)
	8930	2,2',5-Trichlorobiphenyl (BZ-18)
	9050	2,3,3',4,4',5-Hexachlorobiphenyl (BZ-156)
	9193	2,3,3',4,4',6-Hexachlorobiphenyl (BZ-158)
	8985	2,3,3',4,4'-Pentachlorobiphenyl (BZ-105)
	9819	2',3,3',4,5-Pentabromodiphenyl ether (BDE-122)
	8990	2,3,3',4',6-Pentachlorobiphenyl (BZ-110)
	9207	2,3,3',4'-Tetrachlorobiphenyl (BZ-56)
	9820	2',3,4,4',5-Pentabromodiphenyl ether (BDE-123)
	8995	2,3',4,4',5-Pentachlorobiphenyl (BZ-118)
	9758	2,3,4,4'-Tetrabromodiphenyl ether (BDE-60)
	9764	2,3',4,4'-Tetrabromodiphenyl ether (BDE-66)
	9221	2,3,4,4'-Tetrachlorobiphenyl (BZ-60)
	8960	2,3',4,4'-Tetrachlorobiphenyl (BZ-66)
	9821	2',3,4,5,5'-Pentabromodiphenyl ether (BDE-124)
	9822	2',3,4,5,6'-Pentabromodiphenyl ether (BDE-125)
	9775	2',3,4,5-Tetrabromodiphenyl ether (BDE-76)
	9230	2,3',4',5-Tetrachlorobiphenyl (BZ-70)

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EPA 8082A	9760	2,3,4,6-Tetrabromodiphenyl ether (BDE-62)		
	9769	2,3',4',6-Tetrabromodiphenyl ether (BDE-71)		
	9732	2',3,4-Tribromodiphenyl ether (BDE-33)		
	9239	2,3',4'-Trichlorobiphenyl (BZ-33)		
	9733	2',3,5-Tribromodiphenyl ether (BDE-34)		
	9250	2,4,4',5-Tetrachlorobiphenyl (BZ-74)		
	9727	2,4,4'-Tribromodiphenyl ether (BDE-28)		
	9252	2,4,4'-Trichlorobiphenyl (BZ-28)		
	8940	2,4',5-Trichlorobiphenyl (BZ-31)		
	9256	2,4'-Dichlorobiphenyl (BZ-8)		
	8880	Aroclor-1016 (PCB-1016)		
	8885	Aroclor-1221 (PCB-1221)		
	8890	Aroclor-1232 (PCB-1232)		
	8895	Aroclor-1242 (PCB-1242)		
	8900	Aroclor-1248 (PCB-1248)		
	8905	Aroclor-1254 (PCB-1254)		
	8910	Aroclor-1260 (PCB-1260)		
	8912	Aroclor-1262 (PCB-1262)		
	8913	Aroclor-1268 (PCB-1268)		
EPA 8260C			10307003	Volatile Organics: GC/MS (capillary column)
	5105	1,1,1,2-Tetrachloroethane		
	5160	1,1,1-Trichloroethane		
	5110	1,1,2,2-Tetrachloroethane		
	5195	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)		
	5165	1,1,2-Trichloroethane		
	4630	1,1-Dichloroethane		
	4640	1,1-Dichloroethylene		
	4670	1,1-Dichloropropene		
	5150	1,2,3-Trichlorobenzene		
	5180	1,2,3-Trichloropropane		
	5155	1,2,4-Trichlorobenzene		
	5210	1,2,4-Trimethylbenzene		
	4570	1,2-Dibromo-3-chloropropane (DBCP)		
	4585	1,2-Dibromoethane (EDB, Ethylene dibromide)		
	4610	1,2-Dichlorobenzene		
	4635	1,2-Dichloroethane (Ethylene dichloride)		
	4655	1,2-Dichloropropane		
	5215	1,3,5-Trimethylbenzene		
	4615	1,3-Dichlorobenzene		
	4660	1,3-Dichloropropane		

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EPA 8260C	4620	1,4-Dichlorobenzene
	4665	2,2-Dichloropropane
	4410	2-Butanone (Methyl ethyl ketone, MEK)
	4500	2-Chloroethyl vinyl ether
	4535	2-Chlorotoluene
	4860	2-Hexanone (MBK)
	4540	4-Chlorotoluene
	4910	4-Isopropyltoluene (p-Cymene)
	4995	4-Methyl-2-pentanone (MIBK)
	4315	Acetone
	4325	Acrolein (Propenal)
	4340	Acrylonitrile
	4375	Benzene
	4385	Bromobenzene
	4390	Bromochloromethane
	4395	Bromodichloromethane
	4397	Bromoethane (Ethyl Bromide)
	4400	Bromoform
	4450	Carbon disulfide
	4455	Carbon tetrachloride
	4475	Chlorobenzene
	4575	Chlorodibromomethane
	4485	Chloroethane (Ethyl chloride)
	4505	Chloroform
	4645	cis-1,2-Dichloroethylene
	4680	cis-1,3-Dichloropropene
	4560	Cyclohexanone
	4595	Dibromomethane (Methylene bromide)
	4625	Dichlorodifluoromethane (Freon-12)
	4725	Diethyl ether
	9375	Di-isopropylether (DIPE)
	4765	Ethylbenzene
	4770	Ethyl-t-butylether (ETBE) (2-Ethoxy-2-methylpropane)
	9408	Gasoline range organics (GRO)
	4835	Hexachlorobutadiene
	4870	Iodomethane (Methyl iodide)
	4900	Isopropylbenzene (Cumene)
	5240	m+p-xylene
	4950	Methyl bromide (Bromomethane)
	4960	Methyl chloride (Chloromethane)
	5000	Methyl tert-butyl ether (MTBE)
	4975	Methylene chloride (Dichloromethane)
	5005	Naphthalene

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EPA 8260C				
	4435	n-Butylbenzene		
	5090	n-Propylbenzene		
	5250	o-Xylene		
	4440	sec-Butylbenzene		
	5100	Styrene		
	4370	T-amylmethylether (TAME)		
	4420	tert-Butyl alcohol		
	4445	tert-Butylbenzene		
	5115	Tetrachloroethylene (Perchloroethylene)		
	5140	Toluene		
	4700	trans-1,2-Dichloroethylene		
	4685	trans-1,3-Dichloropropylene		
	4605	trans-1,4-Dichloro-2-butene		
	5170	Trichloroethene (Trichloroethylene)		
	5175	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)		
	5225	Vinyl acetate		
	5235	Vinyl chloride		
EPA 8260C SIM			10307105	Volatile Organic Compounds by GC/MS-SIM
	5105	1,1,1,2-Tetrachloroethane		
	4640	1,1-Dichloroethylene		
	4635	1,2-Dichloroethane (Ethylene dichloride)		
	4340	Acrylonitrile		
	4375	Benzene		
	4645	cis-1,2-Dichloroethylene		
	5115	Tetrachloroethylene (Perchloroethylene)		
	4700	trans-1,2-Dichloroethylene		
	5170	Trichloroethene (Trichloroethylene)		
	5235	Vinyl chloride		
EPA 8270D			10186002	Semivolatile Organic compounds by GC/MS
	6715	1,2,4,5-Tetrachlorobenzene		
	5155	1,2,4-Trichlorobenzene		
	4610	1,2-Dichlorobenzene		
	4615	1,3-Dichlorobenzene		
	4620	1,4-Dichlorobenzene		
	4735	1,4-Dioxane (1,4- Diethyleneoxide)		
	6380	1-Methylnaphthalene		
	4659	2,2-Oxybis(1-chloropropane)		
	6835	2,4,5-Trichlorophenol		
	6840	2,4,6-Trichlorophenol		
	6000	2,4-Dichlorophenol		
	6130	2,4-Dimethylphenol		

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EPA 8270D	6175	2,4-Dinitrophenol
	6185	2,4-Dinitrotoluene (2,4-DNT)
	6190	2,6-Dinitrotoluene (2,6-DNT)
	5795	2-Chloronaphthalene
	5800	2-Chlorophenol
	6360	2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)
	6385	2-Methylnaphthalene
	6400	2-Methylphenol (o-Cresol)
	6460	2-Nitroaniline
	6490	2-Nitrophenol
	5945	3,3'-Dichlorobenzidine
	6465	3-Nitroaniline
	5660	4-Bromophenyl phenyl ether (BDE-3)
	5700	4-Chloro-3-methylphenol
	5745	4-Chloroaniline
	5825	4-Chlorophenyl phenylether
	4910	4-Isopropyltoluene (p-Cymene)
	6410	4-Methylphenol (p-Cresol)
	6470	4-Nitroaniline
	6500	4-Nitrophenol
	5500	Acenaphthene
	5505	Acenaphthylene
	5510	Acetophenone
	7005	Alachlor
	6700	alpha-Terpineol
	5545	Aniline
	5555	Anthracene
	7075	Azinphos-methyl (Guthion)
	5562	Azobenzene
	5595	Benzidine
	5575	Benzo(a)anthracene
	5580	Benzo(a)pyrene
	5605	Benzo(e)pyrene
	5590	Benzo(g,h,i)perylene
	5600	Benzo(k)fluoranthene
	5585	Benzo[b]fluoranthene
	5610	Benzoic acid
	5630	Benzyl alcohol
	5640	Biphenyl
	5760	bis(2-Chloroethoxy)methane
	5765	bis(2-Chloroethyl) ether
	7125	Bolstar (Sulprofos)
	5670	Butyl benzyl phthalate

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5671	Butyl diphenyl Phosphate
5673	Butylated Hydroxy Toluene (BHT)
5680	Carbazole
7255	Chlorfenvinphos
7300	Chlorpyrifos
5855	Chrysene
7315	Coumaphos
7330	Crotoxyphos
7385	Demeton-s
6065	Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate, DEHP)
7410	Diazinon
5895	Dibenz(a,h) anthracene
5905	Dibenzofuran
5912	Dibutyl phenyl Phospahate
7465	Dicrotophos
6070	Diethyl phthalate
7475	Dimethoate
6135	Dimethyl phthalate
5925	Di-n-butyl phthalate
6200	Di-n-octyl phthalate
8625	Disulfoton
7550	EPN
7565	Ethion
7570	Ethoprop
7600	Fensulfothion
7605	Fenthion
6265	Fluoranthene
6270	Fluorene
6275	Hexachlorobenzene
4835	Hexachlorobutadiene
6285	Hexachlorocyclopentadiene
4840	Hexachloroethane
6315	Indeno(1,2,3-cd) pyrene
6320	Isophorone
7770	Malathion
7785	Merphos
7825	Methyl parathion (Parathion, methyl)
7850	Mevinphos
7880	Monocrotophos
7905	Naled
5005	Naphthalene
5015	Nitrobenzene
6530	n-Nitrosodimethylamine

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EPA 8270D	6545	n-Nitrosodi-n-propylamine	
	6535	n-Nitrosodiphenylamine	
	7955	Parathion, ethyl	
	6605	Pentachlorophenol	
	6615	Phenanthrene	
	6625	Phenol	
	7985	Phorate	
	6665	Pyrene	
	5095	Pyridine	
	6683	Retene	
	8110	Ronnel	
	8155	Sulfotepp	
	8200	Tetrachlorvinphos (Stirophos, Gardona) Z-isomer	
	8245	Tokuthion (Prothiophos)	
	8262	Tributyl phosphate	
	8275	Trichloronate	
	8282	Triphenyl phosphate	
EPA 8270D SIM		10242509	Semivolatile Organic compounds by GC/MS Selective Ion Monitoring
	6380	1-Methylnaphthalene	
	6385	2-Methylnaphthalene	
	5500	Acenaphthene	
	5505	Acenaphthylene	
	5555	Anthracene	
	5575	Benzo(a)anthracene	
	5580	Benzo(a)pyrene	
	5605	Benzo(e)pyrene	
	5590	Benzo(g,h,i)perylene	
	9309	Benzo(j)fluoranthene	
	5600	Benzo(k)fluoranthene	
	5585	Benzo[b]fluoranthene	
	5640	Biphenyl	
	1201	Butyltin trichloride	
	5680	Carbazole	
	5855	Chrysene	
	5895	Dibenz(a,h) anthracene	
	5905	Dibenzofuran	
	5913	Dibutyltin	
	1202	Dibutyltin dichloride	
	6265	Fluoranthene	
	6270	Fluorene	
	6315	Indeno(1,2,3-cd) pyrene	
	1206	Monobutyltin	

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EPA 8270D SIM	5005	Naphthalene	
	6608	Perylene	
	6615	Phenanthrene	
	6665	Pyrene	
	1209	Tetrabutyltin	
	1213	Tributyltin	
	1203	Tributyltin chloride	
EPA 8290A			10187403 Polychlorinated Dibenzodioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) by GC/HRMS
	9516	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	
	9519	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	
	9420	1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)	
	9426	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)	
	9423	1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)	
	9471	1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-Hxcdf)	
	9453	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd)	
	9474	1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf)	
	9456	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,6,7,8-Hxcdd)	
	9477	1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf)	
	9459	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd)	
	9543	1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf)	
	9540	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd)	
	9480	2,3,4,6,7,8-Hexachlorodibenzofuran	
	9549	2,3,4,7,8-Pentachlorodibenzofuran	
	9618	2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD)	
	9612	2,3,7,8-Tetrachlorodibenzofuran	
	9438	Hpcdd, total	
	9444	Hpcdf, total	
	9468	Hxcdd, total	
	9483	Hxcdf, total	
	9555	Pecdd, total	
	9552	Pecdf, total	
	9609	TCDD, total	

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EPA 8290A	9615	TCDF, total		
EPA 9010C			10243002	Total and Amenable Cyanide by Distillation and UV-Vis
	1510	Amenable cyanide		
	1645	Total cyanide		
EPA 9014			10193803	Titrimetric and Manual Spectrophotometric Determinative Methods for Cyanide
	1510	Amenable cyanide		
	1635	Cyanide		
	1645	Total cyanide		
EPA 9030B			10195605	Acid-Soluble and Acid-Insoluble sulfides: Distillation
	2005	Sulfide		
EPA 9034			10196006	Titrimetric Procedure for Acid-Soluble and Acid-Insoluble Sulfides
	2005	Sulfide		
EPA 9036			10196404	Sulfate (Colorimetric, Automated, Methylthymol Blue, AA II)
	2000	Sulfate		
EPA 9040C			10244403	pH Electrometric Measurement
	1900	pH		
EPA 9050A			10198808	Specific Conductance
	1610	Conductivity		
EPA 9056A			10199607	Determination of Inorganic Anions by Ion Chromatography
	1540	Bromide		
	1575	Chloride		
	1730	Fluoride		
	1810	Nitrate as N		
	1840	Nitrite as N		
	1870	Orthophosphate as P		
	2000	Sulfate		
EPA 9060A			10244801	Total Organic Carbon
	2040	Total organic carbon		
EPA 9065			10200405	Phenolics (Spectrophotometric, Manual 4-AAP with Distillation)
	1905	Total phenolics		
EPA 9214			10206403	Potentiometric Determination of Fluoride in Aqueous Samples with Ion-Selective Electrode
	1730	Fluoride		

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EPA 9251			10207406	Chloride (Colorimetric, Automated Ferricyanide AAII)
	1575	Chloride		
EPA RSK-175 (GC-FID)			10212905	Methane, Ethane, and Ethene in water by Headspace GC/FID
	4323	Acetylene		
	4747	Ethane		
	4752	Ethene		
	4926	Methane		
	5029	n-Propane		
NWTPH-Dx			90018409	Oregon DEQ TPH Diesel Range
	9369	Diesel range organics (DRO)		
	9488	Jet Fuel		
	9499	Motor Oil		
	2050	Total Petroleum Hydrocarbons (TPH)		
NWTPH-GX (GC/MS)			90018658	Oregon DEQ TPH Gasoline Range Organics by GC/MS Purge & Trap
	9408	Gasoline range organics (GRO)		
NWTPH-HCID			90013200	Oregon DEQ Total Petroleum Hydrocarbon ID
	2050	Total Petroleum Hydrocarbons (TPH)		
Puget Sound Estuary Program (PSEP): Conventional Sediment Variables			60006408	PSEP: Organotins, TOC, and Sulfide
	1201	Butyltin trichloride		
	5913	Dibutyltin		
	1202	Dibutyltin dichloride		
	1206	Monobutyltin		
	1209	Tetrabutyltin		
	1213	Tributyltin		
	1203	Tributyltin chloride		
SM 2120 B-2011			20039310	Color
	1605	Color		
SM 2130 B-2011			20048220	Turbidity by Nephelometric Method
	2055	Turbidity		
SM 2320 B-2011 online			20045618	Alkalinity as CaCO3
	1505	Alkalinity as CaCO3		
SM 2340 B-2011 online			20046611	Hardness
	1750	Hardness		
SM 2510 B-2011			20048617	Conductivity by Probe
	1610	Conductivity		
SM 2520 B-2011			20040088	Salinity by Electrical Conductivity Method
	1975	Salinity		

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SM 2540 B-2011 2011			20049416	Total Solids Dried at 103 - 105C
	1950	Residue-total		
SM 2540 C-2011 online			20050413	Residue-filterable (TDS)
	1955	Residue-filterable (TDS)		
SM 2540 D-2011			20051212	Total Suspended Solids Dried at 103 - 105 C
	1960	Residue-nonfilterable (TSS)		
SM 2540 E-2011 2011			20051596	Fixed & Volatile Solids Ignited at 550 C
	1725	Total, fixed, and volatile residue		
SM 2540 F-2011			20052215	Settleable Solids
	1965	Residue-settleable		
SM 2540 G-2011 online			20005270	Total, Fixed, and Volatile Solids
	1725	Total, fixed, and volatile residue		
SM 3500-Cr B-2011			20066266	Chromium by Colorimetric Method
	1040	Chromium		
SM 3500-Fe B-2011			20069016	Iron by Phenanthroline Method
	1070	Iron		
SM 4110 B-2011			20076919	Anions by Ion Chromatography with Chemical Suppression of Eluent
	1540	Bromide		
	1575	Chloride		
	1730	Fluoride		
	1810	Nitrate as N		
	1820	Nitrate-nitrite		
	1840	Nitrite as N		
	1870	Orthophosphate as P		
	2000	Sulfate		
SM 4500-Cl⁻ E-97 online			20086800	Chloride by Automated Ferricyanide Method
	1575	Chloride		
SM 4500-CN E-2011 2011			20096428	Cyanide by Colormetric Method
	1645	Total cyanide		
SM 4500-CN⁻ C-2011			20065663	Cyanide (Total) After Distillation
	1645	Total cyanide		
SM 4500-CN⁻ G-2011			20097227	Cyanides Amenable to Chlorination after Distillation
	1510	Amenable cyanide		
SM 4500-CN⁻ I-2011			20098026	Weak Acid Dissociable Cyanide
	2074	Weak Acid Dissociable Cyanide		

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SM 4500-F⁻ C-2011 online			20102414	Fluoride by Ion Selective Electrode
	1730	Fluoride		
SM 4500-H+ B-2011			20105220	pH - Electrometric Measurement
	1900	pH		
SM 4500-NH3 D-2011 online			20109415	Ammonia Nitrogen by Selective Ion Probe
	1515	Ammonia as N		
SM 4500-NH3 H-2011 online			20112214	Ammonia Nitrogen by Flow Injection Analysis
	1515	Ammonia as N		
SM 4500-NO3⁻ I-2011			20118574	Nitrate by Cadmium Reduction Flow Injection
	1810	Nitrate as N		
	1840	Nitrite as N		
	1825	Total nitrate+nitrite		
SM 4500-Norg D-2011			20120289	Organic Nitrogen by Block Digestion and Flow Injection Analysis
	1795	Kjeldahl nitrogen - total		
SM 4500-O C-2001			20120836	Dissolved Oxygen by Azide Modification
	1880	Oxygen, dissolved		
SM 4500-P B4-2011 online			20123415	Phosphorus Digestion with Sulfuric Acid - Nitric Acid
	1910	Phosphorus, total		
SM 4500-P B5-2011			20123368	Phosphorus by Persulfate Digestion Method
	1910	Phosphorus, total		
SM 4500-P E-2011			20124225	Phosphorus by Ascorbic Acid Method
	1870	Orthophosphate as P		
	1910	Phosphorus, total		
SM 4500-S2 F-2011			20126663	Sulfide by Iodometric Method
	2005	Sulfide		
SM 4500-S2⁻ D-2011 online			20125864	Sulfide by Methylene Blue Method
	2005	Sulfide		
SM 4500-SO3⁻ B-2011			20130636	Sulfite by Iodometric Method
	2015	Sulfite-SO3		
SM 4500-SO4 G-2011			20134412	Sulfate - Methylthymol Blue Flow Injection Analysis
	2000	Sulfate		
SM 5210 B-2011 online			20135266	Biochemical Oxygen Demand (5 days @ 20 C).
	1530	Biochemical oxygen demand		
	1555	Carbonaceous BOD, CBOD		

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SM 5220 D-2011 2011			20136816	Chemical Oxygen Demand by Closed Reflux and Colorimetric Determination
	1565	Chemical oxygen demand		
SM 5310 B-2011 2011			20137820	TOC by High-Temperature Combustion Method
	1710	Dissolved organic carbon (DOC)		
	2040	Total organic carbon		
SM 5520 B-2011			20141666	Oil and Grease by Partition-Gravimetric Method
	1803	n-Hexane Extractable Material (O&G)		
SM 5520 D-2005 SM 5520 D-2005			20142409	Oil and Grease by Soxhlet Extraction Method
	1860	Oil & Grease		
SM 5520 F-2011			20143413	Oil and Grease Hydrocarbons
	1803	n-Hexane Extractable Material (O&G)		
	1860	Oil & Grease		
SM 5520 G-2011			20143617	Oil and Grease by Solid-Phase, Partition-Gravimetric Method
	1803	n-Hexane Extractable Material (O&G)		
	1860	Oil & Grease		
SM 5530 D 22nd ED			20143720	Phenols by Direct Photometric Method
	1905	Total phenolics		
WA EPH			60015001	Extractable Petroleum Hydrocarbons
	6220	1,2-Diphenylhydrazine		
	6211	EPH Aliphatic >C10-C12		
	6212	EPH Aliphatic >C12-C16		
	6214	EPH Aliphatic >C16-C21		
	6216	EPH Aliphatic >C21-C34		
	6222	EPH Aliphatic C9-C18		
	6224	EPH Aromatic >C10-C12		
	6226	EPH Aromatic >C12-C16		
	6228	EPH Aromatic >C16-C21		
	6236	EPH Aromatic C8-C10		
WA VPH			60015056	Volatile Petroleum Hydrocarbons (VPH) by GC/PID Purge & Trap
	5300	VPH Aliphatic >C10-C12		
	5301	VPH Aliphatic >C6-C8		
	5302	VPH Aliphatic >C8-C10		
	5303	VPH Aliphatic C5-C6		
	5308	VPH Aromatic >C10-C12		
	5309	VPH Aromatic >C12-C13		
	5310	VPH Aromatic >C8-C10		

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Solids

AK101 GRO-MS AK101 GRO-MS			90015159	Determination of Gasoline Range Organics by GC/MS - Alaska Department of Environmental Conservation
	9408	Gasoline range organics (GRO)		
AK102 DRO AK102 DRO			90015206	Determination of Diesel Range Organics - Alaska Department of Environmental Conservation
	9369	Diesel range organics (DRO)		
AK103 RRO			90015400	Determination of Residual Range Organics - Alaska Department of Environmental Conservation
	9499	Motor Oil		
EPA 1311			10118806	Toxicity Characteristic Leaching Procedure
	9822	Extraction/Preparation		
EPA 1312			10119003	Synthetic Precipitation Leaching Procedure
	9822	Extraction/Preparation		
EPA 1613B			10120602	Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope Dilution GC/HRMS
	9516	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)		
	9519	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)		
	9420	1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)		
	9426	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)		
	9423	1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)		
	9471	1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-Hxcdf)		
	9453	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd)		
	9474	1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf)		
	9456	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,6,7,8-Hxcdd)		
	9477	1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf)		
	9459	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd)		
	9543	1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf)		
	9540	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd)		
	9480	2,3,4,6,7,8-Hexachlorodibenzofuran		

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EPA 1613B	9549	2,3,4,7,8-Pentachlorodibenzofuran		
	9618	2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD)		
	9612	2,3,7,8-Tetrachlorodibenzofuran		
	9438	Hpcdd, total		
	9444	Hpcdf, total		
	9468	Hxcdd, total		
	9483	Hxcdf, total		
	9555	Pecdd, total		
	9552	Pecdf, total		
	9609	TCDD, total		
	9615	TCDF, total		
EPA 200.7 5			10014003	ICP - metals
	1000	Aluminum		
	1005	Antimony		
	1010	Arsenic		
	1015	Barium		
	1020	Beryllium		
	1025	Boron		
	1030	Cadmium		
	1035	Calcium		
	1040	Chromium		
	1050	Cobalt		
	1055	Copper		
	1070	Iron		
	1075	Lead		
	1085	Magnesium		
	1090	Manganese		
	1100	Molybdenum		
	1105	Nickel		
	1125	Potassium		
	1140	Selenium		
	1145	Silicon		
	1150	Silver		
	1155	Sodium		
	1160	Strontium		
	1165	Thallium		
	1175	Tin		
	1180	Titanium		
	1185	Vanadium		
	1190	Zinc		
EPA 200.8 5.5			10014809	Metals by ICP-MS
	1000	Aluminum		

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Certificate: WA100006 - 011

Tukwila, WA 98168-3240

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Solids

EPA 200.8 5.5	1005	Antimony		
	1010	Arsenic		
	1015	Barium		
	1020	Beryllium		
	1030	Cadmium		
	1035	Calcium		
	1040	Chromium		
	1050	Cobalt		
	1055	Copper		
	1070	Iron		
	1075	Lead		
	1085	Magnesium		
	1090	Manganese		
	1100	Molybdenum		
	1105	Nickel		
	1125	Potassium		
	1140	Selenium		
	1150	Silver		
	1155	Sodium		
	1165	Thallium		
	1185	Vanadium		
	1190	Zinc		
EPA 245.5			10037602	Mercury in Sediment by Cold Vapor Atomic Absorption
	1095	Mercury		
EPA 300.0 2.1			10053200	Methods for the Determination of Inorganic Substances in Environmental Samples
	1540	Bromide		
	1575	Chloride		
	1730	Fluoride		
	1810	Nitrate as N		
	1840	Nitrite as N		
	1870	Orthophosphate as P		
	2000	Sulfate		
EPA 3050B			10135601	Acid Digestion of Sediments, Sludges, and soils
	9822	Extraction/Preparation		
EPA 3060A			10136604	Alkaline Digestion for Hexavalent Chromium
	9822	Extraction/Preparation		
EPA 351.2 2			10065404	Total Kjeldahl Nitrogen - Block Digest, Phenate
	1790	Kjeldahl nitrogen		
	1795	Kjeldahl nitrogen - total		

Solids

EPA 353.2 2			10067604	Nitrate/Nitrite Nitrogen - Automated, Cadmium
	1810	Nitrate as N		
	1820	Nitrate-nitrite		
	1840	Nitrite as N		
EPA 3540C			10140202	Soxhlet Extraction
	9822	Extraction/Preparation		
EPA 3546			10141205	Microwave Extraction
	8031	Extraction/Preparation		
EPA 3550C			10142004	Ultrasonic Extraction
	9822	Extraction/Preparation		
EPA 3580A			10143007	Waste Dilution
	9822	Extraction/Preparation		
EPA 3611B			10145207	Alumina Column Cleanup and separation of petroleum wastes
	8031	Extraction/Preparation		
EPA 3620C			10146006	Florisil Cleanup
	8031	Extraction/Preparation		
EPA 3630C			10146802	Silica gel cleanup
	8031	Extraction/Preparation		
EPA 3640A			10147203	Gel Preparation Cleanup
	9822	Extraction/Preparation		
EPA 3650B			10147805	Acid base partition cleanup
	8031	Extraction/Preparation		
EPA 3660B			10148400	Sulfur cleanup
	9822	Extraction/Preparation		
EPA 3665A			10148808	Sulfuric Acid / permanganate Cleanup
	9822	Extraction/Preparation		
EPA 420.1			10079400	Phenolics - Spectrophotometric, manual.
	1905	Total phenolics		
EPA 5000			10152600	Sample Preparation for Volatile Organics
	9822	Extraction/Preparation		
EPA 5035			10154004	Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples
	9822	Extraction/Preparation		
EPA 6010C 3			10155905	Inductively Coupled Plasma - Atomic Emission Spectrometry
	1000	Aluminum		
	1005	Antimony		

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EPA 6010C 3			
	1010	Arsenic	
	1015	Barium	
	1020	Beryllium	
	1025	Boron	
	1030	Cadmium	
	1035	Calcium	
	1040	Chromium	
	1050	Cobalt	
	1055	Copper	
	1070	Iron	
	1075	Lead	
	1085	Magnesium	
	1090	Manganese	
	1100	Molybdenum	
	1105	Nickel	
	1125	Potassium	
	1140	Selenium	
	1145	Silicon	
	1150	Silver	
	1155	Sodium	
	1160	Strontium	
	1165	Thallium	
	1175	Tin	
	1180	Titanium	
	1185	Vanadium	
	1190	Zinc	
EPA 6020A 1		10156419	Inductively Coupled Plasma -Mass Spectrometry
	1000	Aluminum	
	1005	Antimony	
	1010	Arsenic	
	1015	Barium	
	1020	Beryllium	
	1030	Cadmium	
	1035	Calcium	
	1040	Chromium	
	1050	Cobalt	
	1055	Copper	
	1070	Iron	
	1075	Lead	
	1085	Magnesium	
	1090	Manganese	
	1100	Molybdenum	
	1105	Nickel	

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EPA 6020A 1	1125	Potassium		
	1140	Selenium		
	1150	Silver		
	1155	Sodium		
	1165	Thallium		
	1185	Vanadium		
	1190	Zinc		
EPA 7196A			10162400	Chromium Hexavalent colorimetric
	1045	Chromium VI		
EPA 7471B			10166402	Mercury by Cold Vapor Atomic Absorption
	1095	Mercury		
EPA 8015C			10173805	Non-halogenated organics using GC/FID
	9369	Diesel range organics (DRO)		
	9408	Gasoline range organics (GRO)		
EPA 8021B			10174808	Aromatic and Halogenated Volatiles by GC with PID and/or ECD Purge & Trap
	4375	Benzene		
	4765	Ethylbenzene		
	5240	m+p-xylene		
	5000	Methyl tert-butyl ether (MTBE)		
	5250	o-Xylene		
	5140	Toluene		
EPA 8041A			10176804	Phenols by Gas Chromatography
	6730	2,3,4,5-Tetrachlorophenol		
	6735	2,3,4,6-Tetrachlorophenol		
	6740	2,3,5,6-Tetrachlorophenol		
	6830	2,3,6-Trichlorophenol (4C)		
	6835	2,4,5-Trichlorophenol		
	6605	Pentachlorophenol		
EPA 8081B			10178800	Organochlorine Pesticides by GC/ECD
	8580	2,4'-DDD		
	8585	2,4'-DDE		
	8590	2,4'-DDT		
	7355	4,4'-DDD		
	7360	4,4'-DDE		
	7365	4,4'-DDT		
	7025	Aldrin		
	7110	alpha-BHC (alpha-Hexachlorocyclohexane)		
	7115	beta-BHC (beta-Hexachlorocyclohexane)		
	7250	Chlordane (tech.)		

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Solids

EPA 8081B	7240	cis-chlordane (alpha-Chlordane)			
	7925	cis-Nonachlor			
	7105	delta-BHC			
	7470	Dieldrin			
	7510	Endosulfan I			
	7515	Endosulfan II			
	7520	Endosulfan sulfate			
	7540	Endrin			
	7530	Endrin aldehyde			
	7535	Endrin ketone			
	7120	gamma-BHC (Lindane, gamma-HexachlorocyclohexanE)			
	7685	Heptachlor			
	7690	Heptachlor epoxide			
	6275	Hexachlorobenzene			
	4835	Hexachlorobutadiene			
	7810	Methoxychlor			
	7870	Mirex			
	3890	Oxychlordane			
	8250	Toxaphene (Chlorinated camphene)			
	7245	trans-chlordane (gamma-Chlordane)			
	7910	trans-Nonachlor			
EPA 8082A			10179201	Polychlorinated Biphenyls (PCBs) by GC/ECD	
	9902	2,2',3,3',4,4',5,5',6-Nonabromodiphenyl ether (BDE-206)			
	9890	2,2',3,3',4,4',5,5'-Octabromodiphenyl ether (BDE-194)			
	9090	2,2',3,3',4,4',5,5'-Octachlorobiphenyl (BZ-194)			
	9903	2,2',3,3',4,4',5,6,6'-Nonabromodiphenyl ether (BDE-207)			
	9891	2,2',3,3',4,4',5,6-Octabromodiphenyl ether (BDE-195)			
	9892	2,2',3,3',4,4',5,6'-Octabromodiphenyl ether (BDE-196)			
	9103	2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ-195)			
	9866	2,2',3,3',4,4',5-Heptabromodiphenyl ether (BDE-170)			
	9065	2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ-170)			
	9020	2,2',3,3',4,4'-Hexachlorobiphenyl (BZ-128)			
	9112	2,2',3,3',4,5',6,6'-Octachlorobiphenyl (BZ-201)			
	9873	2,2',3,3',4',5,6-Heptabromodiphenyl ether (BDE-177)			

Solids

EPA 8082A	9116	2,2',3,3',4,5,6'-Heptachlorobiphenyl (BZ-174)
	9114	2,2',3,3',4,5',6'-Heptachlorobiphenyl (BZ-177)
	9120	2,2',3,3',4,6'-Hexachlorobiphenyl (BZ-132)
	9133	2,2',3,4,4',5,5',6-Octachlorobiphenyl (BZ-203)
	9134	2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ-180)
	9878	2,2',3,4,4',5,6'-Heptabromodiphenyl ether (BDE-182)
	9075	2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ-183)
	9835	2,2',3,4,4',5'-Hexabromodiphenyl ether (BDE-138)
	9025	2,2',3,4,4',5'-Hexachlorobiphenyl (BZ-138)
	9784	2,2',3,4,4'-Pentabromodiphenyl ether (BDE-85)
	9080	2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ-187)
	9030	2,2',3,4,5,5'-Hexachlorobiphenyl (BZ-141)
	9151	2,2',3,4',5',6-Hexachlorobiphenyl (BZ-149)
	9796	2,2',3',4,5-Pentabromodiphenyl ether (BDE-97)
	8975	2,2',3,4,5'-Pentachlorobiphenyl (BZ-87)
	9154	2,2',3,4',5'-Pentachlorobiphenyl (BZ-97)
	9797	2,2',3',4,6-Pentabromodiphenyl ether (BDE-98)
	9035	2,2',3,5,5',6-Hexachlorobiphenyl (BZ-151)
	9166	2,2',3,5',6-Pentachlorobiphenyl (BZ-95)
	8945	2,2',3,5'-Tetrachlorobiphenyl (BZ-44)
	9569	2,2',4,4',5,5'-Hexabromodiphenyl ether (BDE-153)
	9040	2,2',4,4',5,5'-Hexachlorobiphenyl (BZ-153)
	9850	2,2',4,4',5',6-Hexabromodiphenyl ether (BDE-154)
	9571	2,2',4,4',5-Pentabromodiphenyl ether (BDE-99)
	9175	2,2',4,4',5-Pentachlorobiphenyl (BZ-99)
	9572	2,2',4,4',6-Pentabromodiphenyl ether (BDE-100)
	9773	2,2',4,4'-Tetrabromodiphenyl ether (BDE-47)

Solids

Solids	EPA 8082A	8980	2,2',4,5,5'-Pentachlorobiphenyl (BZ-101)
		8950	2,2',4,5'-Tetrachlorobiphenyl (BZ-49)
		9716	2,2',4-Tribromodiphenyl ether (BDE-17)
		8955	2,2',5,5'-Tetrachlorobiphenyl (BZ-52)
		8930	2,2',5-Trichlorobiphenyl (BZ-18)
		9050	2,3,3',4,4',5-Hexachlorobiphenyl (BZ-156)
		9193	2,3,3',4,4',6-Hexachlorobiphenyl (BZ-158)
		8985	2,3,3',4,4'-Pentachlorobiphenyl (BZ-105)
		9819	2',3,3',4,5-Pentabromodiphenyl ether (BDE-122)
		8990	2,3,3',4',6-Pentachlorobiphenyl (BZ-110)
		9207	2,3,3',4'-Tetrachlorobiphenyl (BZ-56)
		9820	2',3,4,4',5-Pentabromodiphenyl ether (BDE-123)
		8995	2,3',4,4',5-Pentachlorobiphenyl (BZ-118)
		9758	2,3,4,4'-Tetrabromodiphenyl ether (BDE-60)
		9764	2,3',4,4'-Tetrabromodiphenyl ether (BDE-66)
		9221	2,3,4,4'-Tetrachlorobiphenyl (BZ-60)
		8960	2,3',4,4'-Tetrachlorobiphenyl (BZ-66)
		9821	2',3,4,5,5'-Pentabromodiphenyl ether (BDE-124)
		9822	2',3,4,5,6'-Pentabromodiphenyl ether (BDE-125)
		9775	2',3,4,5-Tetrabromodiphenyl ether (BDE-76)
		9230	2,3',4',5-Tetrachlorobiphenyl (BZ-70)
		9760	2,3,4,6-Tetrabromodiphenyl ether (BDE-62)
		9769	2,3',4',6-Tetrabromodiphenyl ether (BDE-71)
		9732	2',3,4-Tribromodiphenyl ether (BDE-33)
		9239	2,3',4'-Trichlorobiphenyl (BZ-33)
		9733	2',3,5-Tribromodiphenyl ether (BDE-34)
		9250	2,4,4',5-Tetrachlorobiphenyl (BZ-74)
		9727	2,4,4'-Tribromodiphenyl ether (BDE-28)
		9252	2,4,4'-Trichlorobiphenyl (BZ-28)
		8940	2,4',5-Trichlorobiphenyl (BZ-31)
		9256	2,4'-Dichlorobiphenyl (BZ-8)
		8880	Aroclor-1016 (PCB-1016)
		8885	Aroclor-1221 (PCB-1221)

Solids

EPA 8082A	8890	Aroclor-1232 (PCB-1232)	
	8895	Aroclor-1242 (PCB-1242)	
	8900	Aroclor-1248 (PCB-1248)	
	8905	Aroclor-1254 (PCB-1254)	
	8910	Aroclor-1260 (PCB-1260)	
	8912	Aroclor-1262 (PCB-1262)	
	8913	Aroclor-1268 (PCB-1268)	
EPA 8260C			10307003 Volatile Organics: GC/MS (capillary column)
	5105	1,1,1,2-Tetrachloroethane	
	5160	1,1,1-Trichloroethane	
	5110	1,1,2,2-Tetrachloroethane	
	5195	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	
	5165	1,1,2-Trichloroethane	
	4630	1,1-Dichloroethane	
	4640	1,1-Dichloroethylene	
	4670	1,1-Dichloropropene	
	5150	1,2,3-Trichlorobenzene	
	5180	1,2,3-Trichloropropane	
	5155	1,2,4-Trichlorobenzene	
	5210	1,2,4-Trimethylbenzene	
	4570	1,2-Dibromo-3-chloropropane (DBCP)	
	4585	1,2-Dibromoethane (EDB, Ethylene dibromide)	
	4610	1,2-Dichlorobenzene	
	4635	1,2-Dichloroethane (Ethylene dichloride)	
	4655	1,2-Dichloropropane	
	5215	1,3,5-Trimethylbenzene	
	4615	1,3-Dichlorobenzene	
	4660	1,3-Dichloropropane	
	4620	1,4-Dichlorobenzene	
	4665	2,2-Dichloropropane	
	4410	2-Butanone (Methyl ethyl ketone, MEK)	
	4500	2-Chloroethyl vinyl ether	
	4535	2-Chlorotoluene	
	4860	2-Hexanone (MBK)	
	4540	4-Chlorotoluene	
	4910	4-Isopropyltoluene (p-Cymene)	
	4995	4-Methyl-2-pentanone (MIBK)	
	4315	Acetone	
	4325	Acrolein (Propenal)	
	4340	Acrylonitrile	
	4375	Benzene	

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Solids EPA 8260C

4385	Bromobenzene
4390	Bromochloromethane
4395	Bromodichloromethane
4397	Bromoethane (Ethyl Bromide)
4400	Bromoform
4450	Carbon disulfide
4455	Carbon tetrachloride
4475	Chlorobenzene
4575	Chlorodibromomethane
4485	Chloroethane (Ethyl chloride)
4505	Chloroform
4645	cis-1,2-Dichloroethylene
4680	cis-1,3-Dichloropropene
4595	Dibromomethane (Methylene bromide)
4625	Dichlorodifluoromethane (Freon-12)
9375	Di-isopropylether (DIPE)
4765	Ethylbenzene
4770	Ethyl-t-butylether (ETBE) (2-Ethoxy-2-methylpropane)
9408	Gasoline range organics (GRO)
4835	Hexachlorobutadiene
4870	Iodomethane (Methyl iodide)
4900	Isopropylbenzene (Cumene)
5240	m+p-xylene
4950	Methyl bromide (Bromomethane)
4960	Methyl chloride (Chloromethane)
5000	Methyl tert-butyl ether (MTBE)
4975	Methylene chloride (Dichloromethane)
5005	Naphthalene
4435	n-Butylbenzene
5090	n-Propylbenzene
5250	o-Xylene
4440	sec-Butylbenzene
5100	Styrene
4370	T-amylmethylether (TAME)
4420	tert-Butyl alcohol
4445	tert-Butylbenzene
5115	Tetrachloroethylene (Perchloroethylene)
5140	Toluene
4700	trans-1,2-Dichloroethylene
4685	trans-1,3-Dichloropropylene
4605	trans-1,4-Dichloro-2-butene
5170	Trichloroethene (Trichloroethylene)

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EPA 8260C	5175	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)		
	5225	Vinyl acetate		
	5235	Vinyl chloride		
EPA 8270D			10186002	Semivolatile Organic compounds by GC/MS
	5155	1,2,4-Trichlorobenzene		
	4610	1,2-Dichlorobenzene		
	4615	1,3-Dichlorobenzene		
	4620	1,4-Dichlorobenzene		
	4735	1,4-Dioxane (1,4- Diethyleneoxide)		
	6380	1-Methylnaphthalene		
	4659	2,2-Oxybis(1-chloropropane)		
	6835	2,4,5-Trichlorophenol		
	6840	2,4,6-Trichlorophenol		
	6000	2,4-Dichlorophenol		
	6130	2,4-Dimethylphenol		
	6175	2,4-Dinitrophenol		
	6185	2,4-Dinitrotoluene (2,4-DNT)		
	6190	2,6-Dinitrotoluene (2,6-DNT)		
	5795	2-Chloronaphthalene		
	5800	2-Chlorophenol		
	6360	2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2 -methylphenol)		
	6385	2-Methylnaphthalene		
	6400	2-Methylphenol (o-Cresol)		
	6460	2-Nitroaniline		
	6490	2-Nitrophenol		
	5945	3,3'-Dichlorobenzidine		
	6465	3-Nitroaniline		
	5660	4-Bromophenyl phenyl ether (BDE-3)		
	5700	4-Chloro-3-methylphenol		
	5745	4-Chloroaniline		
	5825	4-Chlorophenyl phenylether		
	4910	4-Isopropyltoluene (p-Cymene)		
	6410	4-Methylphenol (p-Cresol)		
	6470	4-Nitroaniline		
	6500	4-Nitrophenol		
	5500	Acenaphthene		
	5505	Acenaphthylene		
	5510	Acetophenone		
	7005	Alachlor		
	6700	alpha-Terpineol		
	5545	Aniline		

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Solids EPA 8270D

5555	Anthracene
7075	Azinphos-methyl (Guthion)
5562	Azobenzene
5595	Benzidine
5575	Benzo(a)anthracene
5580	Benzo(a)pyrene
5605	Benzo(e)pyrene
5590	Benzo(g,h,i)perylene
5600	Benzo(k)fluoranthene
5585	Benzo[b]fluoranthene
5610	Benzoic acid
5630	Benzyl alcohol
5640	Biphenyl
5760	bis(2-Chloroethoxy)methane
5765	bis(2-Chloroethyl) ether
7125	Bolstar (Sulprofos)
5670	Butyl benzyl phthalate
5671	Butyl diphenyl Phosphate
5673	Butylated Hydroxy Toluene (BHT)
5680	Carbazole
7255	Chlorfenvinphos
7300	Chlorpyrifos
5855	Chrysene
7315	Coumaphos
7330	Crotoxyphos
7385	Demeton-s
6065	Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate, DEHP)
7410	Diazinon
5895	Dibenz(a,h) anthracene
5905	Dibenzofuran
5912	Dibutyl phenyl Phospahate
7465	Dicrotophos
6070	Diethyl phthalate
7475	Dimethoate
6135	Dimethyl phthalate
5925	Di-n-butyl phthalate
6200	Di-n-octyl phthalate
8625	Disulfoton
7550	EPN
7565	Ethion
7570	Ethoprop
7600	Fensulfothion
7605	Fenthion

Solids

EPA 8270D	6265	Fluoranthene		
	6270	Fluorene		
	6275	Hexachlorobenzene		
	4835	Hexachlorobutadiene		
	6285	Hexachlorocyclopentadiene		
	4840	Hexachloroethane		
	6315	Indeno(1,2,3-cd) pyrene		
	6320	Isophorone		
	7770	Malathion		
	7785	Merphos		
	7825	Methyl parathion (Parathion, methyl)		
	7850	Mevinphos		
	7880	Monocrotophos		
	7905	Naled		
	5005	Naphthalene		
	5015	Nitrobenzene		
	6530	n-Nitrosodimethylamine		
	6545	n-Nitrosodi-n-propylamine		
	6535	n-Nitrosodiphenylamine		
	7955	Parathion, ethyl		
	6605	Pentachlorophenol		
	6615	Phenanthrene		
	6625	Phenol		
	7985	Phorate		
	6665	Pyrene		
	5095	Pyridine		
	6683	Retene		
	8110	Ronnel		
	8155	Sulfotepp		
	8200	Tetrachlorvinphos (Stirophos, Gardona) Z-isomer		
	8245	Tokuthion (Prothiophos)		
	8262	Tributyl phosphate		
	8275	Trichloronate		
	8282	Triphenyl phosphate		
EPA 8270D SIM			10242509	Semivolatile Organic compounds by GC/MS Selective Ion Monitoring
	6380	1-Methylnaphthalene		
	6385	2-Methylnaphthalene		
	5500	Acenaphthene		
	5505	Acenaphthylene		
	5555	Anthracene		
	5575	Benzo(a)anthracene		
	5580	Benzo(a)pyrene		

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Environmental Laboratory Accreditation Program

ORELAP Fields of Accreditation

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Tukwila, WA 98168-3240

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Solids

EPA 8270D SIM	5605	Benzo(e)pyrene	
	5590	Benzo(g,h,i)perylene	
	9309	Benzo(j)fluoranthene	
	5600	Benzo(k)fluoranthene	
	5585	Benzo[b]fluoranthene	
	5640	Biphenyl	
	1201	Butyltin trichloride	
	5680	Carbazole	
	5855	Chrysene	
	5895	Dibenz(a,h) anthracene	
	5905	Dibenzofuran	
	5913	Dibutyltin	
	1202	Dibutyltin dichloride	
	6265	Fluoranthene	
	6270	Fluorene	
	6315	Indeno(1,2,3-cd) pyrene	
	1206	Monobutyltin	
	5005	Naphthalene	
	6608	Perylene	
	6615	Phenanthrene	
	6665	Pyrene	
	1209	Tetrabutyltin	
	1213	Tributyltin	
	1203	Tributyltin chloride	
EPA 8290A			10187403 Polychlorinated Dibenzodioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) by GC/HRMS
	9516	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	
	9519	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	
	9420	1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)	
	9426	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)	
	9423	1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)	
	9471	1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-Hxcdf)	
	9453	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd)	
	9474	1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf)	
	9456	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,6,7,8-Hxcdd)	
	9477	1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf)	

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EPA 8290A	9459	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd)			
	9543	1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf)			
	9540	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd)			
	9480	2,3,4,6,7,8-Hexachlorodibenzofuran			
	9549	2,3,4,7,8-Pentachlorodibenzofuran			
	9618	2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD)			
	9612	2,3,7,8-Tetrachlorodibenzofuran			
	9438	Hpcdd, total			
	9444	Hpcdf, total			
	9468	Hxcdd, total			
	9483	Hxcdf, total			
	9555	Pecdd, total			
	9552	Pecdf, total			
	9609	TCDD, total			
	9615	TCDF, total			
EPA 9010C				10243002	Total and Amenable Cyanide by Distillation and UV-Vis
	1510	Amenable cyanide			
	1645	Total cyanide			
EPA 9013				10193609	Cyanide Extraction Procedure for Solids and Oils
	8031	Extraction/Preparation			
EPA 9014				10193803	Titrimetric and Manual Spectrophotometric Determinative Methods for Cyanide
	1510	Amenable cyanide			
	1635	Cyanide			
	1645	Total cyanide			
EPA 9030B				10195605	Acid-Soluble and Acid-Insoluble sulfides: Distillation
	2005	Sulfide			
EPA 9034				10196006	Titrimetric Procedure for Acid-Soluble and Acid-Insoluble Sulfides
	2005	Sulfide			
EPA 9045D				10244607	Soil and Waste pH
	1900	pH			
EPA 9056A				10199607	Determination of Inorganic Anions by Ion Chromatography
	1540	Bromide			
	1575	Chloride			
	1730	Fluoride			
	1810	Nitrate as N			

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EPA 9056A	1840	Nitrite as N		
	1870	Orthophosphate as P		
	2000	Sulfate		
EPA 9065			10200405	Phenolics (Spectrophotometric, Manual 4-AAP with Distillation)
	1905	Total phenolics		
EPA 9071B			10201602	Oil and Grease Extraction Method for sludge and sediment samples
	1860	Oil & Grease		
EPA 9080			10203200	Cation-Exchange Capacity of Soils (Ammonium Acetate)
	1560	Cation exchange capacity		
EPA 9214			10206403	Potentiometric Determination of Fluoride in Aqueous Samples with Ion-Selective Electrode
	1730	Fluoride		
NWTPH-Dx			90018409	Oregon DEQ TPH Diesel Range
	9369	Diesel range organics (DRO)		
	9488	Jet Fuel		
	9499	Motor Oil		
	2050	Total Petroleum Hydrocarbons (TPH)		
NWTPH-GX (GC/MS)			90018658	Oregon DEQ TPH Gasoline Range Organics by GC/MS Purge & Trap
	9408	Gasoline range organics (GRO)		
NWTPH-HCID			90013200	Oregon DEQ Total Petroleum Hydrocarbon ID
	2050	Total Petroleum Hydrocarbons (TPH)		
PLUMB 1981			60006259	Extraction/Preparation
	8031	Extraction/Preparation		
Puget Sound Estuary Program (PSEP): Conventional Sediment Variables			60006408	PSEP: Organotins, TOC, and Sulfide
	1201	Butyltin trichloride		
	5913	Dibutyltin		
	1202	Dibutyltin dichloride		
	1206	Monobutyltin		
	2005	Sulfide		
	1209	Tetrabutyltin		
	2040	Total organic carbon		
	1213	Tributyltin		
	1203	Tributyltin chloride		
SM 2510 B-2011			20048617	Conductivity by Probe
	1610	Conductivity		
SM 2540 B-2011 2011			20049416	Total Solids Dried at 103 - 105C
	1950	Residue-total		

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Solids

SM 2540 E-2011 2011			20051596	Fixed & Volatile Solids Ignited at 550 C
	1725	Total, fixed, and volatile residue		
SM 2540 G-2011 online			20005270	Total, Fixed, and Volatile Solids
	1725	Total, fixed, and volatile residue		
SM 2580 B-2011			20054062	Oxidation-Reduction Potential Measurement in Clean Water
	1871	O-R Potential		
SM 3500-Cr B-2011			20066266	Chromium by Colorimetric Method
	1040	Chromium		
SM 3500-Fe B-2011			20069016	Iron by Phenanthroline Method
	1070	Iron		
SM 4110 B-2011			20076919	Anions by Ion Chromatography with Chemical Suppression of Eluent
	1540	Bromide		
	1575	Chloride		
	1730	Fluoride		
	1810	Nitrate as N		
	1820	Nitrate-nitrite		
	1840	Nitrite as N		
	1870	Orthophosphate as P		
	2000	Sulfate		
SM 4500-CN E-2011 2011			20096428	Cyanide by Colormetric Method
	1645	Total cyanide		
SM 4500-CN⁻ C-2011			20065663	Cyanide (Total) After Distillation
	1645	Total cyanide		
SM 4500-CN⁻ I-2011			20098026	Weak Acid Dissociable Cyanide
	2074	Weak Acid Dissociable Cyanide		
SM 4500-F⁻ C-2011 online			20102414	Fluoride by Ion Selective Electrode
	1730	Fluoride		
SM 4500-H+ B-2011			20105220	pH - Electrometric Measurement
	1900	pH		
SM 4500-NH3 D-2011 online			20109415	Ammonia Nitrogen by Selective Ion Probe
	1515	Ammonia as N		
SM 4500-NH3 H-2011 online			20112214	Ammonia Nitrogen by Flow Injection Analysis
	1515	Ammonia as N		
SM 4500-NO3⁻ I-2011			20118574	Nitrate by Cadmium Reduction Flow Injection
	1810	Nitrate as N		
	1840	Nitrite as N		

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Solids

SM 4500-NO3¯ I-2011	1825	Total nitrate+nitrite		
SM 4500-Norg D-2011			20120289	Organic Nitrogen by Block Digestion and Flow Injection Analysis
	1795	Kjeldahl nitrogen - total		
SM 4500-P B5-2011			20123368	Phosphorus by Persulfate Digestion Method
	1910	Phosphorus, total		
SM 4500-P E-2011			20124225	Phosphorus by Ascorbic Acid Method
	1870	Orthophosphate as P		
	1910	Phosphorus, total		
SM 4500-S2 F-2011			20126663	Sulfide by Iodometric Method
	2005	Sulfide		
SM 4500-SO3¯ B-2011			20130636	Sulfite by Iodometric Method
	2015	Sulfite-SO3		
SM 4500-SO4 G-2011			20134412	Sulfate - Methylthymol Blue Flow Injection Analysis
	2000	Sulfate		
SM 5310 B-2011 2011			20137820	TOC by High-Temperature Combustion Method
	2040	Total organic carbon		
SM 5520 B-2011			20141666	Oil and Grease by Partition-Gravimetric Method
	1803	n-Hexane Extractable Material (O&G)		
SM 5520 D-2005 SM 5520 D-2005			20142409	Oil and Grease by Soxhlet Extraction Method
	1860	Oil & Grease		
SM 5520 E-05 online			20142807	Oil and Grease by Extraction Method for Sludge Samples
	1860	Oil & Grease		
SM 5520 F-2011			20143413	Oil and Grease Hydrocarbons
	1803	n-Hexane Extractable Material (O&G)		
	1860	Oil & Grease		
SM 5520 G-2011			20143617	Oil and Grease by Solid-Phase, Partition-Gravimetric Method
	1803	n-Hexane Extractable Material (O&G)		
	1860	Oil & Grease		
SM 5530 D-2005			20143764	Phenols by Direct Photometric Method
	1905	Total phenolics		
WA EPH			60015001	Extractable Petroleum Hydrocarbons
	6220	1,2-Diphenylhydrazine		
	6211	EPH Aliphatic >C10-C12		
	6212	EPH Aliphatic >C12-C16		

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Solids

WA EPH			
	6214	EPH Aliphatic >C16-C21	
	6216	EPH Aliphatic >C21-C34	
	6222	EPH Aliphatic C9-C18	
	6224	EPH Aromatic >C10-C12	
	6226	EPH Aromatic >C12-C16	
	6228	EPH Aromatic >C16-C21	
	6236	EPH Aromatic C8-C10	
WA VPH			60015056 Volatile Petroleum Hydrocarbons (VPH) by GC/PID Purge & Trap
	5300	VPH Aliphatic >C10-C12	
	5301	VPH Aliphatic >C6-C8	
	5302	VPH Aliphatic >C8-C10	
	5303	VPH Aliphatic C5-C6	
	5308	VPH Aromatic >C10-C12	
	5309	VPH Aromatic >C12-C13	
	5310	VPH Aromatic >C8-C10	

Analytical Resources Inc. Quality Assurance Plan

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Quality Assurance Plan

Analytical Resources, Inc.
4611 S. 134th Place, Suite 100
Tukwila, WA 98168-3240

Revision 016
7/27/18

Uncontrolled Copy
When Printed

This Quality Assurance Plan is approved and authorized for release by:

Mark Weidner, Laboratory Technical Director

Brian N. Bebee, Organic Analysis Section Technical Director

Eric Larson, Inorganic Analysis Section Technical Director

Bob Congleton, Quality Assurance Officer

Quality Assurance Plan

Analytical Resources, Inc.

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SECTION 1: INTRODUCTION

Quality Assurance Policy and Objectives

Analytical Resources, Inc. (ARI) strives to consistently provide accurate, reproducible and legally defensible data that meets its client's expectations. ARI's management has developed the policies and procedures described in this document to accomplish this goal and will provide the resources necessary to ensure that they are implemented in a timely, cost effective manner.

This Laboratory Quality Assurance Plan (LQAP) has been prepared to conform to requirements of:

1. ISO/IEC 17025:2005 (E)

2. TNI Standard 2009 particularly Volume 1, Modules 1,2 and 4

3. Department of Defense Quality Systems Manual for Environmental Laboratories, Version 5.0, July 2013

The principal tenet of the Quality Assurance Program at Analytical Resources Inc. (ARI) is that every employee knows she/he is a vital component of the program, and holds a responsibility to produce high-quality, defensible, reproducible data in a timely manner. While production of quality data is a global philosophy, held by the entire laboratory, each individual is responsible for ensuring that the data they produce meets the required quality objectives outlined in this LQAP.

1.2 Ethics Policy on Data Quality and Confidentiality

To ensure uncompromised data quality and client confidentiality, ARI has established the following corporate ethics policy. The policy applies to all ARI employees at every organizational level.

General

ARI's corporate commitment to integrity and honesty in the workplace is clearly stated in the ARI Employee's Handbook, under "Standards of Conduct" which is attached as Appendix H. The ARI commitment to excellence in data quality extends to and includes all aspects of data production, review and reporting.

Any attempt by management or any employee to compromise this commitment presents a case for serious disciplinary action. Any indications or allegations of waste, fraud or abuse will be rigorously investigated by ARI management, with the penalties for verified cases to be employment termination, and if appropriate, prosecution. In addition to these steps, any such charges related to data generated for the federal government will also be reported to the Inspector General of the appropriate department.

Circumstances

All ARI employees will immediately report to management any information concerning the misrepresentation or possible misrepresentation of analytical data (or any associated components).

Misrepresentation of data includes (but is not limited to) the following:

- *Altering an instrument, computer or clock to falsify time or output*
- *Altering the content of a logbook or data sheet in order to misrepresent data*
- *Falsifying analyst identity*
- *Changing documents with correction fluid with the intent of falsifying information*
- *Preparing or submitting counterfeit data packages or reports*
- *Unauthorized release (either written or verbal) of confidential data*
- *Illegal calibration techniques (peak shaving, fraudulent integrator parameters)*
- *Any attempt to misrepresent data or events as they actually occur in the course of data production or reporting*

Responsibilities

It is the responsibility of all ARI employees to report any situation which may be averse to data quality or confidentiality, or which may impact the final data quality. All ARI employees have the obligation to discuss known or suspected violations of this policy with laboratory management, who in turn are obliged to inform the ARI's Laboratory Director. If a satisfactory resolution is not obtained or is not possible at laboratory level, all ARI employees have the right and responsibility to discuss the matter directly with the Laboratory Director.

It is the responsibility of ARI's Laboratory Director to promptly investigate any reports of known or suspected violations. The ARI Laboratory Manager has the authority and responsibility to resolve all known or potential violations of the policy.

It is the responsibility of ARI management to provide all of its employees with the facilities, equipment, and training to achieve the quality goals stated in the policy.

Documentation

To reaffirm an awareness of and commitment to the highest standards of data quality, excellence, and integrity, all employees are required to sign the following "Commitment to Excellence in Data Quality" statement:

> "As an ARI employee, I have the right and responsibility to report any situation which may adversely affect quality or which may impact the final quality or integrity of data produced for our clients."
>
> "I will report immediately to management any information concerning the misrepresentation or possible misrepresentation of analytical data (or any of its associated components). Examples of this include (but are not limited to): alteration of an instrument computer or clock, alteration of the contents of logbooks and/or data sheets in order to misrepresent data, misrepresentation of analyst identity, intentional falsification of documents with correction fluid ("white-out"), preparation and submittal of counterfeit data packages, use of illegal calibration techniques (peak shaving, use of fraudulent integrator parameters, etc.), or any attempt to misrepresent data or events as they actually occur in the course of an analysis."
>
> "I will likewise alert management of any situation or activity which may be adverse to the confidentiality of clients' data."
>
> "I will not knowingly participate in any such activity, nor fail to report such activities of which I may become aware. I understand that any voluntary participation on my part in such activities may result in the termination of my employment, and possible legal prosecution."
>
> "Where circumstances permit, I will report any actual or suspected violations of this policy to my lab or section supervisor. If a satisfactory resolution is not obtained or is not possible at that level, I have the right and obligation to discuss the matter directly with the ARI Laboratory Manager."

Confidentiality

All information related to client projects, such as client work plans, documentation and analytical data will be considered confidential. This information will be released only to the client or an authorized representative. Should an outside agency request information related to a client project, the client will be contacted for approval prior to releasing any information.

Some programs or contractual agreements (such as the USEPA Contract Laboratory Program) may have specific requirements for protecting a client's confidentiality. Project Managers will be responsible for strict control of access to any such confidential information or documentation. All data generated from the analysis of confidential samples will also be considered confidential.

SECTION 2.0: QA MANAGEMENT AND RESPONSIBILITIES

2.1 Overall Structure

ARI's laboratory management includes the Laboratory Director Chief, the Chief Operations Officer, Laboratory Technical Directors, the Client Service Manager and the Quality Manager. Key administrative personnel such as Laboratory Supervisors, the IT Manager and Project Managers support the management structure. ARI's organizational structure is outlined in Appendix A. Section 2.2 outlines management's roles and responsibilities.

The Board of Directors shall direct ARI′s QA Policy and shall determine the philosophy of the QA Program. It shall be the responsibility of management to translate this policy into practical procedures with respect to the business plan developed for ARI, and direct laboratory personnel regarding the incorporation of these procedures into daily laboratory activities.

Management has overall responsibility for the technical operations and the authority needed to generate the required quality of laboratory operations. Management ensures communication within the organization to maintain an efficient and effective laboratory operation and to communicate the importance of meeting customer, statutory, and regulatory requirements. Management ensures that the system documentation is known and available so that appropriate personnel aware of their responsibilities. When changes to the management system occur or are planned, management ensures that the integrity of the system is maintained.

Management is responsible for carrying out testing activities that meet the requirements of the TNI Standard, the ISO/IEC 17025 Standard, the DoD-QSM and that meet the needs of the client.

2.2 Hierarchical Responsibilities

<u>Laboratory Director</u>

The Laboratory Director shall interpret overall QA Policy based on the requirements of the TNI Standard, the ISO/IEC 17025 Standard, the DoD-QSM and determine the broad practicality of policies based on methodologies, technological advances, and the current environmental market. It shall be the interpretation of these policies that will, in turn, direct the growth ARI, the addition or withdrawal of methods to ARI′s repertoire, and ARI′s marketing focus.

At a minimum of once a year the Laboratory Director shall include on the agenda of the Board of Directors meeting a discussion of ARI′s QA Policy. This discussion will include the reputation of ARI for producing quality analyses, the effect of QA policies on turn-around time, competitive edge and cost-of-analysis, needs for stricter or more flexible policies, and the response of employees to the QA policies in place at that time.

At a minimum of once every six months the Laboratory Director shall attend management meetings, which include on the agenda the subject 'QA Program'. This format will allow for the dissemination of information on any QA issues addressed in the laboratory or by the Board of Directors. Management shall also use these meetings to discuss requirements of clients that are not met by ARI′s present QA Program, and the appropriate response to these requirements.

The Laboratory Director may be required to act as a technical advisor at any impromptu meetings called by management to address QA issues that cannot be immediately resolved within a laboratory section.

It shall also be the Laboratory Director's authority and responsibility to hold final review approval for all SOPs of ARI. Once an SOP has been updated and reviewed by the laboratory section, it shall go through the Section and Laboratory Managers for approval, and then to the LTD for final approval before the SOP is released.

The Technical Director of the Organics Division is the deputy Laboratory Technical Director. Whenever the Laboratory Director is absent for 15 or more consecutive days the Technical Director - Organics Division will temporarily assume her/his duties.

ARI’s primary accreditation bodies will be notified when the Laboratory Director will be absent for 35 consecutive days.

Chief Operating Officer

The Chief Operating Officer is responsible to coordinate Client Services and Information Technology activities to result in an integrated approach to quality data production. It shall be the Chief Operating Officer's responsibility to coordinate Client Services, Laboratory Management, and Information Technology Services, to ensure that QA Program requirements and data quality objectives are met.

The Chief Operating Officer plans and initiates periodic management meetings, at which the QA Program will be an agenda item. Management shall use these meetings to discuss requirements of clients that are not met by ARI′s present QA Program, the appropriate response to these requirements, and dissemination of information on any QA issues addressed in the laboratory or by the Board of Directors.

It is the responsibility of the Chief Operating Officer, along with the QA Manager, Laboratory Director, Section Managers and Client Services, to establish testing activities that meet the requirements of the TNI Standard, the ISO/IEC 17025 Standard, the DoD-QSM and that meet the needs of the client.

The Chief Operating Officer has the authority to direct Client Services to discontinue the bidding/contracting process for a new project, refuse samples, or to re-schedule projects based on Data Quality Objectives or current workload. The Chief Operating Officer also shall evaluate staffing and equipment needs based on information from the Section Managers and Client Services and may elect to meet new project requirements by increasing staffing levels or purchasing additional equipment.

The Chief Operating Officer serves as a senior-level technical reference for all laboratory activities, and as such will be brought in to advise on out-of-control events and trends, corrective actions, and/or other QA issues that require his/her expertise.

ARI's Client Services Manager is the deputy Chief Operating Officer and will assume the Chief Operating Officer duties whenever the Chief Operating Officer is absent for more than seven consecutive days.

Laboratory Technical Directors- Organic Division and Inorganic Division

Laboratory Technical Directors shall have the final authority in decisions concerning implementation of QA policy in their laboratory sections. It is their expertise that will determine if testing activities meet the requirements of the TNI Standard, the ISO/IEC 17025 Standard, the DoD-QSM and the needs of the client.

Laboratory Technical Directors are responsible for correcting out of control events within their respective laboratories. Laboratory Technical Directors and supervisors shall instruct employees in the proper employment of QA Policies.

Laboratory Technical Directors are responsible for completing or delegating updates of laboratory procedures and quality assurance manual sections as scheduled by the QA Manager. They will review and approve all laboratory Standard Operation Procedures.

The Laboratory Technical Directors are best able to determine capacity of the Laboratory Sections. To ensure that analyses are completed within required hold times, the Laboratory Technical Directors will give Supervisors the authority to balance employee workloads and modify employee work schedules. It is the Laboratory Technical Directors' responsibility to take reports from supervisors and work with the Laboratory Director to increase staffing levels or reject samples as needed. It is the Laboratory Technical Directors' responsibility to work with the Laboratory Director and section supervisors and analysts to ensure that sample capacity does not affect the quality of data generated from that laboratory section.

It is the responsibility of the Laboratory Technical Directors, along with the QA Manager, Laboratory Director, Chief Operating Officer, and Client Services, to determine in which QA Proficiency Programs the Laboratory will participate, and which accreditation processes ARI will pursue. It is the responsibility of the Laboratory Technical Directors, with the Section Supervisors, to ensure that all laboratory sections perform the tasks required by the QA Manager to pursue each accreditation or to complete a scheduled audit.

The Laboratory Technical Directors will be responsible for reviewing training records of analysts produced by the Section Supervisor. Training shall be the responsibility of the Section Supervisor, but it is the responsibility of the Laboratory Technical Directors to oversee this training.

It is the Laboratory Technical Directors' responsibility to work with the Section Supervisor and Project Manager to ensure that Project Requirements are achievable and valid for the given methods. At times, ARI′s clients have requests or requirements for methods that are 1) not the method of choice in the laboratory, 2) not presently performed by the laboratory, or 3) unachievable by the instrumentation used in the laboratory. It is the responsibility of the

Laboratory Technical Directors, Section Supervisors and Project Manager to work with the client to resolve these issues before samples are accepted.

Clients may also request modifications to the methods that must be approved by the Section Supervisor, the Section Manager and the Quality Manager. These modifications must be thoroughly documented and all pertinent information on modifications must be conveyed to the analysts, sample preparation sections, sample receiving, and computer services, as needed for implementation.

The Laboratory Technical Directors are responsible for resolution of out-of-control events that have not or cannot be resolved by the analysts or Section Supervisor.

The Laboratory Technical Directors have the authority to re-classify analysts or require additional training of analysts based on their performance.

The Laboratory Technical Directors have the responsibility of balancing client requests and requirements with the QA policies of ARI. It is the Laboratory Technical Directors' task to evaluate a client's Data Quality Objectives (submitted through Client Services), and with the Project Managers, Laboratory Supervisors and Quality Manager to determine the feasibility of laboratory performance. Feasibility will be based on the quality objectives requested, current QA Manual, present workload (in-house and scheduled/pending), the technology in place, and staffing levels available. Current workload in-house will be evaluated using reports from Information Technology, and scheduled/pending workload will be evaluated using written and verbal input from Client Services.

Deputies for the Organics and Inorganics Technical Directors are the Organics Extraction Laboratory Supervisor and the Metals Instrument Laboratory Supervisor respectively.

Laboratory Supervisor

To ensure that analyses are completed within required hold times, the Laboratory Supervisors have the authority to balance employee workloads and modify employee work schedules. The Laboratory Supervisors, with the input of the Laboratory Technical Director, have the authority to request overtime from employees should the workload warrant the additional effort, or to modify employee schedules to extend the operating hours of the laboratory section.

The Laboratory Supervisors shall oversee the day-to-day section operations, using LIMS printouts and verbal or written workload estimates and requests from Project Managers to adjust section efforts as needed. It is also the Laboratory Supervisors responsibility to inform management, when capacities are limited, so that the appropriate adjustments can be made to reduce workloads or increase laboratory capacities. At no time should sample capacity be allowed to affect the quality of data generated from any laboratory section.

It is the Laboratory Supervisors responsibility to ensure that employees have the proper training for their positions. This training will include training in the methods, use of the LIMS system if applicable, training in correct documentation procedures, and all information necessary for adherence to the ARI QA Program. The Laboratory Supervisors shall either perform the training personally, or designate the trainer for given methods or procedures. It is the Laboratory Supervisor's responsibility to test each employee for each method or procedure, and to thoroughly document each employee's advances and current capabilities. The Laboratory Supervisors shall have the authority to require further training or supervision for any employee, and shall be the authority to approve each employee for working without supervision. All employee training records are maintained in the SharePoint *Employee Records* library.

It is the Laboratory Supervisors responsibility to work with the Laboratory Technical Director and Project Manager to ensure that project requirements are achievable and valid for the given methods. At times clients have requests and/or requirements for methods that are 1) not the method of choice in the laboratory, 2) not presently part of the method as performed by the laboratory, or 3) unachievable by the instruments used in the laboratory. It is the responsibility of the Laboratory Supervisors, Laboratory Technical Director and Project Manager to work with the client to resolve these issues before samples are accepted.

It is the responsibility of the Laboratory Supervisors to ensure that each analyst reads and understands all requirements submitted with each sample set, including those for any special analyte, calibration, or data deliverable. It is the Laboratory Supervisors responsibility to clarify any issues, with the input of the Laboratory Technical Director and the Project Manager for the client.

Clients also at times will request modifications to methods, which must be approved by the Laboratory Supervisors and Laboratory Technical Director. These modifications must be thoroughly documented and all pertinent information on modifications must be conveyed to the analysts, sample preparation sections, sample receiving, and computer services as needed for implementation.

It is the Laboratory Supervisors responsibility to ensure that each employee understands the requirements of all projects they work with. This may necessitate section meetings or project-specific cross-section teams to work with Project Managers for large, specialty projects to ensure that everyone has the same understanding of project requirements.

The Laboratory Supervisors is responsible for resolution of out-of-control events that have not or cannot be resolved by the analysts, and for ensuring that the analysts complete all documentation. If the Laboratory Supervisors and laboratory section analysts cannot resolve the issues in a timely manner, the Laboratory Supervisors will request the assistance of laboratory management to bring the section into compliance. The Laboratory Supervisors will also inform Project Management and his/her Laboratory Technical Director of possible delays in the analytical process.

The Laboratory Supervisors shall have the authority, usually in consultation with Laboratory Technical Director or Project Management to use professional judgment in requiring samples be re-prepared, and shall determine which analysts have the authority to require re-preparation of samples.

It is the responsibility of the Laboratory Supervisors to inform the Quality Manager, Laboratory Technical Director and Computer Services section of any changes in methodologies that will require revision of SOPs, MDLs, Control Limits or the LIMS programming. This includes changes in spiking compounds, spiking levels, preparation methods and analytical methods.

Analysts

Analysts are responsible for following the current SOPs (with project-specific modifications if required) in preparing and analyzing client samples and quality control samples to meet the project specific Data Quality Objectives. It is the analyst's responsibility to ensure that he/she understands all requirements of a project before proceeding with sample preparation or analysis.

Analysts are responsible for working with the Laboratory Supervisors to ensure that all sample preparations and analyses are performed within required holding times and required turn-around times, and that all documentation is completed in a timely fashion. It is each analyst's responsibility to bring any recurrent or anticipated problems to the attention of laboratory management.

It is each analyst's responsibility to correct his/her own errors, to document corrective actions thoroughly, to perform peer review, and to ensure that fellow employees within the section follow documentation procedures.

Laboratory Supervisors may give lead analysts responsibility for training and evaluation of new staff members. This training will include instruction in the methods, use of the LIMS system if applicable, correct documentation procedures, and all information necessary for adherence to the ARI QA Program. Analysts will be responsible for maintaining all instruments and equipment in optimum operating condition and documenting this maintenance as required by the QA Program.

It is the responsibility of each analyst to request the assistance of Laboratory Supervisors or other managers in resolving out-of-control situations that cannot be corrected in a timely manner, and to perform the documentation of all corrective action activities.

Quality Manager

The Quality Manager is responsible for the oversight of the QA Program as defined by the Board of Directors and interpreted by the Laboratory Technical Director, the Chief Operations Officer and Laboratory Technical Directors.

The Quality Manager is responsible for maintaining all required outside accreditation and will coordinate with appropriate accrediting bodies

Part of this oversight will be monitoring of the QA Program through submission of performance testing (PT) samples, blind QA samples and double-blind QA samples. The Quality Manager will be responsible for submitting these samples to the laboratory for analysis, overseeing submission of the results to the appropriate agencies.

The Quality Manager will plan, coordinate and document periodic internal and external assessments of ARI's Quality System. Internal assessments will examine all phases of laboratory operation annually. External assessments are scheduled by ARI's accrediting bodies.

The Quality Manager is responsible for scheduling an annual review of ARI's laboratory Quality Assurance Manual (LQAP) and all SOPs. The Quality Manager will produce and maintenance of bench sheets, logbooks, control charts, MDL studies, MDL/LOD verifications and any other quality related documents.

The Quality Manager is responsible for evaluation of the laboratories' adherence to defined protocols through periodic audits of completed projects and of the laboratory facilities.

The Quality Manager will be responsible for evaluation of outside accreditation requested by Client Services. The QA Manager will deliberate with other management personnel on the feasibility of pursuing accreditation based on the scope of the accreditation, the effort required to pursue accreditation and the scope of work that might become available once the accreditation is obtained. If a decision is made to pursue an accreditation, it is the responsibility of the Quality Manager to coordinate laboratory efforts towards the accreditation.

The Quality Manager will serve as a resource for quality-related issues for all Laboratory Sections, and will serve management in an advisory capacity.

The Quality Manager will plan, implement and maintain ARI's technical training program.

The Quality Manager will have documented training in elementary statistics and Quality Systems theory.

Information Technology

Information Technology is responsible for ensuring that the LIMS correctly reflects the preparations and analyses performed and that the LIMS is updated to include the current SOP, MDL, RL and QL data, as submitted by the QA Manager. Computer Services personnel are also responsible for ensuring that all electronic deliverables for clients are formatted correctly as requested by the Project Managers and that electronic data matches the hardcopy deliverables submitted.

It is the responsibility of the Information Technology Manager to update, or to designate the task of updating, the LIMS as determined by Laboratory Management, including adjustment to current MDL/RL data, additions of analytes to methods, changes in method designations or changes in calculations for methodologies.

Information Technology will be responsible for generating the work list scripts required to allow analysts to enter data into the LIMS, and for generating the report scripts that produce final hardcopy or electronic reports for clients.

Information Technology Management and personnel are also responsible for generation and review of electronic data deliverables (EDD), as requested by clients through Project Management. Information Technology personnel will review the EDD for compliance with the Software Quality Assurance SOP before it is released to the client.

Information Technology will be responsible for informing laboratory Section Managers and Project Managers of any discrepancies found between the EDD and the hardcopy, and for following up on corrections to hardcopy and EDD as required.

ARI's Chief Operating Officer is the deputy Information Technology Manager. When the Information Technology Manager is absent the Chief Operating Officer perform Information Technology duties.

Client Services

Client Services (CS) (Project Managers, Sample Receiving, and Sales Management) personnel are the primary interface between ARI′s clients and the laboratory sections. CS staff shall be responsible, with the assistance of the Section Managers and Supervisors, for ensuring that the laboratories understand and can meet the Data Quality Goals and Requirements of each Project before committing laboratory services to the project. CS will monitor the quality of sample processing after they are received.

Client Services Management and Project Managers shall ensure that the laboratories can meet the data quality objectives for a project. The Project Managers are responsible for knowing the capabilities of the laboratory, in order to develop project proposals or accept samples without consultation with laboratory management. It is the responsibility of Client Services to consult

with the Laboratory Manager and Section Managers, or supervisors designated by Management, when data quality goals are not included in standard Company policies. Clients may, at times, request modifications to methods that must be approved by the Supervisor and Section Manager. These modifications must be thoroughly documented and all pertinent information on modifications must be conveyed to the analysts, sample preparation sections, sample receiving, and computer services as needed for verification of feasibility. Laboratory Management may determine that a project should not be pursued based on the specific Data Quality Objectives and on current or projected laboratory capacity.

Project Managers shall be responsible for ensuring that project requirements and analytical requests are submitted correctly to all laboratory sections. Once samples have been logged into the laboratory, it is the responsibility of the Project Managers to ensure that all information is available to the laboratories concerning the Data Quality Objectives and deliverables requirements. It is also the responsibility of the Project Managers to convey changes in client requirements to the laboratories and ensure that all paperwork reflects the changes if necessary.

It is the responsibility of Project Managers and Client Services Management to ensure that specific EDD formats are submitted to Computer Services and approved as feasible before contracting with a client to provide the EDD.

It is the responsibility of Project Managers to notify clients of out-of-control events, “problem” samples, or anticipated turn-around time delays, as conveyed to them by Laboratory Management. It is also the responsibility of Project Management to work with Laboratory Management in setting priorities during times of heavy sample workloads.

Project Managers shall be responsible for coordinating data submissions and compiling hardcopy data for final submission to the client. This involves conducting a fourth level data review, from which any data which is found to contain errors that were not found earlier in the review process is returned to the Data Reviewer for correction and/or corrective action. The Project Manager will be responsible for compiling all analyst notes into a project narrative. This will include discussion of any sample receipt discrepancies, sample preparation and analysis difficulties or non-compliance, and any corrective actions that may have been required during

processing. It will also discuss quality control analyses and results if applicable to the sample set.

Project Managers shall work with Laboratory Management in determination of the direction of growth for ARI, as the Project Managers are best able to define the analytical needs of clients based on new technologies and new environmental regulations.

ARI's Chief Operating Officer is the deputy Client Services Manager. When the Client Services Manager is absent the Chief Operating Officer perform Client Services Manager duties.

SECTION 3: PERSONNEL QUALIFICATIONS AND TRAINING

The production of quality analytical data is dependent upon a laboratory staff with qualifications and training necessary to perform assigned tasks. All personnel employed by ARI will receive adequate training and instruction specific to their responsibilities. Prior to assigning a staff member full responsibility for performing a laboratory procedure, her/his skills are evaluated and verified acceptable. It is the obligation of ARI′s supervisors and managers to ensure that personnel are qualified to successfully perform all assigned duties.

ARI′s training program is described in SOP 1017S (*Training and Demonstration of Proficiency*). The procedures described in the SOP ensure that all ARI employees are proficient at the tasks required to produce quality analytical data. The SOP also provides for periodic review of each employees training and proficiency status, which may indicate any need for additional or remedial training. All training and review procedures are documented as described in the SOP.

Basic elements of ARI′s training program are:

1. All employees are required to read and document their knowledge of non-technical documents that describe general policies in place at ARI including ARI′s *Employee Manual* and ARI′s *Chemical Hygiene Plan*.
2. All technical employees are required to read and document their knowledge of ARI′s *Laboratory Quality Assurance Plan* and quality assurance policies.
3. All new employees must attend a Quality Assurance Orientation during which ARI′s general and specific requirements for the production of quality analytical data are introduced.
4. All new technical employees will attend a laboratory specific technical orientation conducted by their laboratory supervisor or manager that provides specific information about laboratory operation.
5. All employees will complete an ‘on the job’ training program designated by their supervisor. The training program will be laboratory, SOP and employee specific. The training is incremental with each step documented in an employee Training File. While an analyst is in the training period, her/his supervisor or trainer must approve all their `analytical work.

6. Upon completion of the training program a technical employee must complete an Initial Demonstration of Capability (IDOC) as described in ARI SOP 1017S. An analyst is considered proficient and may perform analytical procedures without supervision only after they have completed training and a successful IDOC.
7. The proficiency of each employee performing a given laboratory SOP is continually monitored and documented as described SOP 1017S. To maintain proficiency, an employee must continually generate data that meets all of ARI's published acceptance criteria for a given SOP. Unacceptable results or insufficient number of analyses performed in a calendar quarter will result in revocation of proficiency. This will result in a remedial training program.
8. Each analyst is responsible for maintaining a training record as described in SOP 1017S. The training record will document an employee's experience, training and capability. The training file will be maintained in ARI's "cloud" based Microsoft SharePoint™

SECTION 4: FACILITIES AND EQUIPMENT

4.1 Facilities

ARI′s physical facilities allow for efficient sample processing and analysis while maintaining consideration for the health and safety of the staff. The facility accommodates the following operations:

Sample receipt and storage
Sample container preparation and shipment
Sample preparation and analysis (organic and inorganic)
Project planning and management
Quality assurance
Data review and report generation
Computer programming and operations
Records storage
Instrument spare parts storage
Frozen sample archive
Short-term hazardous waste storage

A detailed description of ARI′s facilities is included as Appendix C.

4.2 Security

Facilities

To ensure sample and process security, access to ARI's facilities is limited to employees and escorted visitors. All outside entrances are locked and/or continuously monitored. Visitors must register at the reception desk, be escorted while in the laboratory and sign out prior to leaving. Key access to the facility is controlled; keys are issued only on a limited "as needed" basis.

Because of the strictly controlled access and a 24-hour monitored alarm system, ARI considers the entire facility is a secure area. This eliminates the need for locked sample and data storage within the building.

Data Access

ARI's Computer Services (CS) Manager controls security of, and access to, electronic data on all data systems. ARI's CS team has implemented processes and procedures to ensure data integrity and prevent intentional intrusion by outside parties. These measures are robust but not so restrictive that they prevent data accessibility. These measures include building security,

limited computer system access, password systems, encryption, firewalls and the use of virus protection programs. ARI′s Intranet is protected from outside tampering by a proxy server (firewall) connection to the Internet.

LIMS - System Security

Building/Computer Room Security

Access to the building is restricted to employees, vendors with security passes, and escorted visitors. Room 203 contains the computer and main console for the LIMS system. This room is closed and locked at all times. Access to this room is limited to CS personnel, escorted repair technicians, and escorted visitors. Only CS personnel will be allowed access to the main console.

System Password Policy

User name and password restrict access to the LIMS computer. Remote access to the LIMS server is not allowed.

Database Access Restrictions

Interaction with the database is menu-controlled and allows the LIMS Manager to restrict access. Technicians may be given the ability to fill a limited number of work lists, with no authorization to distribute data. Some users may be given “read only” access to the database.

Users will be given access to the database only to complete tasks for those analyses for which they are responsible. No users are to be given access to the shell or command prompt unless 1) they have completed the appropriate training and 2) administrative access to the computer systems is required by their job function

4.3 Safety

The safety and well-being of staff is imperative. ARI’s facilities are designed and equipped to minimize personnel exposure to hazardous substances or situations. The Chemical Hygiene Plan details safety procedures and requirements that ARI staff must follow. An active safety committee meets monthly to review the safety activities of all laboratory sections and to ensure that all operations and equipment meet safety criteria. *The Chemical Hygiene Plan* is reviewed annually and updated as needed to incorporate any changes to ARI′s safety program.

4.4 Instrumentation and Support Equipment

4.4.1 Instrumentation

Generation of quality data is dependent upon instrumentation and support equipment that is in optimum operating condition. All instrumentation and support equipment will be optimally maintained following method requirements and/or manufacturer's recommendations. Preventative maintenance is performed on a scheduled basis, with more frequent maintenance during periods of increased sample load or after analysis of highly contaminated samples. All instrument maintenance is documented in Element LIMS. When non-routine maintenance is required the following information must be recorded:

1. A statement of the problem or symptom that requires correction.
2. Details of the maintenance procedure including listing the parts repaired or replaced.
3. Documentation that the instrument has returned to routine performance.

ARI maintains an inventory of spare parts or orders parts on an expedited basis to minimize downtime.

Appendix D is a list of currently laboratory instrumentation and equipment.

4.4.2 Support Equipment

4.4.2.1 Thermometers in use at ARI are traceable to an NIST standard and calibrated or verified as described in SOP 1020S. Electronic thermometers are verified quarterly and liquid in glass thermometers annually. When appropriate, thermometers are assigned a correction factor based upon the most recent calibration. ARI personnel must calculate and record corrected temperatures based on the correction factor.

4.4.2.2 Water Bath temperatures are recorded before each use to ensure the temperature is acceptable for its intended use.

4.4.2.3 Incubator temperatures (corrected) are recorded at least twice a day while in use. The date and time for each observation is recorded.

4.4.2.4 Oven temperatures are recorded at the beginning and end of each work day they are in-use.

4.4.2.4 Refrigerator and Freezer temperatures are recorded automatically every 30 minutes by ARI's electronic "ThermoLogger". QA staff are notified via e-mail when a recorded temperature is out of compliance. "Thermologger" temperature probes are verified / calibrated quarterly.

4.4.2.4 Balance accuracy is verified daily prior to use with two Class S weights that bracket the normal weighting range of the balance. A balance must be accurate to ±0.1% or ±0.5 mg whichever is greater. All analytical balances are professionally cleaned and calibrated annually by an outside contractor. Class S weights are calibrated every five years by an outside contractor.

4.4.2.5 pH Meters are standardized prior to each use with at least two standard buffers, one at 4.0 and one at 7.0 pH units.

4.4.2.6 The accuracy of Variable Volume Pipettes and Mechanical Burettes is routinely verified on a daily, weekly or monthly basis as described in ARI's SOP 1015S.

4.4.2.8 Sample Containers: – ARI supplies clients with containers for the collection of field samples. All containers supplied for organic and trace metals analyses are pre-cleaned and certified by the manufacturer. When the manufacturer's certified concentration is greater than ARI's reporting limit for a specific project, a container is used to prepare a method (bottle) blank. ARI certifies that the containers from the same lot are suitable for sample collection when target analytes are not detected in the bottle blank. Containers for conventional analyses are not pre-cleaned and are certified internally by ARI following the procedures in Appendix 12.3 of ARI SOP 001S (Sample Receiving).

Container lot numbers are recorded when containers are sent to a client.

4.4.3 Chemical Standards and Reagents

4.4.3.1 Reagent Water Supply

ARI maintains a centralized water purification system. The quality of the water produced is monitored and documented daily in a bound logbook. All reagent / de-ionized water used within the laboratory must meet or exceed ASTM Type II Standards. In addition, water used in the Volatile Organic Laboratory is filtered through activated charcoal to ensure it does not contain organic compounds.

4.4.3.2 Chemical Standards

Most standards used to determine the concentration of target analytes are purchased as certified solutions. These standards are traceable to a National Institute of Standards & Technology (NIST) standards and documented with a Certificate of Analysis. In addition, all quantitative standards (traceable, non-traceable and those prepared by ARI) are verified by comparison to a second standard reference material obtained from an alternate source. The source, date of receipt, required storage conditions and an expiration date for all standards are recorded in ARI's Element LIMS system. SOP 1024S "Preparation and Traceability of Standards and Reagents" outlines procedures for receiving, preparation and storage of analytical standards

4.4.3.3 Chemical Reagents

Many of the analytical processes in use at ARI require chemical reagents not directly used in the calibration process. These reagents provide for analyte preservation, adjustment of pH, formation of colorimetric indicators, etc. All reagents are purchased in a grade and purity sufficient for their intended use. All reagents and accompanying Certificates of Analysis are documented in Element LIMS. Each original reagent container is labeled with the date it is opened and an expiration date as appropriate.

Solutions prepared from reagents are recorded in the LIMS system. Reagent containers are labeled with Reagent Number, date of preparation, expiration date, and preparer's identification.

Procedures for Reagent Receiving and Preparation are detailed in SOP 1024S.

Trace Metals Acids

To ensure the quality of acids, nitric and hydrochloric, used for trace metals analyses, ARI purchases only the highest quality, certified "metals free" acids. Each lot received is analyzed for purity prior to use to ensure that it is acceptable. When possible, an entire lot of acid will be reserved for use exclusively by ARI. This minimizes the possibility of receiving contaminated or unacceptable acid.

Solvents

To ensure the quality of solvents used for sample preparation and analysis, ARI uses only the highest purity solvents available. A portion of each lot of solvent received is analyzed to verify

its stated purity. Only solvent lots determined acceptable will be used for sample processing. Whenever possible, entire solvent lots will be reserved for use. This minimizes the possibility of receiving contaminated or unacceptable solvents.

Compressed and Cryogenic Gases

To reduce the possibility of system contamination, compressed and cryogenic gases used for operating analytical instrumentation will be of a specified purity level. A cylinder suspected of introducing contamination into a system is immediately replaced.

4.5 Computer Systems

ARI maintains several data systems. These are used to automate such diverse functions as accounting, payroll, sales and marketing, sample receiving, instrument data collection, production of hardcopy and electronic data deliverables, intra- and internet applications and project management. Specific information about these systems is contained in Appendix D and various SOPs.

ARI maintains a Laboratory Information Management System (LIMS) that stores analytical data, calculates final results and produces final reports (both hardcopy and electronic). The LIMS system is the major data system used at ARI. A separate Software Quality Assurance Plan outlines the QA/QC procedures for the LIMS system.

SECTION 5: LABORATORY DOCUMENTATION AND RECORDS

All laboratory operations and procedures performed during sample receipt, processing and reporting are thoroughly documented in electronic or handwritten records. These records are objective evidence of the work performed and are detailed enough to allow recreation of all procedures performed by the laboratory.

All routine procedures performed at ARI are documented in Standard Operating Procedures (SOPs). Electronic, controlled copies of all SOPs are maintained in ARI's "cloud" based Microsoft SharePoint™ file system. SOPs are reviewed and/or edited annually or when processes or procedures change.

If ARI is sold or transferred to a different ownership group, all records will be handled as specified in client contracts. In the absence of contractual requirements, records will be transferred to the new owner(s) as specified in the purchase/sale agreement."

5.1 Responsibilities

All staff members are responsible for complete and accurate documentation of laboratory activities. Each laboratory section employs a comprehensive set of documents (bench sheets, forms, etc.) to record all activities performed in that section. All staff members are responsible for reviewing and documenting their understanding of appropriate SOPs. ARI's QA Officer is responsible for maintaining control of laboratory documents and ensuring their consistent use.

To ensure that all documents including SOPs accurately reflect the activities performed at ARI, section supervisors and managers are required to review all documents and recommend changes to the LQAP annually. ARI's QA Officer is responsible for coordinating document revisions and ensuring that all staff members have access to the most current laboratory documents.

5.2 Document Control

ARI's Quality Assurance Program requires that all forms and SOPs used within the laboratory be monitored to ensure that only the currently approved versions are in use. The QA Officer maintains electronic versions of all SOPs, forms and manuals in ARI's "cloud" based Microsoft SharePoint™ file system. These electronic files are the only official controlled copies. Printed

copies are considered "Uncontrolled". Documents in use by individual analysts or sent to clients are "Uncontrolled". All documents will include a revision date. The LQAP and SOPs will also have an effective date. The time between the revision and effective dates is used for training and orderly implementation of changes. The listing of documents (SOPs, forms, bench sheets, etc.) in ARI's "cloud" based Microsoft SharePoint™ file system is considered the only official listing of ARI's QA documents. SharePoint also includes copies of prior versions of QA documents.

The QA Officer coordinates the generation of new forms or SOPs and modifications to existing documents. Document number assignments will be as follows:

Laboratory Section	Form Number	SOP Number
Client Services	0001 - 0999	001 - 099
Computer Systems	1000 - 1999	100 - 199
Data Services	2000 - 2999	200 - 299
Extractions	3000 - 3999	300 - 399
GC Laboratory	4000 - 4999	400 - 499
Metals Laboratory	5000 - 5999	500 - 599
Conventional Laboratory	6000 - 6999	600 - 699
Volatile Organic Laboratory	8000 - 8999	700 - 799
Semi-volatile Laboratory	7000 - 7999	800 - 899
Quality Assurance Monitoring	10000 - 10999	1000 - 1099

Document numbers will include an F for forms and an S for SOPs i.e. 101F or 1234S.

Laboratory forms and SOPs will be generated or revised on an "as needed" basis, and will be reviewed and revised at least annually. SOPs are prepared in a consistent format provided in SOP 1006S, "Document Preparation, Control, and Archival. A comprehensive review of all laboratory documentation will be performed annually coordinated by the QA Officer.

All documents generated by the laboratory are considered proprietary and must not be shared outside of the laboratory without prior consent from ARI.

5.3 Reference Documentation

To provide an understanding of the procedures employed to generate quality data, a comprehensive set of reference materials is available to staff members. The laboratory maintains copies of the following method compilations:

Code of Federal Regulations (Section 40)
Test Methods for Evaluating Solid Waste (USEPA SW-846)
Methods for Chemical Analysis of Water and Waste (USEPA 500 and 600 series methods)
Standard Methods for the Examination of Water and Wastewater
Recommended Protocols for Measuring Selected Environmental Variables in Puget Sound (PSEP)
Hazardous Waste Remedial Actions Program (HAZWRAP)
IEC/ISO 17025 (2005)
State of Alaska Department of Environmental Conservation (ADEC)
Oregon Department of Environmental Quality (DEQ) Petroleum Hydrocarbon Methods
Washington Department of Ecology (WDOE) Guidance for Remediation of Releases from Underground Storage Tanks (Appendix L)
Washington State SARA
Washington State EPH/VPH Methods
TNI -The NELAC Institute Standard 2009
Department of Defense Quality Systems Manual (QSM Versions 5.0 and 5.1)
Washington State Sediment Sampling and Analysis Plan

Other methods followed within the laboratory are also available. Published modifications to analytical methods will be reviewed and incorporated into laboratory SOPs. If a method for a parameter is developed by ARI, it will be detailed in an SOP. SOPs will be available for all laboratory activities. A listing is available in ARI's SharePoint™ "SOP" Library.

The Laboratory Quality Assurance Manual provides an overview of the laboratory-wide Quality Assurance program. An electronic copy of the Quality Assurance Manual is available to all laboratory sections in ARI's SharePoint™ "Popular Documents" Library.

ARI maintains a file of various laboratory and environmental publications and reference texts. These reference materials are available to all staff in ARI's SharePoint™ "QA Reference" site. Operation and maintenance manuals are available for all equipment and instrumentation used within the laboratory. Additionally, senior level staff members are available to serve as reference sources. These staff members have numerous years of pertinent experience and can provide insight and guidance for all procedures and laboratory activities.

5.4 Quality Assurance Policies

Quality Assurance Policies provide standards and procedures to guide ARI employees in proper implementation of the QA Program. Appendix P includes current QA Policies.

5.5 Worksheets and Logbooks

Use of Laboratory Forms and Logbooks

All activities noted in writing on laboratory forms and logs are recorded in blue ink. Initials of the staff member performing the activity, as well as the date the activity is performed are noted on all forms and logs. Any supplementary information about the activity, such as unusual observations or suspected procedural errors is noted on the forms and logs.

A change to existing information is annotated by drawing a single line through the original entry, initialing, and dating the deletion. Correct information is then written above the deleted entry. When appropriate to clarify the intent of the change a note describing the reason for the change is added. The use of correction fluids or other techniques that cover an entry in its entirety is forbidden on laboratory documents.

Since sample processing within an analytical laboratory involves many detailed steps, documentation can be quite extensive and varied. The following guidelines ensure consistency in laboratory record keeping:

Analytical Standard Preparation

Document the preparation of all stock and working standards in Element LIMS. Each record includes preparation date, initial and final concentrations (including solute and solvent amounts), standard ID number, expiration date and the identity of the person preparing the standard. Stock solution entries include standard lot number and supplier. Working solution entries include the stock solution ID number.

Sample Storage Temperature Logs

The temperature of all refrigerators and freezers used for sample and standards storage is monitored daily using the electronic “Thermologger” system monitored and maintained by QA.

Balance Calibration Logs

The true and measured values for each calibration check weight are recorded in balance specific logbooks, along with the date and recorder's initials. Any actions taken, such as notifying QA of malfunctions is indicated alongside the entry for that date.

Instrument Sequence Logs

The Instrument Sequence Logs maintained in Element LIMS document the daily operation of each analytical instrument. The logs document the ID, date and time for each sample analyzed. In addition, instrument conditions, analyst ID and standards used and any unusual circumstances are recorded in the log. Comments related to sample analysis and minor maintenance are noted on the instrument logs. For GC/MS analyses, instrument performance is documented by recording internal standard response alongside the sample identification.

Sample Preparation/Analysis Worksheets

Sample preparation and analysis activities are documented on appropriate worksheets. Sample identifications, weights or volumes used, intermediate cleanups, final volumes, preparation dates and analyst initials will be noted as well as any observations about sample condition. Any issues encountered during sample preparation are also noted. Surrogate and spiking solution ID numbers, and concentrations added to the samples, must be indicated on the bench sheets. Worksheets are generated manually, scanned and attached to an analytical batch in Element LIMS as a PDF file.

For some parameters, analytical results are summarized on an analysis worksheet. Sample identifications, sample preparation information, sample results, quality control results, analysis date, analyst initials and reported detection limits must be indicated on the worksheet. Any necessary data qualifiers are also noted on the worksheet. Worksheet data is manually entered in Element LIMS

Maintenance Logs

All maintenance performed on instrumentation or laboratory equipment must be documented in Element LIMS. Maintenance performed, date and analyst performing the maintenance,

and steps taken to verify that the maintenance was successful are detailed. A demonstration that GC instruments are in-control following maintenance is documented in the instrument run log.

5.5 Document /Data Storage and Archival

Logbooks

Completed hardcopy logbooks are forwarded to the QA Officer to be indexed and archived for 10 years.

Analytical Records

Copies of all analytical records (project information, instrument logs, chromatograms, calibrations, quantification reports, etc.) are maintained as part electronic files on ARI's servers. The files are backed up to "Cloud" storage daily. All electronic data is archived for five (5) years or as specified by contract.

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SECTION 6: PURCHASING SERVICES AND SUPPLIES

ARI ensures that purchased supplies, consumables and services that affect the quality of environmental tests are of required or specified quality. This includes all chemicals (solvents, chemical standards, reagents, etc.) used in an analytical process and services provided by an outside vendor such as balance, weight and thermometer calibrations, support equipment maintenance and service contracts for instrumentation.

Laboratory managers or their designee are responsible for the quality and suitability of supplies and equipment routinely used in their laboratory section. This involves accurately defining required specifications for all purchased supplies, equipment and services. Purchasing documents are prepared that adequately describes the services or supplies and their specifications.

Suppliers are approved based on the quality of their products, their ability to deliver products as requested, the overall quality of their services, and competitive pricing. Documentation used in the evaluation process may include but is not limited to: Certifications by recognized accrediting organizations, evidence of quality furnished by the supplier, certificates of analysis, recommendations from other purchasers, and records of historical compliance with ARI's requirements. A list of approved vendors is maintained by ARI's QA department, is available to all staff and is reviewed and updated annually. Quality critical consumables and equipment must be purchased from an approved vendor or specifically approved by a laboratory manager.

Upon receipt, ARI inspects all supplies received for consistency with the order and to document any shipping damage such as breakage or leaks. ARI's purchaser must verify that the quality of any chemical received (expiration date, concentration, grade, etc.) meet specifications. Supplies received are stored according to manufacturer's recommendations, laboratory SOPs or test method specifications. Purchased supplies and reagents that affect the quality of the tests are not used until they are inspected or otherwise verified as complying with requirements defined in ARI's analytical SOPs.

Chemical or certified products are documented in Element LIMS and are labeled with an Element ID. Electronic copies of all quality documents received with the supplies and services (specifications, certificates of analyses, warranties, maintenance records, calibration

recordetc.tc) are archived and electronically linked to the Element LIMS identification. Details are found in SOP 1013S, Chemical and Certified Product Receiving.

SECTION 7: SAMPLE COLLECTION

Analytical Resources Inc. is not routinely involved with sample collection. The laboratory does, however, supply clean sampling containers to its clients upon request. Contamination free container are essential to maintaining the integrity of samples collected in the field.

7.1 Sample Container Preparation and Shipment

To minimize the possibility of contamination from containers furnished by outside sources, ARI will furnish all necessary sample containers for client projects. Sample containers provided by ARI are either pre-cleaned to EPA specifications, certified clean by the manufacturer or tested for contamination by ARI. Lot numbers for containers are tracked to link bottle orders to lot numbers.

As per client request, the appropriate blank sample labels are either provided to the client in bulk fashion (loose) or are affixed to each sample container prior sending the containers to a client. The sample label allows for recording of the following information at the time of collection: client name, client sample identification, sampling site, date and time of sample collection, analytical parameters, and any preservatives used. Sample labels provided by ARI are coated to prevent bleeding of recorded information when they become wet.

To ensure that the correct number of appropriate sample containers are prepared and submitted to the client, a Bottle Request is completed by a Client Services staff member or Project Manager at the time sample containers are ordered by the client. All necessary preservatives are also noted on the Bottle Request. The Bottle Request is then forwarded to appropriate personnel in the Sample Receiving Section for order preparation. All required containers will be gathered and preservatives added as specified. A copy of the Bottle Request accompanies the sample containers to allow the client to verify that the order is properly filled. Additional containers will be supplied for quality control purposes and in case of container breakage or sampling complications. A listing of containers and preservatives recommended for analyses performed by ARI are listed in the document “Summary of Sample Containers, Preservatives and Holding Time Requirements” in ARI’s “cloud” based Microsoft SharePoint™ file system

To facilitate transportation of containers to the sampling site, sample containers will be placed in coolers along with appropriate packing material. The inclusion of packing materials, such as

vermiculite or “bubblewrap”, is provided to minimize the possibility of container breakage and cross-contamination. Sample containers will be organized in the coolers per analytical or client specifications. Depending on client preference and project requirements, coolers and sample containers will be shipped to a specified location, delivered by ARI courier, or held at the laboratory for pick up. To ensure that sample identification, analytical parameters, and sample custody are properly documented, Chain of Custody records will accompany all sample container shipments. When appropriate, as for drinking water source sampling events or for parameters that require preservation in the field, sample collection instructions will also be included with shipments.

SECTION 8: SAMPLE RECEIPT AND CONTROL

All samples received must adhere to ARI's "Sample Acceptance Policy" reproduced in Appendix E. Acceptable samples are logged into Element LIMS which provides for tracking the location and status of samples throughout the analytical process. Following analysis, remaining sample is safely disposed following Washington State Department of Ecology protocol. Documentation of all sample control activities and adherence to standard procedures is an important aspect of ensuring that data quality objectives are met. All samples received by the laboratory are processed in a central Sample Receiving area. To ensure the safety of staff members receiving samples, coolers will be opened under a hood or in a well-ventilated area. Appropriate personal protection, such as disposable gloves, safety glasses and laboratory coats are worn during sample receipt and log-in and all general safety practices specified in ARI's Chemical Hygiene Plan are followed.

8.1 Sample Admission

Sample receiving procedures are detailed in ARI's SOP 1001 and outlined below:

1.Chain of Custody documentation is completed.

2. Each sample container is examined to verify that the condition is acceptable, and that sample integrity has not been compromised during shipment. The condition of samples and their packaging material is documented on a "Cooler Receipt Form".

3.The number and type of sample containers received will be verified against the Chain of Custody record

4. A corrective action is initiated for sample containers broken during shipment. Compromised sample is disposed following procedures detailed in ARI's Chemical Hygiene Plan (Section 5, Waste Disposal Procedures).

5 Samples are logged into ARI's Element LIMS, each sample container is assigned a sequential sample identification number and a Work Order (WO) is generated for the set of samples. The sample identifiers are used to monitor each sample and container throughout the analytical process. The date and time of receipt, sample temperature and any unusual observations

concerning the samples are recorded in Element LIMS. Discrepancies between the Chain of Custody record and sample containers will be noted, as well as discrepancy resolutions.

6. Client specific quality control requirements and any other pertinent information indicated on the Chain of Custody Record is recorded in Element LIMS and sample labels printed and the status of the samples is set to “Received”. The sample information in LIMS is now available to authorized laboratory personnel for review.

7. Sample containers are labelled and delivered to the appropriate laboratory section. The accuracy of sample container labeling is verified by a second person.

8. ARI’s Project Manager will review the documentation in Element LIMS and edit it as necessary to ensure the client’s expectations will be met. When necessary, Clients are consulted to resolve any remaining discrepancies. When the Project Manager is satisfied that the information in Element is complete and correct, she/he will set the sample status to “Available”.

9. Laboratory supervisors are responsible for timely analysis of all “Available” samples.

8.2 Subcontracting Policies

ARI may subcontract analysis to other laboratories. QA Policy 15 (Appendix I) is followed to ensure that data produced by a subcontractor is high quality, defensible and will meet the client’s expectations.

8.3 Sample Custody

To ensure the integrity of sample processing, ARI documents the custody of all samples from the time they arrive at the lab until their final disposal.

The National Enforcement Investigations Center (NEIC) of EPA defines custody in the following ways:

It is in your actual possession, or
It is in your view, after being in your physical possession, or
It was in your possession, then you locked or sealed it up to prevent tampering, or
It is in a secure area.

Sample and extract custody are documented in ARI’s Element LIMS. All specific locations where samples (including extracts and digestates) are stored or processed in ARI’s facility are assigned a unique LIMS identification. Each sample container is also assigned a unique LIMS

identification. Location and sample labels include an identifying bar code. When a sample is moved from one location to another the change is documented in LIMS by scanning the bar code of the location and sample. LIMS also records the analyst who moved the sample. This process produces an electronic "Chain of Custody" for each sample container as it moves through the laboratory from initial receipt through final disposal.

8.4 Special Custody Considerations

To avoid possible cross-contamination of low level samples in ARI's VOA laboratory, those samples known or suspected to contain high levels of contaminants, such as underground storage tank (UST) samples, will be segregated from other samples prior to analysis.

Samples with a very short holding time or require "RUSH" analysis may be delivered directly to the lab.

Soil samples for the USEPA Contract Laboratory Program are considered USDA "Regulated Soil", must be segregated from other samples and require special disposal procedures. The special requirements are outlined in Sample Receiving SOP 101S.

Clients may request that samples be preserved and archived prior to analysis.

8.5 Sample Archival and Disposal

After completion of analysis, unused sample aliquots are routinely stored for 30 days (water) or 60 days (soil). Samples with specific storage requirements such as "freeze and hold" are designated in Element LIMS and annotated labels are applied. Sample volumes that are to be shared between multiple laboratories are designated as "shared" in Element LIMS and the sample containers receive yellow markers prior to delivery to Refrigerator 36 ("share" refrigerator).

Analytical data in Element LIMS is used to identify samples containing analytes at or above regulatory disposal levels. Those are identified and handled as hazardous waste. A designated staff member coordinates periodic pickup of hazardous waste by an USEPA approved TSD (Treatment, Storage, and Disposal) Company and maintains hazardous waste disposal records Specific guidelines for handling hazardous samples and waste are detailed in ARI's Chemical Hygiene Plan (Section 5, Waste Disposal Procedures).

SECTION 9: PROJECT MANAGEMENT AND TRACKING

9.1 Project Management

Concise and accurate communication between a client and ARI, and within the laboratory, is a critical component of the analytical process. ARI's Project Managers (PM) coordinate this communication. PMs serve as the central focus for all project related activities and communications. The PM confirms that project requirements are consistent with laboratory capabilities, and coordinates with laboratory sections to provide analytical results within specified project timelines.

ARI's PM will review work plans and requirements for all pending projects. Any questions related to the work plan are resolved prior to project commencement. The PM will consult with appropriate analytical sections to clarify any issues regarding procedures and capabilities. Project deliverables requirements are finalized at this time. Upon receipt and log-in of project samples, the PM will review all documentation to ensure that samples were properly logged in, and that analytical and QC requirements were correctly specified. The Project Manager also provides any additional project related information that will assist the analytical sections with sample analysis. Laboratory sections do not proceed with a given work order until it is reviewed and approved by a PM. Exceptions are parameters with critical (less than 48 hour) holding times or those that arrive on weekends or holidays when none of the Project Managers can be contacted.

Throughout the project, the Project Manager will monitor all analytical activities to help ensure that the project is completed and delivered on schedule. Any issues arising during sample processing is promptly discussed with the client. Likewise, the analytical staff will be informed of any client concerns or project modifications. The PM will also resolve issues that arise during subsequent review of the analytical data by the client.

9.2 Project Tracking

Monitoring the laboratory workload ensures that adequate staffing and equipment will be available to produce quality analytical data that meets client's expectations. At the time a client project is tentatively scheduled, information regarding the project will be documented in the Element LIMS. Project specifics, sample quantities, parameters and anticipated sample delivery

dates and analytical costs are specified. Work plans and other project specific information is attached archived in Element LIMS as electronic files. Schedules for pending projects are communicated to the lab sections through periodic distribution of database printouts.

Each laboratory section is responsible for ensuring that all analyses are completed following project requirements on or before the due date. Analysts must be aware of holding times, special analytical requirements, and required turnaround times. Analytical sections will remain in close communication with the Project Management staff so that any issues arising during sample analysis can be promptly addressed or discussed with the client.

Project Managers or their designee are responsible for monitoring project status. Status reports are generated as needed from Element LIMS and are distributed to lab sections and Project Managers. These reports allow the Project Managers to identify samples which must be expedited to meet project timelines. Additionally, verbal communication between Project Managers and lab sections provides information about project status.

When analysis for a work order is complete, the project manager will compose a “Case Narrative” detailing the analytical process. The narrative will reference issues or concerns raised during the analysis and indicate how they were resolved. The PM then uses Element LIMS to generate a final report and invoice which are delivered to ARI’s client. When requested, preliminary and interim results may be forwarded to the client.

SECTION 10: ANALYTICAL METHODS

To ensure that analytical data generated are consistent and comparable, ARI follows clearly defined protocols for all laboratory processes and procedures. Standard Operating Procedures (SOPs) provide detailed guidelines for completing a procedure. Document control procedures and periodic audits ensure that operations are performed in accordance with the most current SOPs. All routine deviations from published methods will be noted in the SOPs. Analysis or project specific deviations are noted in Analyst Notes and reported in an Analytical Narrative.

10.1 Responsibilities

ARI staff are responsible for performing procedures in accordance with the guidelines specified in ARI's SOPs. Laboratory Management is responsible for ensuring that staff faithfully follow current SOPs. The QA Officer is responsible for coordinating periodic review and revision of SOPs. The QA Officer is also responsible for maintaining SOP document control and ensuring that the most current versions of all SOPs are available to staff members.

10.2 Methods

Laboratory procedures may reference any established methods specified in active versions of the following publications:

1. *Code of Federal Regulations (Section 40)*
2. *Test Methods for Evaluating Solid Waste (USEPA SW-846)*
3. *USEPA Contract Laboratory Program Statement of Work for Organic Analysis*
4. *USEPA Contract Laboratory Program Statement of Work for Inorganic Analysis*
5. *Methods for Chemical Analysis of Water and Waste (USEPA 500 and 600 series)*
6. *Standard Methods for the Examination of Water and Wastewater*
7. *Protocols for Measuring Selected Environmental Variables in Puget Sound (PSEP)*
8. *Navy Installation Restoration Laboratory Quality Assurance Guide (February 1996)*
9. *Hazardous Waste Remedial Actions Program (HAZWRAP)*
10. *State of Alaska Department of Environmental Conservation (ADEC)*
11. *Oregon Department of Environmental Quality (DEQ) Petroleum Hydrocarbon Methods*
12. *Washington Department of Ecology (WA-Ecology) Guidance for Remediation of Releases from Underground Storage Tanks (Appendix L)*
13. *The Department of Defense Quality Systems Manual (DoD-QSM)*
14. *Washington State Sediment Sampling and Analysis Plan*

The laboratory will adhere to established methods whenever possible. Occasionally, however, procedures may be modified to meet client or project specific requests. These modifications are

thoroughly documented in project files. A complete listing of SOPs is available in ARI's SharePoint™ SOP Library. The SOP documents available in SharePoint™ are the official, controlled versions. Analyst may print an uncontrolled version for personnel use but are required to adhere to the electronic version in SharePoint™.

10.3 Standard Operating Procedures

Standard Operating Procedures (SOPs) are detailed, step-by-step instructions for completing a laboratory operation. An SOP is available for all procedures within the laboratory, from initial project identification to final data archival. SOPs are generated for procedures developed within the laboratory and for those that follow published analytical methods.

To ensure consistency in defining procedural guidelines, all SOPs that describe analytical procedures will contain the following sections:

1) Method, matrix or matrices, detection limit, scope & application, components to be analyzed
2) Summary of the test method
3) Definitions
4) Interferences
5) Safety
6) Equipment and supplies
7) Reagents and standards
8) Sample collection, preservation, shipment and storage
9) Quality control
10) Calibration and standardization
11) Procedure
12) Data analysis and calculations
13) Method performance
14) Pollution prevention
15) Data assessment and acceptance criteria for quality control measures
16) Corrective actions for out of control data
17) Contingencies for handling out-of-control or unacceptable data
18) Waste management
19) References
20) Appendices, tables, diagrams, flowcharts and validation data

SOPs will be monitored through the laboratory document control system. Each SOP will be assigned a document control number as detailed in Section 5.2 of this LQAP. SOPs are revised whenever a laboratory procedure is changed or modified. All SOPs are reviewed annually by analysts proficient in performing the procedure. SOPs will be generated for each new procedure implemented within the laboratory. Review, modification, new SOP generation, and distribution

will be coordinated through the QA Officer who will periodically audit the laboratory sections to verify that the most current versions of all SOPs are in use.

10.4 Method Selection and Use

Method selection is based on availability of analytical instruments and equipment, chemical standards, expected method performance and marketability. Methods defined and accepted by regulatory agencies and familiar to ARI's clients are preferred. The Laboratory Director or designee, in consultation with marketing, client service, and supervisory staff are responsible for selecting appropriate methods. Client or project-specific methods are used when appropriate.

ARI prefers the most recently promulgated method for all procedures. Section supervisors and managers are responsible for ensuring that the procedures in use reflect the requirements of the promulgated methods. Any modifications made to the method must be documented in SOPs. Method modifications may be acceptable, provided all acceptance criteria specified in the method are met.

Section supervisors and managers will review newly promulgated methods and modify established SOPs as appropriate. When possible, the annual SOP review will be coordinated with anticipated method promulgation dates. This is especially useful for large method compilations, such as SW-846. If the annual SOP review and method promulgation cannot be coordinated, SOPs are revised as soon as possible after a method has been promulgated, especially when method changes are significant.

SOPs will be generated to reflect the most commonly used methods and protocols. When ARI uses two or more methods for an analysis, each will have an SOP. Several methods may be incorporated into one SOP, provided that each method is clearly identified and defined in the SOP. Method modifications or special requirements for ongoing projects, or for specific programs (DoD, CLP, TNI, etc.), will be incorporated into the SOP. These requirements will be annotated to indicate that they are project/program specific. Analysts and technicians are responsible for meeting the program specific procedures.

10.5 Method Performance

Acceptable method performance is documented for all methods prior to use. Section supervisors and managers are responsible for ensuring that method performance is acceptable and support procedures have been performed.

Method performance requires the following:

An SOP for the method. The SOP must provide sufficient detail to perform the analysis and must accurately reflect the published method. Any steps in the method for which analyst discretion is allowed must be clearly defined.

A method detection limit (MDL) performed for the method. Method detection limits must be at or lower than method-specified detection limits.

Method precision and accuracy determined. This may be determined using an MDL or IDL study. Replicates will be evaluated for precision; analyte values will be compared with spike amounts to determine accuracy. Any method-specified precision and accuracy criteria must be met.

All method performance results are reviewed and compiled by the section supervisor and reported to the QA Section. A final SOP is generated and distributed. SOPs are updated in ARI's SharePoint™ SOP Library.

SECTION 11: INSTRUMENT CONTROL

11.1 Detection Limits

To verify that reported limits are within instrument and method capabilities, three levels of detection have been established: method detection limits (MDL) or instrument detection limits (IDL), Limits of Detection (LOD) and Limit of Quantitation (LOQ) or reporting limits (RL). MDLs and IDLs are statistically based values, determined from replicate analyses of analytical standards. LOQ or RL are equivalent to the lowest concentration of analyte used to calibrate a specific analytical procedure. All limits will be summarized and controlled by the QA Officer and are documented in Element LIMS.

Method Detection Limits

The method detection limit (MDL) is considered the lowest concentration of an analyte that a method can detect with 99% confidence. Detailed procedures ARI uses to determine MDLs are published in SOP 1018S. Method detection limits are established and verified for all analytical parameters except those for which there is no spike available.

MDL studies are conducted for all analyses performed by the laboratory on representative water, sediment and, tissue samples when appropriate and suitable sample matrices are available. MDL studies are performed on all instruments used for sample analysis. To allow for reevaluation of method performance, at least two spiked samples are analyzed each calendar quarter. These analyzes are used to evaluate MDLs on an annual basis. An MDL study must be performed annually for each method used to analyze drinking water. MDL studies must be performed following changes in analytical methods or instrumentation.

11.2 Analytical Standards

Generation of high quality results is dependent upon the use of accurately prepared analytical standards. Many stock standards used within the laboratory are commercially prepared solutions with certified analyte concentrations. Neat standards used for stock standard preparation are of the highest purity obtainable. Standard preparations are fully documented in Element LIMS.

Responsibilities

Laboratory staff involved with standards preparation must use good laboratory practices to ensure that all standards are correctly and accurately prepared, validated and documented. Management is responsible for ensuring that all staff members follow specified standards, preparation and inventory procedures. The QA Officer is responsible for periodically auditing standard preparation records to verify compliance with the laboratory Quality Assurance Program.

Organic Standards

ARI's Organic Analysis Lab uses commercially prepared stock solutions for instrument calibration and QC sample preparation. The manufacturers certify the accuracy and traceability of these standards. Analyte concentration(s), supplier, lot number and expiration date for the purchased standards are documented in Element LIMS. Stock solutions will be stored according to the manufacturers instruction.

The purchased standards are diluted to prepare spiking solutions for instrument calibration and QC sample preparation. Working standard solutions are stored in amber bottles with Teflon-lined caps at appropriate temperatures. Each standard solution is labeled with the solution number, compound, analyst initials and its expiration date. The preparation and expiration of these working standards is documented in Element LIMS.

Working standards are verified accurate by comparing them with second source standards purchased from an alternate supplier.

Occasionally ARI will prepare standard solutions from neat chemicals. Requirements for preparation and documentation of such standards are published in ARI SOP 1018S.

Metals Standard Preparation

Commercially prepared single element stock solutions are used in ARI's Metals Laboratory. Preparation of working solutions from these single element stocks is documented in Element LIMS including the preparation date, expiration date, and analyst initials. Working calibration standards are prepared weekly for ICP analyses and bi-monthly for ICP-MS. Calibration verification standards are prepared as needed for ICP and ICP-MS analyses.

Standards preparation is performed in accordance with good laboratory practices. All preparation equipment will be thoroughly cleaned prior to and after use.

Inorganic (Wet Chemistry) Standard Preparation

Working standards for wet chemistry parameters are prepared on a daily basis and documented in Element LIMS. Stock and check standard solutions are replaced when they expire or are consumed. Stock and check standard solutions are labeled with the compound, preparation data (weight and volume), units of concentration, preparation date, expiration date, and analyst initials.

Standards preparation is performed in accordance with good laboratory practice. Glassware and other preparation equipment is thoroughly cleaned prior to and after use. Standard material weights and solution volumes will be accurate to ± 3%. Stock standards will be stored in appropriate containers at recommended temperatures..

11.3 Calibration

Instrumentation used in analytical processes must be in optimal operating condition and properly calibrated to ensure that ARI's data is of known and documented quality. Instrument verification and calibration are essential components of ARI's analytical procedures. Optimum operating conditions are verified through various tuning and calibration procedures outlined below. The procedures and acceptance criteria for evaluating the operation and calibration of instrumentation are detailed in ARI's analytical SOPs.

Gas Chromatography and Gas Chromatography/Mass Spectrometry (GC/MS)

The performance of GC/MS systems for either VOA or SVOA analyses is verified and documented through analysis of the following standard solutions:

1. An Instrument Performance Check Solution analyzed prior to analysis and a minimum of every 12 hours during the analytical sequence.

2. Calibration Standards- between five and eight calibration standards are analyzed immediately following instrument performance is verified. Each GC/MS must meet calibration criteria specified in the analytical SOP.

3. A Continuing Calibration Verification standard is analyzed at a minimum of every 12 hours for GC/MS or 10 samples for GC analyses during an analytical sequence. For continuing calibrations, minimum response factor and percent difference criteria are considered in evaluating the acceptability of the calibration.

The composition of the standards is method/analysis specific. System evaluation is performed prior to sample analysis. Evaluation criteria used for GC/MS analyses are as specified in analytical SOPs.

The analyst performing the calibration will include documentation of any problems encountered during the calibration analyses with the data, and will also note any corrective actions taken. Verification and calibration data is maintained in ARI's Element LIMS.

Internal standard responses and retention times for all standards are evaluated immediately after analysis. This serves as a baseline from which all sample internal standard responses and retention times are evaluated.

Inductively Coupled Plasma Atomic Emission Spectrometry (ICP)

1. Initial standardization is performed daily by analyzing a blank and four multiple element standards with a single concentration for each analytical wavelength.

2. The calibration is immediately verified with the analysis of an initial calibration verification standard (ICV) obtained from a source independent from the IC standard. The calibration is verified throughout the analytical sequence by analyzing a continuing calibration verification standard (CCV) after every 10 sample analyses. The calibration check standard values must be within ± 10% of the true value.

3. After initial calibration, a calibration blank (ICB) will be analyzed to check for baseline drift or carryover. The level of analyte detected in the calibration blank must be ±1 RL. Calibration blanks (CCB) are analyzed immediately following each calibration verification standard analysis.

4. Following calibration verification a standard at the reporting limit (CRI) is analyzed for all elements. Control limits have been set at ±0.5RL and any sample determined to have a concentration below this standard is reported as undetected.

5. The upper limit of the calibration range, linear dynamic range, is established for each analytical wavelength using standards of increasing concentrations. These standards are analyzed against the normal calibration curve and must be within 10% of their true value to verify linearity. At a minimum this upper range will be checked

every six months or whenever major changes are made to the instrument. Any sample analyzed with a concentration above 90% of this linear dynamic range must be diluted and reanalyzed.

6. To verify the inter-element correction equations, inter-element correction standards (ICS) are analyzed at the start of the analytic run. Both the major interfering and the interfered with elements are evaluated.

Cold Vapor Atomic Absorption (CVAA) Spectroscopy

1. CVAA instrumentation is initially calibrated using a minimum of three standards of varying concentrations and a calibration blank. Initial calibration is performed daily.

2. The calibration is immediately verified with the analysis of an independent source initial calibration verification standard (ICV). The calibration is verified throughout the analytical sequence by analyzing a continuing calibration verification standard (CCV) after every 10 sample analyses. The initial calibration verification standard value must be within ± 10% of the true value whereas the CCV will be considered in control if it is within ±20% for CVAA analysis.

3. After initial calibration, a calibration blank (ICB) will be analyzed to check for baseline drift or carryover. The level of analyte detected in the calibration blank should be ±1 RL. Calibration blanks (CCB) are analyzed immediately following each calibration verification standard analysis.

4. Following calibration verification, a standard at the reporting limit is analyzed for all elements. Control limits have been set at 70–130% and any sample determined to have a concentration below this standard is reported as undetected. Any sample determined to have a concentration above the high calibration standard must be diluted and reanalyzed.

Inductively Coupled Plasma Mass Spectrometry (ICP-MS)

1. Initial standardization is performed daily by analyzing a blank and four multiple element standards.

2. The calibration is immediately verified with the analysis of an independent source initial calibration verification standard (ICV). The calibration is verified throughout the analytical sequence by analyzing a continuing calibration verification standard (CCV) after every 10 sample analyses. The calibration check standard values will be within ± 10% of the true value.

3. After initial calibration, a calibration blank (ICB) will be analyzed to check for baseline drift or carryover. The level of analyte in the calibration blank must be ±1 RL. Calibration blanks (CCB) are analyzed immediately following each calibration verification standard analysis.

4. Following calibration verification a standard at the reporting limit (CRI) is analyzed for all elements. Control limits have been set at ±0.5RL and any sample determined to have a concentration below this standard is reported as undetected.

5. The upper limit of the calibration range, linear dynamic range, is established for each analytical wavelength using high level standards. These standards are analyzed daily, or as necessary, against the normal calibration curve and must be within 10% of their true value to verify linearity. Any sample analyzed with a concentration above 90% this linear dynamic range must be diluted and reanalyzed.

6. To verify the inter-element correction equations, inter-element correction standards (ICS) are analyzed at the beginning of the analytic run. Both the major interfering and the interfered with elements are evaluated.

Inorganic Analyses other than Metals (Conventional Analyses)

Instrumentation and equipment used in analyzing samples for conventional wet chemical parameters (predominantly inorganic anions and aggregate organic characteristics) are evaluated through the analysis of either internally prepared primary standards or externally derived Standard Reference Materials.

Depending upon the analysis, calibration is based upon direct stoichiometric relationships, regression analysis, or a combination of the two. Stoichiometry generally involves standardization of a titrant against a known primary standard and then the use of that titrant for determining the concentration of an unknown analyte (e.g. the use of sodium thiosulfate in the iodometric titration of dissolved oxygen). Regression analysis involves the determination of the mathematical relationship between analyte concentration and the response produced by the measurement employed. Regression analysis is used for colorimetric determinations, ion specific electrode analysis and ion chromatography. The curve of response versus concentration is fit by the method of least squares using linear, polynomial or logarithmic regression dependent upon the pattern of response being measured. The regression coefficient will be greater than or equal to 0.995 for the calibration to be considered acceptable.

Calibration is repeated as required by the analytical method, ARI's SOP or specific instrumentation. Immediately following calibration, the analysis of an Initial Calibration Verification standard (ICV) and Initial Calibration Verification Blank (ICB) verify the standardized titrant or the calibration curve. The verification standard is derived from a source other than that used for standardization or development of the standard curve. The ICV must return a value within 10% of its known concentration. The ICB must be less than the Reporting Limit (RL) or

the lowest point on the standard curve, whichever is less. Initial calibration verification must be successfully completed prior to the analysis of samples.

Calibration verification is repeated after every ten samples processed during an analytical run. This Continuing Calibration Verification (CCV) will validate the method performance through an analytical sequence. If the continuing calibration values for either the standard or blank are out-of-control, the analyst will prepare a fresh CCV standard to verify the outlying condition. When the condition is verified, the analysis will stop and the method will be re-calibrated. All samples run between the outlying CCV and the preceding in-control CCV will be re-analyzed. In-control verification standards and blanks must bracket all samples within an analytical run.

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SECTION 12: DATA VALIDATION and REVIEW

ARI performs four levels of review on one hundred percent of laboratory data generated. The review process is outlined below and detailed in SOPs 206S-Inorganic Data Review and 207S-Organic Data Review.

The four levels of review are:

1. Analyst review
2. Peer review
3. Supervisory review
4. Administrative review.

In addition, Quality Assurance coordinates a review of 10% or more of all completed data packages for compliance with ARI's Quality Assurance Plan. The data validation outlined below is in addition to the initial project review in Section 7 and QA reviews outlined in Section 11. A determination, at any point during the analysis, reporting, or review process that data may be unacceptable, requires a prompt corrective action. Corrective actions are determined on a case by case basis. Every employee involved in data reporting and review must have knowledge of ARI's quality control requirements and be responsible for identifying occurrences that require corrective action.

Two levels of review, such as Peer and Supervisory, may occur concurrently.

12.1 Analyst review:

Each analyst is responsible for producing quality data that meets ARI′s established requirements for precision and accuracy and will meet a client's expectation.

Prior to sample preparation or analysis an analyst will verify that:

1. Sample holding time has not expired.
2. A description of the sample or extract condition is described accurately on the laboratory bench sheet.
3. Specified methods of analysis are appropriate and will meet project required Data Quality Objectives.

4. Equipment and Instrumentation are in proper operating condition.
5. Instrument calibration and/or calibration verification are in control.

During sample preparation or analysis an analyst will:

1. Verify that Method Blanks and Blank Spike Samples are in control.
2. Verify that QC (replicate, matrix spike analyses, SRM, etc.) samples meet precision and accuracy requirements.
3. In addition to verifying that quality control requirements are acceptable, the analyst will review each sample to determine if any compound of interest is present at levels above the calibrated range of the instrument.
5. Check for data translation or transcription errors
6. Record all details of the analysis in the appropriate bench sheet or logbook.
7. Note any unusual circumstances encountered.

Following the analysis or sample preparation an analyst will:

1. Examine each sample and blank to identify false positive or false negative results.
2. Determine whether any sample requires reanalysis due to unacceptable QC.
3. Review data for any unusual observances that may compromise the quality of the data, such as matrix interference
4. Verify that data entry and calculations are accurate with no transcription errors
5. Document anomalous results or analytical concerns on the bench sheet, corrective action form or Analyst Notes for incorporation into the case narrative.
6. Note data with qualifying flags as necessary.
7. Enter reviewed data into Element LIMS, incorporate all necessary sample and quality control information into the data package and forward it for further review.

12.2 Peer review:

A second analyst trained in the appropriate SOPs will complete a peer review. Peer review will include at a minimum:

1. Verification that all QA (holding times, calibrations, method blanks, BS, spiked sample analyses, etc.) criteria are in control.
2. Review of the data for possible calculation and transcription errors.
3. Review bench sheets and analyst notes for completeness and clarity.
4. Approve the analytical results or recommend corrective action to the laboratory supervisor.
5. All corrections should be saved and data should be re-queried to verify completeness before continuing review.

When a second trained analyst is not available a peer review is not completed.

12.3 Supervisory Review:

Following analyst and peer review, data is forwarded to the laboratory supervisor for review. The supervisor will:

1. Review the data package for completeness and clarity.
2. Follow-up on the peer review recommendations.
3. All corrections should be saved and data should be re-queried to verify completeness before continuing review

Designated reviewers normally perform the peer and supervisory reviews for GC-MS data.

12.4 Administrative Review:

Administrative review is the final data validation process. Designated reviewers in the Metals, Conventional and Organic laboratories perform administrative reviews. Personnel performing the administrative review are responsible for the final sign-off and release of the data. Administrative reviewers release the data to a Project Manager for incorporation into the final data deliverable package.

Administrative review will:

1. Verify that the analytical package submitted for reporting is complete and contains all necessary information and documentation.
2. Verify that appropriate and necessary data qualifying flags have been applied (Listed in Appendix N).
3. Verify that method blank and BS data are acceptable, quality control requirements are met for surrogates in all samples and blanks, and that all necessary re-analyses or dilutions were performed.
4. Check the technical validity (i.e. are total metal ≥ dissolved metals, is the cation/anion balance correct, etc.) of the complete data set.
5. Verify that all necessary final data reports are generated and that all necessary data and documentation are included in the package.
6. Approve data reports for release.

12.5 Quality Assurance Review

10% of all final data packages are reviewed by ARI's QA staff for QA/QC compliance This assessment includes, but is not limited to, review of the following areas:

1. Reporting and analysis requirements
2. Initial and continuing calibration records
3. Quality control sample results (method blank, BS, spikes, replicates, reference materials)
4. Internal and surrogate standard results
5. Detection and reporting limits
6. Analyte identifications

Data review activities are summarized and documented by the reviewer. The review notes are filed with the associated raw data in the project file. Any QA-related deficiencies identified during the data review will be forwarded to the QAM for corrective action.

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SECTION 13: QUALITY CONTROL SAMPLE ANALYSIS AND EVALUATION

Routine analysis of quality control (QC) samples is necessary to assess or validate the quality of data produced in ARI's laboratory. ARI routinely utilizes the following quality control analyses as defined in Section 11.3:

1. method blank (MB)
2. storage blank (SB)
3. surrogate standard analyses (SS)
4. blank spike (BS)
5. blank spike duplicate (BSD)
6. certified reference material (CRM)
7. sample (matrix) duplicate (MD)
8. matrix spike (MS)
9. matrix spike duplicate (MSD)

The number and type of QC analyses depend on the analytical method and/or the QA/QC protocol required for a specific project. A range of acceptable results is defined for each type of QC analysis. When the results of all quality control analysis are acceptable, the analysis is considered to be "in-control" and the data suitable for its intended use. Conversely, quality control sample results that do not meet the specified acceptance criteria indicate that the procedure may not be generating acceptable data and corrective action may be necessary to bring the process back "in-control".

Detailed information concerning sample preparation batches, QC analyses and surrogate standards follow:

13.1 Sample Preparation Batch

All QC samples are associated with a discrete sample preparation batch. A preparation batch is defined as 20 or fewer field samples of similar matrix processed together by the same analysts, at the same time, following the same method and using the same lot of reagents. Additional batch requirements may be specified in ARI's standard operating procedures. Each preparation batch is uniquely identified. All samples, field and QC, are assigned an Element LIMS ID number and are linked to their respective preparation batch. Each sample batch will contain all required QC samples in addition to a maximum of twenty field samples.

ARI will accommodate client, QC protocol or QAPP specific sample batching schemes.

13.2 QC Sample Requirements

Each preparation batch will include, at a minimum, a method blank (MB) and a blank spike (BS). Additional QC samples may be analyzed based upon the specific QC protocol, data deliverable or client requirements. ARI recommends that QC samples used to measure analytical precision also be included in each sample batch. These may include: a matrix spike and a matrix spike duplicate pair; a sample duplicate and a matrix spike pair or a Blank Spike Duplicate (BSD) for comparison with the Blank Spike (BS).

13.3 QC Sample Definitions

13.3.1 Method Blank (MB)

A method blank is an aliquot of water or solid sample matrix that is free of target analytes and processed as part of a sample batch. An acceptable method blank verifies that contaminants or compounds of interest are not introduced into samples during laboratory processing. Method blanks are spiked with surrogate standards for all organic analyses.

ARI defines an acceptable method blank as one that contains no target analytes at a concentration greater than ARI's reporting limit or 5% of an appropriate regulatory limit or 10% of the analyte concentration in the sample whichever is greatest. Clients may specify other MB acceptance criteria on a project basis.

A minimum of one method blank will be included in each preparation batch. A maximum of twenty samples may be associated with one method blank. An acceptable method blank is required prior to analysis of field samples from a preparation batch.

The results of the method blank analysis will be reported with the sample results.

13.3.2 Storage Blank (SB)

Storage blanks are organic-free water samples placed in each volatile organic sample storage refrigerator to monitor for possible cross-contamination of samples within the storage units. A storage blank from each refrigerator will be analyzed every 7 days. Storage Blank analyses is reviewed by laboratory management and archived in ARI's Element LIMS.

13.3.3 Blank Spike Sample (BS)

A BS is processed as part of each preparation batch, and is used to determine method efficiency. A BS is an aliquot of water or solid matrix free of target analytes to which selected target analytes are added in known quantities. Analytes spiked into BS samples are listed in ARI's method SOPs. BS samples are spiked with surrogate standards for all organic analyses.

Following analysis, the percent recovery of each added analyte is calculated and compared to historical control limits. Current control limits are available in Element LIMS. When calculated recovery values for all spiked analytes are within specified limits, the analytical process is considered in control. Any recovery value not within specified limits requires corrective action prior to analysis of client samples from the associated preparation batch.

A minimum of one BS will be prepared for each sample preparation batch. BS analyses for those methods not requiring pre-analysis sample preparation are performed after each continuing calibration. The results of all BS performed are reported with the sample results. A maximum of twenty samples may be associated with one BS.

Clients or QA protocol may require the analysis of a duplicate BS. When BS duplicates are analyzed the failure to meet QC limits of any analyte in either BS will trigger a corrective action.

13.3.4 Replicate Analysis

Replicate analyses are often used to determine method precision. Replicates are two or more identical analyses performed on subsamples of the same field sample at the same time. Replicate analyses should be performed on samples that are expected to contain measurable concentrations of target analytes.

The calculated percent difference between replicates must be within specified limits or corrective actions are required. Percent differences exceeding the specified limit signal the need for procedure evaluation unless the excessive difference between the replicate samples is clearly matrix related.

For inorganic analyses, a minimum of one replicate set is processed for each analytical batch. Replicate sample analyses are not routinely performed for organic parameters. Instead, analytical precision is evaluated through the analysis of a duplicate matrix spike sample (MSD).

In order to perform replicate analyses, ARI's must receive sufficient volume to prepare the replicate aliquots.

Field replicates submitted to the laboratory are analyzed as discrete samples.

13.3.5 Matrix Spike

A matrix spike is an environmental sample to which known quantities of selected target analytes are added. The matrix spike is processed as part of an analytical batch and is used to measure the efficiency and accuracy of the analytical process for a particular sample matrix. The analytes spiked into MS samples are listed in ARI's method specific SOPs. MS samples are spiked with surrogate standards for all organic analyses.

Following MS analysis the percent recovery of each spiked analyte is calculated and compared to historical control limits. If recovery values for the spiked compounds fall within specified limits, the analytical process is considered to be in control. When calculated recovery is outside of historical limits corrective action is recommended.

Matrix spike duplicate (MSD) analyses are often used to measure method precision and accuracy. In this case the relative percent difference (RPD) for recovery of spiked compounds is calculated and compared to established criteria.

When directed by a client, ARI will prepare a matrix spike and a duplicate with each batch of samples for inorganic analysis and an MS/MSD set for each batch of samples for organic analyses. Analyte recovery and RPD values are reported with sample data.

13.3.6 Certified Reference Material (CRM)

A CRM is material analyzed and certified by an outside organization to contain known quantities of selected target analytes independent of analytical method. CRMs are normally purchased from outside suppliers and are supplied with acceptance criteria. Analysis of CRM is used to assess the overall accuracy of ARI's analytical process. CRMs are routinely analyzed with each batch of samples for wet chemistry (conventionals analysis) samples. External reference samples are analyzed after instrument calibration and prior to sample analysis. Compound recovery values not within the specified limit may signal the need to evaluate the analytical process. It is important to realize that certified values in a CRM may be determined using analytical methods different from those routinely used by ARI. For this reason, direct comparison of ARI's results with certified values may not be valid indicator of the laboratory's proficiency.

13.3.7 Other Quality Indicators

In addition to analyzing the quality control samples outlined previously, various indicators are added to environmental samples to measure the efficiency and accuracy of ARI's analytical process. Surrogate standards are added to extractable organic samples prior to extraction to monitor extraction efficiency. Surrogate standards are also added to volatile organic samples prior to analysis to monitor purging efficiency. Internal standards are added to metals digestates for ICP-MS analyses and to organic samples or extracts prior to analysis to verify instrument operation.

The calculated recovery of surrogate analytes is compared to historical control limits to aid in assessing analytical efficiency for a given sample matrix.

13.4 Acceptance Limits / Control Limits

Acceptance limits provide a means for evaluating whether a process is in control. Acceptance limits are normally calculated from ARI's historic but may also be specified by in an analytical method or QA protocol. These are based on internal, historical data for organic analyses and method specified limits for inorganic analyses. Samples associated with a specific program or

contract (such as the USEPA Contract Laboratory Program) are evaluated against program/contract-specified criteria. Routine samples are evaluated against internally generated control limits. Project specific control limits may be used when requested following review and approved by laboratory management.

QC Limits are calculated in Element LIMS using historic data as described in SOP 1005S. Control limits will be generated for BS compound recoveries and surrogate recoveries on a method / matrix specific basis. Advisory control limits are utilized for analyses performed on an infrequent basis until a sufficient number of usable data points (20 or more) are collected. Control limits are updated at least annually, but may be updated more frequently if method or instrument changes have been made. Laboratory control and acceptance limits are published in Element LIMS.

Analysts are required to verify that all QC analyzes are in control when performing an initial data review. All out of control QC recoveries require a documented corrective action. ARI will not use control limits for organic analyses that are greater than 80% for the lower limit or less than 120% for the upper limit.

13.5 Control Charts

Control charts, in conjunction with other control sample analyses, are useful in verifying that an analytical procedure is performing as expected. The control chart provides a pictorial representation of how closely control sample results approximate expected values, as well as showing analytical trends. Indicated on the control chart are the mean and upper and lower warning and action limits. The warning and action limits are used to determine whether or not an analytical process is in control. The mean is used to determine whether results obtained for a procedure are trending upward or downward, which may ultimately affect the accuracy of sample results.

Control charts are generated from historical data using Element LIMS. The QA Officer will coordinate generation of control charts based on laboratory data at least quarterly. These control charts are distributed to and reviewed by section supervisors and managers. Any significant trends or variations in results will be identified, and the source of the trend corrected. At the

bench/instrument level, individual results from quality control samples are evaluated against the acceptance limits.

SECTION 14: LABORATORY CORRECTIVE ACTIONS AND REESTABLISHMENT OF CONTROL

To produce quality data, it is important that all aspects of the analytical process are under control and that all specified quality control criteria are met. Occasionally, however, procedures, reagents, standards, and instrumentation fail to meet specified criteria. Should any of those situations occur, the quality of data produced may be compromised. When procedures no longer appear to be in control, sample processing is halted and appropriate actions will be taken to identify and rectify any instrument malfunctions or process-related issues. Prior to resuming sample analysis, verification of control is made through the analysis of various control samples. Actions taken and observations made during reestablishment of control are fully documented on the associated laboratory bench sheet or Analyst Notes form. Only when control is regained and all actions documented will sample processing resume. This ensures that no results generated during the suspect period are reported.

14.1 Responsibilities

It is the responsibility of all laboratory personnel involved with sample processing to determine whether or not a procedure is in control and to verify that all data are produced under conditions that are “in control”. It is at the analytical level that unacceptable conditions are most easily detected and corrected. Laboratory personnel are also responsible for employing and documenting all necessary corrective actions taken to regain control of a procedure. Samples processed during suspect periods are reprocessed, and suspect data will be appropriately annotated to indicate that it is of questionable quality. Analytical staff will verify that all data submitted for review has been generated under acceptable conditions. All anomalies are documented on the Analyst Notes form and must include such information as: type and source of anomaly, reasons for the anomaly, and actions taken to correct the problem. All personnel involved with subsequent and final data review are responsible for verifying that data is generated under acceptable conditions. If suspect data are identified at the review level, responsible analysts are contacted to determine whether additional actions (such as reanalysis)

will be taken. In addition, reviewers will confirm that anomalies noted by the analyst were addressed and that appropriate corrective actions were taken.

On occasion, it is not possible to generate data that meet all Quality Control Standards. This may be due to sample volume limitations or sample matrix effects. It is the responsibility of the analytical and data review staff to document these situations and to maintain communication with the Project Management staff. The Project Management staff, in turn, is responsible for notifying the client or specifying any additional further action. Project Managers must also ensure that clients fully understand which data are questionable and the why acceptable results could not be generated.

It is the responsibility of the QA Officer to perform regular reviews of corrective action procedures to ensure that unacceptable conditions or suspect data will be identified prior to releasing results. Section managers and supervisors are responsible for ensuring that appropriate corrective action procedures are in place and that all staff members are trained to identify and act upon "out of control" situations.

14.2 Corrective Actions

There are various stages of the analytical process where the procedure may fall out of control and require corrective action. In general, all procedures and equipment are monitored to verify that control is maintained during sample processing. The following details those stages as well as the actions taken to reestablish and verify control.

Sample Preparation

During sample preparation, all glassware associated with a specific sample will be clearly labeled to eliminate the possibility of sample mix-up or mislabeling. Laboratory staff will ensure that sample-identifying labels are accurately completed and that correct sample identification is maintained at all times. If a sample appears to have been misidentified or mixed with another sample during preparation, the suspect samples will be discarded and new aliquots taken. If there is insufficient sample for a second preparation, the situation will be documented on the bench sheet and the PM notified immediately.

Addition of surrogate standards or matrix spiking solutions is carefully monitored to ensure that all samples are accurately fortified. Volumes and standard solution numbers of all standards

added to samples are recorded on the bench sheet. If there is suspicion that a sample has been incorrectly spiked a new sample aliquot should be prepared. If there is insufficient volume for re-preparation, the bench sheet is annotated to indicate which samples may be inaccurately fortified.

When sample matrix hinders processing following standard procedures, the section supervisor or manager must be consulted for guidance on appropriate actions. Preparation of less sample or alternate procedures may be necessary. Deviations from normal analytical protocols must be documented on the bench sheet.

If at any time during sample preparation, sample integrity appears compromised or a procedural error is noted, the sample will be discarded and re-prepared. If insufficient sample volume is available for re-preparation, the situation is documented on the bench sheet and the PM immediately notified.

Calibration and Tuning

Prior to sample analysis, all analytical instruments are calibrated and tuned to ensure that equipment meets criteria necessary for production of quality data. Analytical instruments must meet the calibration criteria specified in ARI's SOP. When these criteria are not met, corrective actions must be completed. All corrective actions are accurately and completely documented in the "analysts notes" and attached to the calibration data in Element LIMS. The corrective action must, explain the problem, list actions taken, and document verification that the issue was resolved. Samples will not be analyzed until an initial verification of system performance has been made. When continuing calibration results do not meet criteria, sample analysis will not resume until corrective actions are completed and the system re-calibrated.

GC/MS Analyses - Analysis of the instrument performance check solution (BFB or DFTPP) will meet the specified ion abundance criteria. Initial calibration standards at a minimum of five concentrations will meet specified response factor and percent relative standard deviation criteria. It criteria are not met for initial calibration; the system will be inspected for malfunction. The initial tuning and calibration will be repeated, with all necessary corrective actions taken, until calibration criteria are met.

A check of the calibration curve is performed at the frequency specified in ARI's SOP or the referenced analytical method. All response factor criteria must be met. Additionally, the percent difference between the initial and continuing calibrations will meet specified criteria. If criteria are not met, the system will be inspected for

malfunction. The initial tuning and calibration verification will be repeated, with all necessary corrective actions taken, until calibration criteria are met.

Internal standard responses and retention times for standards will meet specified criteria. Any sample not meeting internal standard criteria will be reanalyzed. If reanalysis yields the same response and the instrument is determined to be functioning correctly, the failure to meet criteria will be attributed to sample matrix interference. No further re-analyses will be required.

GC Analyses - Organochlorine pesticide calibrations will be evaluated using criteria specified in ARI's SOPs. The Resolution Check standard must meet resolution criteria and Endrin and DDT breakdown in the Performance Evaluation Mix standard must meet criteria. Initial calibrations will meet percent relative standard deviation criteria. If, during the initial calibration sequence, criteria are not met, the system will be inspected for malfunction and the initial calibration be reanalyzed. Samples are not analyzed until all initial calibration criteria are met.

Continuing calibrations using a mid-level calibration standard or a Performance Evaluation Mix standard are analyzed at the frequency required by the reference method. Specific method or matrix requirements are documented in the ARI's SOPs. If continuing calibration criteria are not met, the system will be inspected for malfunction and corrective actions will be taken to bring the system back into compliance. If, after corrective actions, the system is still not in compliance, re-calibration will be performed. After the system has been successfully corrected or re-calibrated, all samples previously analyzed between the acceptable and unacceptable continuing calibration are reanalyzed.

If, during the analytical sequence, retention time shifting occurs, the system is inspected for malfunction and corrective actions will be taken to bring the system back into compliance. If, after corrective actions, the system is still not in compliance, re-calibration is performed. After the system has been successfully corrected or re-calibrated, all samples with retention times outside the specified windows will be reanalyzed.

For all GC analyses other than chlorinated pesticides, initial calibration standards analyzed at a minimum of five concentrations will meet percent relative standard deviation criteria. If criteria are not met for initial calibration, the system will be inspected for malfunction. The calibration will be repeated, with all necessary corrective actions taken, until calibration criteria are met.

The calibration is verified after every 10 samples. All percent differences between the initial and continuing calibrations must meet specified criteria. When criteria are not met, the system will be inspected for malfunction and re-calibration will be performed. Samples analyzed between an acceptable and unacceptable calibration check will be reanalyzed.

Metals and Inorganic Analyses - Initial calibrations will be verified by analyzing a calibration check standard immediately after calibration. The calibration is verified throughout the analytical sequence by analyzing a continuing calibration verification

standard (CCV) after every 10 sample analyses. The calibration check standard values must be within ± 10% of the true value.

The calibration check standard analyzed after every 10 samples will meet percent difference criteria. If the calibration check standard is not acceptable, the system will be inspected for malfunction and re-calibration will be performed as necessary. Samples analyzed between acceptable and unacceptable calibration check standards will be reanalyzed.

Instrument Blanks

Prior to sample analysis, instrument and/or calibration blanks may be analyzed and evaluated for the presence of target analytes. When analytes are detected at levels above reporting limits, the source of contamination will be identified. Sample analysis will not commence until analyte levels in instrument and calibration blanks are below the reporting limits. Instrument and calibration blanks are analyzed for VOA analysis only if sample carryover is suspected.

Instrument and calibration blanks may also be analyzed throughout the analytical sequence. These will not contain target analytes at levels above the method detection limits for organic parameters or the reporting limit for inorganic parameters. If one or more analytes exceed the RL, an additional blank is analyzed. If analyte levels are still above the method detection limits, the system is inspected for malfunctions and the source of contamination identified and removed. Sample analysis will not resume until instrument and calibration blank analyte levels are below the RL. Organic samples analyzed between acceptable and unacceptable blanks will be evaluated using the following guidelines:

If no target analytes are detected in the samples, reanalysis is not be required.

If sample target analyte levels are above the method detection limits, reanalysis is samples at the analyst's discretion. Reanalysis will be dependent upon the concentration of the analyte and whether or not there is likelihood that contamination results from sample carryover.

If the analytes present at unacceptable levels in the instrument blank are not of interest or concern in the associated samples, reanalysis may not be required. This is often a consideration for ICP analyses where analytes of concern may be only a subset of the possible analytes.

Methods for the analysis of inorganic analytes require that all samples associated with an out of control blank be re-analyzed.

Method Blanks (MB)

Prior to any sample analysis, method blanks are evaluated for the presence of target analytes. Acceptance criteria for MBs are published in reference methods or quality systems documentation and detailed in ARI's analytical SOPs. When analytes are detected at or above acceptance criteria, a corrective action must be initiated.

Blank Spike Samples

Prior to sample analysis, a blank spike (BS) will be evaluated to verify that recovery values for all spiked compounds are within the specified acceptance limits. If BS recoveries are out of control, corrective action is required. Corrective actions may include one or more actions from a written explanation in the case narrative up to re-preparation and reanalysis of the entire sample batch.

Internal Standards

Some of ARI's analytical procedures utilizes an internal standard (IS) to assess method performance. Acceptance criteria for ISs are published in reference methods or detailed in quality systems documentation. If any internal standard does not meet acceptance criteria, a corrective action must be initiated as detailed in ARI's method specific SOPs.

Surrogate

Surrogate standards are commonly used to assess method performance. Acceptance limits for surrogate recovery are published in quality systems documentation or reference methods and detailed in ARI's analytical SOPs. When surrogate recovery values are outside acceptance limits, a corrective action must be initiated. Corrective actions are generally method specific and may result in repreparation and reanalysis of samples.

Matrix Spikes

Matrix spike (MS) analyses are performed when required by specific analytical protocol or client request. MSs are evaluated to verify that recovery values for all spiked compounds are within the specified acceptance limits. If unacceptable recoveries are obtained a corrective action is initiated as detailed in ARI's analytical SOPs. A post-digestion spike analysis will be performed

for all metals analyses that must adhere to EPA-CLP guidelines or when specifically requested by ARI's client

Sample and Matrix Spike Replicates

When required by analytical protocol or client's request, sample and matrix spike replicates are evaluated to verify that percent differences between the replicates are within acceptance limits. If unacceptable recoveries are obtained a corrective action is initiated as detailed in ARI's analytical SOPs.

Samples

In addition to monitoring sample quality control indicators, ARI evaluates samples to determine the need for reanalysis. Conditions considered while evaluating samples are:

If a target analyte detected in a sample exceeds the upper limit of the instrument calibration range, the sample is diluted and reanalyzed. Dilution and reanalysis continues until the analyte concentration falls within the linear range of calibration. If the sample requires dilution to such a level that surrogates are no longer detectable and analytical accuracy is questionable, the sample may be re-prepared using less sample.

Samples will be evaluated for matrix interference that may affect analyte detection and quantification. Appropriate cleanup procedures will be employed to remove interference. Samples may be diluted and reanalyzed to minimize background interference. When interference cannot be removed, reported results will be qualified as appropriate.

When, in an analyst's judgement, low-level analytes detected in a sample may result from carryover, the sample will be reanalyzed. If analyte levels remain approximately the same the initial results will be considered valid. If analytes are not detected during reanalysis, it will be assumed that the initial detection was due to carryover, and the initial results will not be reported.

If an instrument malfunction or procedural error occurs during analysis, all affected samples will be reanalyzed. If the malfunction appears to be an isolated incident, it will not be necessary to inspect the analytical system. If the malfunction appears to be an ongoing problem, the system will be inspected and maintenance/corrective actions performed prior to resuming analysis.

Sample Storage Temperatures

Acceptable temperatures range for samples that require cooling for preservation are 0°C ≤ T ≤ 6°C for refrigerators and < -15°C for freezers. ARI employs an electronic monitoring system to record refrigerator and freezer temperatures every 30 minutes. When a temperature is outside the acceptance range, the system sends an e-mail message to the appropriate laboratory supervisor and the QA department. Laboratory Supervisors are responsible for determining why the temperature is "out of control" and performing a corrective action. When the cooling device will be "out of control" for more than 30 minutes the samples are temporarily transferred to a properly functioning cooler or freezer.

Balance Calibrations and Certified Weights

Analysts verify and document the accuracy of analytical balances daily before use. Balances must demonstrate a variance of < 5% or 5 mg whichever is less for weights that bracket the working range of the balance. Staff must remove an out of control balance from service and notify the laboratory supervisor who will initiate a corrective action. The balance is retired from service until it is repaired and demonstrated to be back in control. Staff document daily balance checks in a balance specific balance log book.

In addition, ARI outsources an annual service and calibration for each balance to a NIST certified vendor.

Water Supply System

The water supply for the volatile organic and inorganic laboratories will be monitored daily for the presence of contaminants through the analysis of method and/or instrument blanks. Organic contaminants, especially chloroform, are early indicators of the need for preventative maintenance. If organic or other contaminants are detected, the system filters are changed. After filters have been changed, an additional aliquot of water will be analyzed to confirm that contaminants are no longer present.

The water supply for the metals laboratory is monitored daily. When the resistivity falls below 18 megaohm, system maintenance is performed.

Section 15: LABORATORY EVALUATIONS, AUDITS AND CORRECTIVE ACTION SYSTEM

15.1 Internal Audits

Routine evaluations or internal audits of laboratory activities ensure complete and effective implementation of established policies, procedures and quality control requirements. Findings from the evaluations allow ARI to discover and correct activities not in compliance with the laboratory Quality Assurance Program or accreditation program requirements. ARI's QAM schedules internal audits on an annual basis following the guidelines in Appendix K.

Checklists described in SOP 1005S ensure consistent and complete audits. Deficiencies noted during the course of an audit are documented as an issue using ARI's Corrective Action System. Issues are investigated, a root cause analysis performed, and appropriate corrective actions implemented. Follow-up audits ensure that corrective actions have been satisfactorily implemented.

When an audit finding indicates possible errors or deficiencies in analytical data, ARI will correct the error and notify all affected clients within 2 working days.

Activities or procedures routinely audited include: The QAM or designee routinely audits the following activities:

Balance verification records
Sample storage cooler temperature records
Oven, incubator and water bath temperature records
Chain of Custody records
Standard preparation records
Documentation and Response to Client Complaints
Chain of Custody Procedures
Documentation of Computer and Software Revisions
Calibration records
Maintenance records
Control charts

Adherence to SOPs and methods

Support system records (DI water, balances, pipettes, etc.)

Detailed review of specific analytical methods

Data package review

15.2 Audits by Outside Agencies (External Audits)

Agencies that accredit ARI perform periodic assessments (external audits) of laboratory procedures and/or QA documentation. These assessments may take place at ARI's facility (on-site audits) or may be a review of documents delivered to the assessor's location (off-site audits). External audits provide an independent evaluation of laboratory procedures without internal influence or bias. ARI will review all comments, deficiencies, and areas of potential improvement noted by external assessors and implement appropriate corrective actions.

Appendix M lists agencies that accredit and audit ARI's laboratory.

15.3 Performance Testing (PT) Analyses

PT sample analysis is an integral part of ARI's QA program. PT samples contains specific analytes in concentrations unknown to ARI personnel. Laboratories obtain PT samples from and report analytical results back to a specific PT provider. The provider compares a laboratory's results with "true" values and reports the results directly to accrediting agencies. Accuracy of the reported result indicates the laboratory's ability to perform a given analysis. Performance Testing (PT) sample analysis is a means of evaluating individual performance as well as the overall analytical system. PT sample analysis is a requirement of certification and accreditation programs. ARI routinely analyzes two PT samples annually for each of its accredited analyte/matrix combinations.

ARI initiates a corrective action for reported PT results outside of the PT providers acceptance ranges.

ARI also uses PT analyses to document the analytical proficiency of individual analysts.

15.4 Quality Assurance Reports to Management and Staff

In order to ensure that laboratory managers are kept apprised of quality related activities and laboratory performance on an ongoing basis, quality assurance is discussed each week

during the ARI Staff Meeting that includes executive and supervisory staff. The agenda, at a minimum includes:

1. Information concerning current and ongoing internal and external audits
2. Status and results of current or ongoing internal or external proficiency analyses
3. Identification of Quality Control problems in the laboratory
4. Information on all ongoing Corrective Actions
5. Current status of external certifications
6. Current status of the Staff Training Program
7. Outline of new and/or future Quality Assurance Program initiatives

The application of the above combined activities provides comprehensive monitoring and assessment of laboratory performance, and ensures that all data produced by ARI will be of the highest possible quality.

15.5 Annual Management Review

In the last quarter of each year, executive management will perform a comprehensive review of ARI quality system and analytical procedures to assess their continued suitability and effectiveness. Management will consider the following during the review process:

1. Suitability of policies and procedures
2. Reports from management and supervisory personnel
3. Results of internal audits
4. Corrective and preventative actions
5. Results of recent external quality systems audits
6. PT results
7. Changes in volume and type of analyses performed
8. Client Feedback
9. Complaints
10. Recommendations for Improvement
11. Other relevant factors such as quality control activities, available resources and analyst training

15.6 Corrective Action System

The Corrective Action System is an electronic system used by ARI to record errors, omissions or other issues of concern and document corrective and preventative actions taken in response to those issues. The details of the system are discussed in SOP 1005S.

Corrective Actions are initiated when any deficiencies or concerns are noted in the laboratory QA program through any of the following mechanisms:

1. Internal Assessments.
2. External Assessments.
3. Out of Control PT results.
4. Review of Analyst Notes.
5. Employee concerns or observations.
6. Anonymous Reports using Anon Staff Survey (located on intranet homepage)
7. Management Review.
8. Client complaints or concerns.

After discussing the issue with the appropriate personnel, the filed corrective actions are discussed in the weekly workload meeting with all managers and supervisors and included on the QA Quarterly report. As the issues are worked on and documented in the system, key personnel are kept informed of status via automatic email updates. The goal is to resolve all issues in a thorough and timely manner.

Section 16: APPENDICES

A. Laboratory Organization and Key Personnel Resumes
B. Training and Demonstration of Proficiency
C. Laboratory Facilities
D. Laboratory Instrumentation and Computers
E. Standard Operating Procedures
F. Sample Collection Containers, Preservation and Holding Times
G. Laboratory Workflow
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K. Internal Audit Schedule
L. Laboratory Accreditations
M. Data Reporting Qualifiers
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O. QA Policies
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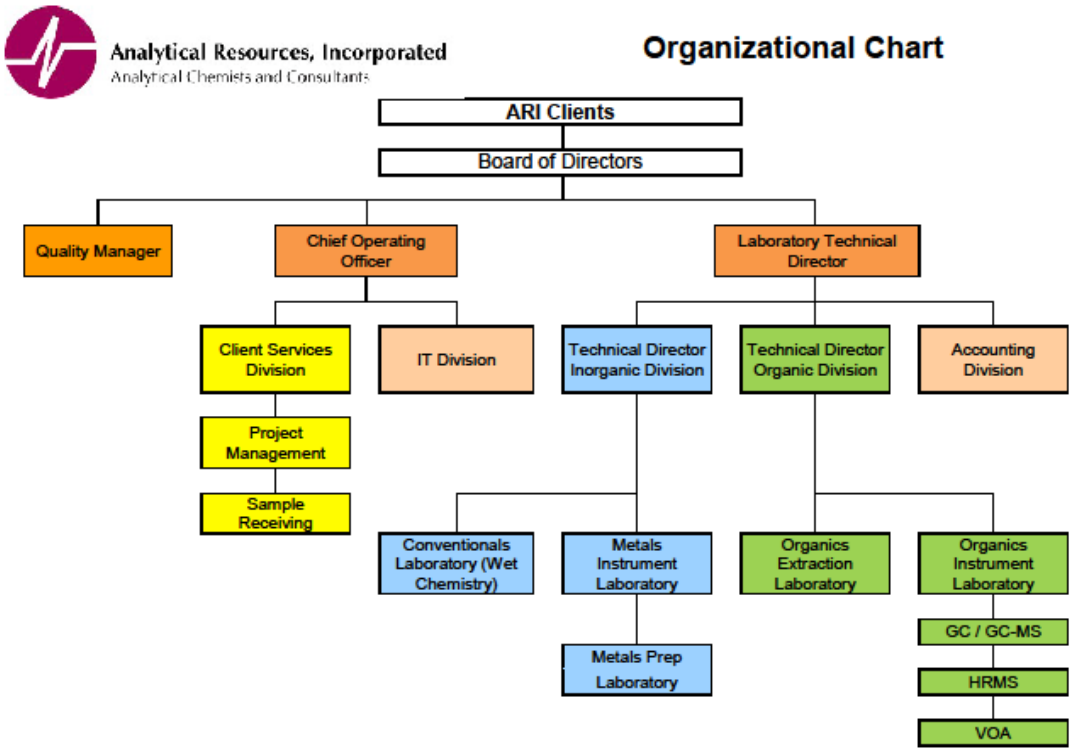
Appendix A

Laboratory Organization Chart and Key Personnel Resumes



KEY PERSONNEL RESUMES

Mark Weidner

Laboratory Technical Director

Profile

Mr. Weidner co-founded Analytical Resources, Inc., along with Brian Bebee, Sue Dunnihoo and David Mitchell. Prior to his co-founding of ARI in 1985, Mr. Weidner was the Head Mass Spectroscopist at Michigan State University and an instructor at the Finnigan Institute. As Laboratory Director, Mr. Weidner is responsible for overall laboratory performance, as well as facility expansion and major purchasing. Mr. Weidner is intimately familiar with all operational and analytical aspects of ARI and initiated many of the procedures currently in use.

Education:

M.S., Medicinal Chemistry, Purdue University, W. Lafayette, IN (1978)

B.S., Biochemistry, Michigan State University, E. Lansing, MI (1975)

Experience:

Laboratory Director/Co-founder, Analytical Resources, Inc., Seattle, WA (1985 to present).

Senior Chemist, City of Seattle, Seattle, WA (1981 to 1985).

Instructor, Finnigan Institute, Cincinnati, OH (1979 to 1981).

Mass Spectroscopist, Michigan State University (1978 to 1979).

Brian Bebee

Technical Director-Organics Division

Profile:

Mr. Bebee co-founded Analytical Resources, Inc., along with Mark Weidner, Sue Dunnihoo, and David Mitchell. Prior to his co-founding of ARI, Mr. Bebee had gained extensive GC/MS experience as a GC/MS Chemist at the Municipality of Metropolitan Seattle, (METRO). When he co-founded ARI in 1985, Mr. Bebee became the Organics Division Manager until 1993, when he assumed the position of Laboratory Manager. As Laboratory Manager, Mr. Bebee is responsible for the day-to-day laboratory operations, including personnel, instrument, and procedural concerns. He is also responsible for the direct supervision of the Volatile and Semivolatile Laboratories.

Education:

A.A., Oceanography, Marine Biology, Biology, Shoreline Community College (1973).

Experience:

Laboratory Manager, Analytical Resources, Inc., Seattle, WA (1987 to present).

Organics Division Manager/Co-founder, Analytical Resources, Inc., Seattle, WA (1985 to 1987).

GC/MS/DS Operator, Municipality of Metropolitan Seattle, Seattle, WA (1980 to 1985).

Senior Water Quality Technician, Municipality of Metropolitan Seattle (METRO), Seattle, WA (1976 to 1980).

Water Quality Technician, Municipality of Metropolitan Seattle (METRO), Seattle, WA (1973 to 1976)

David Mitchell (Retired)

Quality Assurance Manager

Profile:

Mr. Mitchell co-founded Analytical Resources, Inc., along with Mark Weidner, Sue Dunnihoo, and Brian Bebee. Prior to his co-founding of ARI, Mr. Mitchell had gained extensive experience in environmental chemistry as Senior Chemist and Trace Organics Laboratory Supervisor at the Municipality of Metropolitan Seattle (METRO). His responsibilities include the management of ARI's Quality Assurance/Quality Control Program.

Education:

Graduate Work in Chemistry (Organic/Biological), University of Wyoming, Laramie, WY (1970 to 1974).

B.S., Chemistry, Upper Iowa College, Fayette, IA (1970)

Experience:

Quality Assurance Manager, Analytical Resources Inc., Seattle, WA (1998 to Present)

Client Services Manager, Analytical Resources Inc., Seattle WA (1987 to 1998)

Vice President/Co-founder of Analytical Resources, Inc., Seattle, WA (1985 to 1987).

Senior Chemist, METRO Trace Organics Laboratory, Seattle, WA (1979 to 1985).

Research Associate, Northwestern University Medical School (1974 to 1979).

Susan Dunnihoo

Chief Operating Officer

Profile:

Ms. Dunnihoo co-founded Analytical Resources, Inc., along with Mark Weidner, Brian Bebee, and David Mitchell. Prior to her co-founding of ARI, Ms. Dunnihoo had gained extensive experience in environmental chemistry through her work at Laucks Testing Laboratories, the City of Tacoma, and the Municipality of Metropolitan Seattle (METRO). As Director of Client Services, Ms. Dunnihoo is responsible for assisting project managers in responding to the needs of ARI clients, and for communicating to the laboratory the analytical capabilities that required to satisfy future client needs. Ms. Dunnihoo also acts as project manager for a number of projects.

Education

Graduate work in Chemical Oceanography, University of Washington (1976-1980)
ACS Certified BA, Chemistry, Augsburg College, Minneapolis, MN (1976)

Experience

Director, Client Services, Analytical Resources, Inc., Seattle, WA (2007-present)
Client Services Manager, Analytical Resources, Inc., Seattle, WA (1998-2007)
Computer Services Manager, Analytical Resources, Inc., Seattle, WA (1985 to 2000)
Corporate Secretary, Analytical Resources, Inc., Seattle, WA (1985 to present)
Chemist, Laucks Testing Laboratories, Seattle, WA (1983 to 1985)
Chemist, City of Tacoma, Plant II, Tacoma, WA (1982 to 1983)
GC/MS/DS Operator, METRO TPSS Lab, Seattle, WA (1980 to 1982)

Eric Larson

Technical Director-Inorganic Division

Profile:

Mr. Larson oversees ARI's Inorganic Division, which includes Metals Sample Preparation, the Metals Instrument Laboratory, the Conventional Wet Chemistry Laboratory and the inorganic data group. As a Section Manager, Mr. Larson holds the final authority in decisions concerning implementation of QA policy, with the contributions of the Laboratory Director, Laboratory Manager, QA Manager and Project Managers.

Mr. Larson has extensive experience in the environmental chemistry field, with an emphasis in inorganic analyses. Mr. Larson has extensive experience developing and maintaining both in-house proprietary methods and more routine methods and protocols (EPA, Standard Methods, etc.). He is experienced with the operation, maintenance, and repair of a large number of laboratory instruments.

Experience

2015-present	ARI Inorganic Division Manager
2012-2015	ARI Metals Chemist
2011-2012	Product Specialist, Shimadzu
2010-2011	Laboratory Technician, City of Largo
1996-2008	Environmental Program Manager

Education

1988 B.A. Chemistry – University of Washington

Bob Congleton

Quality Assurance Manager

Profile
Mr. Congleton has worked at Analytical Resources, Inc. since 2005. Currently, he oversees ARI's Quality Assurance/Quality Control Program. Mr. Congleton is also responsible for managing the laboratory's hazardous waste disposal activities and leads the safety program.

Education
2013: M.A. Policy Studies – University of Washington (Bothell)
2001: B.S. Conservation of Wildland Resources – University of Washington (Seattle)

Experience
2017-present: QA Manager
2014-present: Hazardous Waste Coordinator
2008-2014: Project Assistant
2005-2008: Sample Receiving

Appendix B

Training

Qualification Requirements

In addition to on-the-job training, ARI recommends a specific level of education and experience for the following positions:

GC/MS Laboratory Supervisor

A Bachelor's degree in chemistry or scientific/engineering discipline, three years' experience operating GC/MS systems and one-year supervisory experience.

GC Laboratory Supervisor

A Bachelor's degree in chemistry or scientific/engineering discipline, three years' experience operating GC systems and one-year supervisory experience.

Sample Preparation Laboratory Supervisor

A Bachelor's degree in chemistry or scientific/engineering discipline, three years' experience in organic sample preparation and one-year supervisory experience.

Data Systems/LIMS Manager

A Bachelor's degree with four or more computer-related courses and three years' experience in systems management or programming. A minimum of one year experience with software utilized for laboratory report generation is also recommended.

Programmer Analyst

A Bachelor's degree with four or more computer-related courses and two years' experience in systems or application programming. A minimum of one-year experience with software utilized for laboratory report generation is also recommended.

Quality Assurance Officer

A Bachelor's degree in chemistry or a scientific/engineering discipline and three years of laboratory experience, including one year of applied experience with quality assurance.

Project Manager

A Bachelor's degree in chemistry or a scientific/engineering discipline and three years of laboratory experience, including one year of applied experience with quality assurance.

GC/MS Chemist

A Bachelor's degree in chemistry or a scientific/engineering discipline and at least one-year experience operating a GC/MS system. Three years of GC/MS operations and spectral interpretation experience may be substituted in lieu of educational requirements.

Mass Spectral Interpretation Specialist

A Bachelor's degree in chemistry or a scientific/engineering discipline and participation in training course(s) in mass spectral interpretation. Also, at least two years of experience in mass spectral interpretation is recommended.

Purge and Trap Expert

A Bachelor's degree in chemistry or a scientific/engineering discipline and one-year experience operating a purge and trap type liquid concentrator interfaced to a GC/MS system.

GC Chemist

A Bachelor's degree in chemistry or a scientific/engineering discipline and at least one-year experience operating a GC system. Three years of GC operations and maintenance experience may be substituted in lieu of educational requirements.

Pesticide Analysis Expert

A Bachelor's degree in chemistry or a scientific/engineering discipline and at least one-year experience operating a GC system. Three years of GC operations and spectral interpretation experience may be substituted in lieu of educational requirements.

ICP Spectroscopist

A Bachelor's degree in chemistry or a scientific/engineering discipline and Four years of applied experience with ICP analysis of environmental samples. Four years of ICP experience may be substituted in lieu of educational requirements.

ICP Operator

A Bachelor's degree in chemistry or a scientific/engineering discipline and one year of experience operating and maintaining ICP instrumentation. Three years of ICP experience may be substituted in lieu of educational requirements.

Atomic Absorption (AA) Operator

A Bachelor's degree in chemistry or a scientific/engineering discipline and one year of experience operating and maintaining graphite furnace and cold vapor AA instrumentation. Three years of AA experience may be substituted in lieu of educational requirements.

Conventionals (Classical Chemistry) Analyst

A Bachelor's degree in chemistry of a scientific/engineering discipline and one year of experience with classical chemistry procedures. Three years of classical chemistry experience may be substituted in lieu of educational requirements.

Sample Preparation Expert

A high school diploma and one college level course in chemistry. One year of experience in sample preparation is also recommended.

Appendix C

Laboratory Facilities

ANALYTICAL RESOURCES INC. occupies a total of 23,500 square feet of floor space located at 4611 S. 134th Place in Tukwila, Washington. The laboratory facility, constructed between September 2001 and June 2002, includes:

- State-of-the-art heating, ventilation and air conditioning (HVAC) systems to ensure a clean comfortable working environment while maintaining air flow balance designed to minimize the possibility of sample cross contamination between laboratory areas.
- A central service area provides space for five walk-in coolers (356 ft^2 total), and a small walk-in freezer, metals archive storage, and sample cooler storage. A 400 ft^2. walk-in freezer covered by a mezzanine for dry storage was added in 2005.
- A data network linking all workstations to a centralized server room. All connections are made to managed switches and hubs and are protected by the latest firewall technology and uninterruptible power supplies.
- Distribution systems to deliver pressurized Air, Zero Grade Air, Argon, Helium, Hydrogen, Nitrogen and to the laboratory areas from a central location.
- A system to deliver ASTM Type 1 water directly to sinks in each laboratory area. Water is purified by filtration, ion exchange and reverse osmosis and continuously re-circulated through a filtration + ion exchange + UV radiation polishing loop that delivers water directly to the laboratories.
- An isolated and ventilated hazardous waste storage area.
- An electronic repair shop and storage room.
- Alarm monitored fire sprinkler and intrusion detection systems

The facilities are divided into five functionally-distinct sections as detailed below:

1) The Organics Division features three main laboratory areas as described below:
   - The <u>Organics Extraction Laboratory</u> (2400 ft^2.) is utilized to isolate and concentrate organic compounds from various environmental sample matrices. The laboratory contains approximately 200 linear feet of bench space and nine fume hoods. It is equipped with two gel permeation chromatographs, an accelerated solvent extractor (ASE) and a gas chromatograph for extract screening purposes. The laboratory includes a separate area for extraction of aqueous samples, a glassware cleaning area and individual workstations for the laboratory supervisor and analyst.
   - The <u>Semivolatile Organics Analysis Laboratory</u> (3000 ft^2) has 124 linear feet of instrument bench space plus personal workstations. The Laboratory is equipped with seven Gas Chromatographs (GCs) with six GC-MS instruments, one High Resolution GC/MS (HRGC-MS) and a fume hood for preparation of standard solutions and dilution of samples. Each gas chromatograph is individually vented to the outside for removal of heat and potentially contaminated GC exhaust gases.
   - The <u>Volatile Organics Analysis (VOA) Laboratory</u> (2500 ft^2) houses seven GC-MS and two GC-PID instruments dedicated to volatile organics analysis. Each instrument is vented to the outside. The laboratory area includes two fume hoods, a sample/standards preparation area, a TCLP preparation/tumbler room and sample holding refrigerators. The HVAC system maintains a positive air pressure in the laboratory using filtered air from outside of the building. This eliminates the possibility of cross contamination of samples with solvents from other areas of the laboratory.

2) The Inorganic Division includes a Trace Metals Laboratory and the Conventional Analyses Laboratory:
   - Trace Metals Laboratory (3000 ft^2)
     - The Metals Preparation Laboratory (1200 ft^2) contains four 8-foot polypropylene fume hoods. An additional eight-foot polypropylene laminar flow fume hood is housed in a separate Class 1000 clean room. The lab is equipped with tumblers, hot-plates, digestion blocks, facilities for glassware cleaning, and two spectrophotometers for cold vapor analysis of mercury, a TCLP tumbler room, and storage areas.
     - The Metals Instrument Laboratory (1300 ft^2) features two inductively coupled argon plasma spectrometers (ICP) for simultaneous analysis of metals species, and two ICP-mass spectrometers for analysis of metals species at low detection levels.
     - A 500 ft^2. Office provides desk area for Trace Metals laboratory personnel.
   - The Conventional Analyses (Wet Chemistry) Laboratory (2500 ft^2) contains approximately 200 linear feet of bench space, eight fume hoods and includes a separate microbiology lab. Instruments in this lab include two Rapid-Flow Analyzers, two TOC analyzers, two ion chromatographs, two uv/visible spectrophotometers, and various other equipment necessary for the evaluation of inorganic parameters.

3) The Sample Receiving Facility consists of an area to accept and log-in samples to ARI's Laboratory Information Management System (LIMS) and an area to prepare and ship sampling supplies.
   - The Sample Receiving Facility (1000 ft^2) is equipped with two fume hoods, and 70 feet of bench space. Four computer terminals are available to log samples into ARI's LIMS.
   - The Sampling Containers Facility (500 ft^2) is used to prepare sampling containers for shipment to ARI's client designated locations.

4) Administrative Areas (8600 ft^2) include:
   - The Quality Assurance Section
   - Executive Offices
   - Project Management Section
   - The Human Resources Section
   - The Computer Services Section
   - One Conference Room
   - A Lunch Room
   - Several Storage Areas

Appendix D

Laboratory Instrumentation And Computers

LABORATORY INSTRUMENTATION and COMPUTERS

Organic Extractions Laboratory Equipment

(MARS 1) CEM MARS™ (2008) – Microwave extraction apparatus.

(MARS 2) CEM MARS™ (2010) – Microwave extraction apparatus.

(MARS 3) CEM MARS™ (2011) – Microwave extraction apparatus.

(GPC 1) Varian Prostar 410 – Fluid Metering Inc. pump and ISCO UA-5 UV detector equipped with a 26 position autosampler used for clean-up of samples prior to final analysis.

(GPC 2) Varian Prostar 410 – Fluid Metering Inc. pump and ISCO UA-5 UV detector equipped with a 26 position autosampler used for clean-up of samples prior to final analysis.

(GPC 3) Varian Prostar 410 – Fluid Metering Inc. pump and ISCO UA-5 UV detector equipped with a 26 position autosampler used for clean-up of samples prior to final analysis.

Zymark Turbo-Vap LV (1999) - 24 place

Zymark Turbo-Vap LV (2002) - 24 place

Zymark Turbo-Vap LV (2007) - 24 place

Biotage Turbo-Vap II (2014) – 24 Place

Zymark Rapid Trace Solid Phase Extraction Workstations (2007) - 13 each

Dioxin Extractions Laboratory Equipment

Zymark Turbo-Vap LV (2010) - 24 place

Rotovap R-205 with V-805 Vacuum Controller (2010) – 2 each

Glas-Col Combo Heating Mantle (2010) – 6 place – 3 each

Vacuum Manifold – 6Place (2010) – for SPE

Gas Chromatograph - High Resolution Mass Spectrometer (GC/HRMS)

(HR1) Waters Autospec Premier (2009) – An HRGC-HRMS system with Masslynx Version 4.1 data acquisition & quantitation software. System includes an Agilent 7890A GC and 7683B autosampler.

(HR2) Waters Autospec Ultima (2015) – An HRGC-HRMS system with Masslynx Version 4.1 data acquisition & quantitation software. System includes an Agilent 6890 GC and 7683B autosampler.

Gas Chromatograph - Mass Spectrometers (GC/MS)

(NT2) Hewlett Packard (1999) – A GC-MS system networked with a Windows 2012 Server running Thruput Target 4.145 data analysis software. System includes Agilent 6890 GC, 5973 MSD, a Teledyne Tekmar Atomx Purge and Trap for VOA analysis of aqueous or solid samples.

(NT3) Hewlett Packard (1999) – A GC-MS system networked with a Windows 2012 Server running Thruput Target 4.145 data analysis software. System includes an HP 6890 Plus GC, an HP 5973 MSD, an OI Analytical Eclipse 4660 and a Varian Archon autosampler for VOA analysis of aqueous or solid samples.

(NT5) Hewlett Packard (2002) – A GC-MS system networked with a Windows 2012 Server running Thruput Target 4.145 data analysis software. The system is equipped with an HP 6890N GC, an HP 5973N MSD, a Teledyne Tekmar Atomx Purge and Trap for VOA analysis of aqueous or solid samples.

(NT6) Hewlett Packard (2002) – A GC-MS system networked with a Windows 2012 Server running Thruput Target 4.145 data analysis software. The system includes an HP 6890 Plus GC, an HP 5973 MSD and an HP 7683 autosampler.

(NT7) Hewlett Packard (2007) – A GC-MS system networked with a Windows 2012 Server running Thruput Target 4.145 data analysis software. The system is equipped with an HP 6890 GC, an HP 5973N MSD, a Varian Archon autosampler and Tekmar Stratum.

(NT8) Agilent (2008) – A GC-MS system networked with a Windows 2012 Server running Thruput Target 4.145 data analysis software. The system is equipped with Agilent 6890N GC, 5975C MSD, and 7683 autosampler.

(NT10) Agilent (2008) – A GC-MS system networked with a Windows 2012 Server running Thruput Target 4.145 data analysis software. The system is equipped with Aglient 6850 GC, an Agilent 5975C inert MSD and an Agilent 6850 autosampler.

(NT11) Hewlett Packard (2009) - A GC-MS system networked with a Windows 2012 Server running Thruput Target 4.145 data analysis software. The system includes an Agilent 6890 N GC, an HP 5973N MSD and an HP 7683 autosampler.

(NT12) Hewlett Packard (2011) - A GC-MS system networked with a Windows 2012 Server running Thruput Target 4.145 data analysis software. The system includes a Hewlett-Packard 6890 GC, an HP 5973N MSD and an HP 7683 autosampler.

(NT14) Hewlett Packard (2014) - A GC-MS system networked with a Windows 2012 Server running Thruput Target 4.145 data analysis software. The system includes an Agilent 7890A GC, an HP 5975C Inert MSD and an HP 7683 autosampler.

(NT15) Hewlett Packard (2014) - A GC-MS system networked with a Windows 2012 Server running Thruput Target 4.145 data analysis software. The system includes an Agilent 6850 GC, an HP 5975C MSD and a Teledyne Tekmar Atomx Purge and Trap for VOA analysis of aqueous or solid samples.

(NT16) Agilent (2015) - A GC-MS system networked with a Windows 2012 Server running Thruput Target 4.145 data analysis software. The system includes an Agilent 7890B GC, an Agilent 5977A MSD and a Teledyne Tekmar Atomx Purge and Trap for VOA analysis of aqueous or solid samples.

Gas Chromatographs

(OE-GC1) Hewlett Packard 5890 Series II (2003) – A GC system equipped with both FID and ECD detectors, capillary injectors, an autosampler and ChemStation. Used for screening samples before full extraction.

(OE-GC2) Hewlett Packard 6890 Series II (2014) – A GC system equipped with both FID and ECD detectors, capillary injectors, an autosampler and ChemStation. Used for screening samples before full extraction.

(FID3A, B) Hewlett Packard 6890 (1996) – A GC system equipped with dual FID detectors, two capillary injectors, a dual tower HP 6890 autosampler, and Agilent ChemStation data system.

(FID4A, B) Hewlett Packard 6890 (1996) – A GC system equipped with dual FID detectors, two capillary injectors, a dual tower HP 6890 autosampler, and HP ChemStation data system.

(PID 1) Hewlett Packard 5890 Series II – (2006) –A GC system equipped with PID and FID detectors in series, a Teledyne Tekmar Atomx sample concentrator and HP ChemStation data system.

(ECD5) Hewlett Packard 6890 (2002) – A GC system equipped with dual µECD detectors, an HP 7683 autosampler and an HP ChemStation data system.

(ECD6) Hewlett Packard 6890 P (2008) – A GC system equipped with dual µECD detectors, an Agilent 6890 autosampler and an HP ChemStation data system.

(FID6) Hewlett Packard 5890E Series II (2008) – A GC system equipped with dual FID detectors, an HP 7694 headspace autosampler and HP ChemStation data acquisition system.

(FID7) Agilent 6850 (2008) – A GC system equipped with a single FID detectors, an Agilent 6850 autosampler and HP ChemStation data acquisition system.

(ECD7) Hewlett Packard 6890 (2008) – A GC system equipped with dual µECD detectors, an Agilent 6890 autosampler, and HP ChemStation data system.

(ECD8) Hewlett Packard 6890N – (2011) – A GC system equipped with dual µECD detectors, an Agilent 7683 autosampler, and HP ChemStation data system.

(FID8) Agilent 6890N (2008) – A GC system equipped with a dual FID detectors, an Agilent 7683B autosampler and HP ChemStation data acquisition system.

(ECD9) Hewlett Packard 7890 – (2015) – A GC system equipped with dual µECD detectors, an Agilent 7693 autosampler and an HP ChemStation data system.

Inorganic Instrumentation

Perkin-Elmer NexIon 300D ICP-MS (2011) - A completely automated reaction cell & collision cell ICP-Mass Spectrometer with Elemental Scientific SC-2 Fast autosampler and multitasking software.

Perkin-Elmer NexIon 350D ICP-MS (2015) - A completely automated reaction cell & collision cell ICP-Mass Spectrometer with Elemental Scientific SC-2 Fast autosampler and multitasking software.

Perkin-Elmer Optima 7300DV ICP (2009) – Automated dual view simultaneous ICP with an Elemental Scientific SC-2 Fast autosampler system

Perkin-Elmer Optima 4300 ICP (2001) - A completely automated dual view simultaneous ICP with auto-sampler and multitasking software.

CETAC M-6000A Mercury Analyzer (2000) – A fully automated high sensitivity cold vapor atomic absorption instrument dedicated to trace and ultratrace Mercury analysis. System is computer controlled with windows base software and an auto-sampler.

Leeman Labs Hydra II Mercury Analyzer (2016) – A fully automated high sensitivity cold vapor atomic absorption instrument dedicated to trace and ultratrace Mercury analysis. System is computer controlled with windows base software and an auto-sampler.

Dionex Ion Chromatography DX 500 (1997) – A fully automated system with an auto-sampler for quantitative anion analyses. The system is computer controlled using Peaknet software.

Dionex Ion Chromatography 2100 (2009) – A fully automated system with an auto-sampler for quantitative anion analyses. The system is computer controlled using Chromeleon CHM-2 Version 7.0 software.

Shimadzu UV1800 (2016) - UV-VIS Spectrophotometer used for quantitative conventionals analysis.

Shimadzu UV1800 (2016) - UV-VIS Spectrophotometer used for quantitative conventionals analysis.

Lachat QuickChem 8000 Flow Injection Analyzer (2003) – Automated flow injection instrument dedicated to low level nutrient analysis

Lachat QuickChem 8500 Flow Injection Analyzer (2007) – Automated flow injection instrument dedicated to low level nutrient analysis

Dohrmann Apollo 9000 (2009) - Total Organic Carbon (TOC) Analyzer, including a boat sampler for solids analysis.

Shimadzu TOC-LCSH (2014) - TOC analyzer with autosampler for aqueous samples.

Accumet AR60 (2013) - pH Meter

Accumet XL60 (2011) – ISE/pH Meter

ORION Model 115 (2010) – Conductivity Meter

ORION 5 Star (2014) – RDO Meter

Hach Ratio 2100N - Turbidimeter

Kontes Midi-Vap Cyanide Distillation Systems (3 each)(1995-2008) – Each of the systems is capable of simultaneously distilling up to 10 samples for cyanide analysis using small sample aliquots.

Centrifuge (1987) - Beckman Model GP with swinging bucket rotor and inserts for 250 ml bottles and scintillation vials

Aim 600 Block Digestion System (2006) with Controller

Environmental Express Hot Block digestion blocks (10 ea.) (1999-2008) for digestion of samples prior to trace metals analysis.

Hach COD Digestion Blocks (2 each)

Incubators: VWR Model 2020 (2each) BOD incubator
Precision Model 2860 Coliform Incubator Oven
Precision Model 2862 Coliform Incubator Oven
Thermolyne Coliform Water Bath Incubator

Network Infrastructure

ARI has a Windows Active Directory network that handles all user authentication, access control, and services. User profiles are created on the AD server and permissions are assigned per roles and responsibilities and group and user levels. The primary server combines three virtual machines, each one individually handling database, file, and LDAP services. The stack is managed through a HyperV hypervisor. The entire stack is backed up locally, with incremental snapshots taken every 30 minutes daily and a full synchronization every morning. The full synchronization is pushed to a cloud storage service, Datto, for secure, offsite storage. ARI uses Key Methods for additional IT support outside the scope of internal staff.

ARI uses Element, developed by Promium, as a Laboratory Information Management System. All data related to sample control, preparation, analysis, reporting, and business operations are retained on this system. User profiles, separate from those on the domain, are used to control access to the different functions of the application and users can be granted read/write permission as needed to fulfill their duties. The application is fully supported by Promium and administrative users have access to the staff engineers. ARI employs a full-time Element developer to build reports and queries needed for reporting data to end users and implementing controls and processes needed for operational flow. Most changes, including additions and deletions, in Element are audited and can be reviewed by management.

Office 365 hosting is used for all e-mail, messaging, and file sharing services. It's centrally managed by ARI IT staff and has a full suite of access control and auditing tools. General lab documentation is controlled via the SharePoint application of Office 365, allowing for document control and versioning.

All servers are secured in a locked room where only management and IT staff have access. Some users have external access to the network but this is limited to current employees and only through an end-to-end encrypted VPN service, NetCloud.

Note: Extensive in-house replacement parts are available for lab instruments and computers, including spare circuit boards. A majority of all service maintenance is performed by ARI employees.

Appendix E

Analytical Methods

ORGANIC ANALYSES

Parameter	Methods	Technique
Volatiles (GC/MS)	524.3/624/8260	CGC/MS
	Low Level Vinyl Chloride & 1,1 – Dichloroethene	GC-MS-SIM
Volatiles (GC)		
Volatile Aromatics	602/8021B	GC/PID
Semivolatiles (GC/MS)		
Semivolatile Organics	625/8270D	GC/MS
Polynuclear Aromatic	Hydrocarbons (PNA/PAH) GC/MS-SIM	625/8270D
Butyl Tin Species	Krone (1988)	GC/MS-SIM
Pesticides/GC Analyses		
Chlorinated Pesticides	608/8081A	GC/ECD
Aroclors/PCBs	608/8082	GC/ECD
PCB Congeners	ARI Method	GC/ECD
Phenols	604/8041	GC/FID
Chlorinated Phenols	8041 (mod)	GC/ECD
Pentachlorophenol	8151A (mod)	GC/ECD
Organophosphorous Pesticides	614/8141A	GC/NPD
Chlorinated Hydrocarbons	612/8121	GC/ECD
Glycols	ARI Method(SOP 426S R2)	GC/FID
Hydrocarbon ID	NWTPH-HCID	GC/FID
Gasoline Range Hydrocarbons	(N)WTPH-G/AK101/WI-GRO	GC/FID
Diesel Range Hydrocarbons	(NWTPH-D/AK102/WI-DRO)	GC/FID
Extractable Petroleum Hydrocarbons	WDOE 6/1997	GC/FID
Volatile Petroleum Hydrocarbons	WDOE 6/1997	GC/PID
Organic Sample Preparation and Clean Up		
TCLP / SPLP Extraction		1311 / 1312
Sonication		3550B
Soxhlet		3540C
Accelerated Solvent Extraction (ASE)		3545B
Separatory Funnel		3510C
Continuous Liquid-Liquid		3520C
Alumina Clean-up		3610B
Florisil	Clean-up	3620B
Gel Permeation (GPC)		3640A
Silica Gel		3630C
Sulfur Clean-up		3660B
Sulfuric Acid Clean-up		3665A

INORGANIC ANALYSES

Parameter	Methods	Technique
Wet Chemistry		
Acidity	2310/305.1	Titrimetric
Alkalinity	2320/310.1	Titrimetric
Ammonia	4500NH_3H/350.1	AutomatedPhenate/ISE
Biological Oxygen Demand-BOD		
Carbonaceous – BOD	5210.B/405.1	5-day Winkler Titration
Bromide	4500Br.B	Phenol Red Colorimetric
Anions	300.0	Ion Chromatography
Cation Exchange Capacity	9080	Neutral Ammonium Acetate
Chemical Oxygen Demand	5220.D/410.4	Closed Reflux, Colorimetric
Chromium Hexavalent (Cr6+)	3500Cr-D/7196A	Diphenylcarbazide
Chloride	4500CI.E/325.2	Automated Ferricyanide
Coliform, Total / Fecal	9222.B/D	Membrane Filtration
Color	2120.B/110.2	Visual Comparison
Conductivity	2510/120.1	Electrometric
Corrosivity (CaCO3 Saturation)	2330	Calc. (pH, Alk, TDS, Ca)
Cyanide, Total	4500CN.C/335.2/9010	PBA, Colorometric
Cyanide, Amenable	4500CN.G/335.1	Alkaline Chlorination
Cyanide, WAD	4500CN.I	Weak Acid Distillation
Dissolved Oxygen	4500-O.C/360.2	Winkler Titration
Fats/Oils/Grease	5520.B/413.1/9070A	Gravimetric
Fluoride	4500F.C/340.2	Ion Specific Electrode
	300.0	Ion Chromatography
Hardness, Calculation	2340.B/6010B	Ca, Mg Calculation
Heterotrophic Plate Count	9215.D	Membrane Filtration
Iron (II) ferrous	3500Fe.D	Phenanthrolene
Nitrate + Nitrite	4500NO_3F/353.2	Automated Cd Reduction
Nitrate	4500NO_3F/353.2	Calculated
	300.0	Ion Chromatography
Nitrite	4500NO_3.F/353.2mod	Automated Colorimetric
	300.0	Ion Chromatography
Oil & Grease, Solids	5520.D/907	Gravimetric
Oil & Grease, Polar/Non Polar	5520.F	Gravimetric
PH	150.1	Electrometric
Phenols	5530.D/420.1/9065	4-AAP w/ Distillation
Phosphorous, Total	4500P.B/365.2	Colorimetric w/ digestion
Phosphorous, Ortho (SRP)	4500P.B/365.2	Colorimetric
	300.0	Ion Chromatography
Salinity	2520	Conductimetric
Total Kjeldahl Nitrogen (TKN)	4500N.org/351.4	Block Digest/ISE
Total Solids	2540.B/160.3	Gravimetric, 104^oC
Total Suspended Solids (TSS)	2540.D.160.2	Gravimetric, 104^oC
Total Dissolved Solids (TDS)	2540.C/160.1	Gravimetric, 180^oC

Total Volatile Solids (TVS)	2540.E/160.4	Gravimetric, 550°C
Settleable Solids	2540.F	Volumetric
Streptococcus, Fecal	9230.C	Membrane Filtration
Sulfide	4500S^{2} E / 376.1/9034	Iodometric
Sulfide, Low Level	4500S^{2} D / 376.2	Methylene Blue
Sulfide, Acid Volatile	4500S^{2} D / 376.2	Methylene Blue
Sulfate	4500SO_4^{2}.F / 375.2 / 9036	Auto. Methylthymol Blue
	300.0	Ion Chromatography
Sulfite	4500SO_3^{2}.B.377.1	Iodometric
Total Organic Carbon (TOC)	5310 B / 415.1 / 9060A,PSEP	Combustion NDIR
Turbidity	2130.B / 180.1	Nephelometric
Total Lipids in Tissue	Bligh & Dyer (mod)	Gravimetric

Trace Metals Analyses

Inductively Coupled Plasma (ICP):

Ag, Al, As, B, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, K, Mg, Mn, Mo, Na, Ni, Pb, Sb, Se, Si, Sn, Sr, Th, Ti, Tl, V, Zn (Li, Th, U, W - special request only)	200.7 / 6010B	ICP

Cold Vapor (CVAA):

Hg	7470A / 7471A	CVAA

Inductively Coupled Plasma/Mass Spectroscopy (ICP-MS):

Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, K, Mg, Mn, Mo, Na, Ni, Pb, Sb, Se, Th, Tl, U, V, Zn	200.8/ 6020 Mod.	ICP/MS

Trace Metals Sample Preparation

Toxicity Characteristic Leaching Procedure	1311
Synthetic Precipitation Leaching Procedure	1312
Digestion for Total Recoverable or Dissolved Metals	3005A
Digestion of Aqueous Samples for Total Metals by ICP	3010A
Digestion of Aqueous Samples for Total Metals by GFAA	3020A
Digestion of Sediment, Sludge and Soil 3050B	

Appendix F

Laboratory Accreditations

The National Environmental Laboratory Accreditation Program (NELAP), the State of Washington Department of Ecology and the State of Alaska Department of Environmental Conservation currently certify Analytical Resources Inc. to perform environmental analysis.

ARI is approved to perform analyzes for the United States Department of Defense (DoD) agencies following the DoD Quality Systems Manual (DoD-QSM)

The Boeing Company and Battelle Pacific Northwest Laboratories have audited and approved ARI's laboratory QA/QC Program

ARI analyzes drinking water, wastewater and solid matrix performance testing (PT) samples for all accredited methods semiannually.

List of Accreditations

1) National Environmental Laboratory Accreditation Conference (NELAC) – Accrediting authority is Oregon Environmental Laboratory Accreditation Program (ORELAP).
2) State of Washington, Department of Ecology - Environmental Laboratory Accreditation Program
3) The Alaska State Department of Environmental Conservation - Laboratory Approval Program
4) United States Department of Defense Environmental Laboratory Accreditation Program (DoD-ELAP) Administered by Perry Johnson Laboratory Accreditation (PJLA).
5) The State of California Environmental Laboratory Accreditation Program (CA-ELAP)

Continuing Contracts Resulting from On-Site Laboratory Audits

1) The Boeing Company Corporate Environmental Affairs Division
2) The City of Seattle
3) The Port of Seattle

Appendix G

Data Reporting Qualifiers

Data Reporting Qualifiers

Effective 7/10/2009

Inorganic Data

U	Indicates that the target analyte was not detected at the reported concentration
*	Flagged value is not within established control limits
B	This analyte was detected in the method blank
CONF	Confluent growth
N	Matrix Spike recovery not within established control limits
NA	Not Applicable, analyte not spiked
H-	The natural concentration of the spiked element is so much greater than the concentration spiked that an accurate determination of spike recovery is not possible
L	Analyte concentration is ≤5 times the Reporting Limit and the replicate control limit defaults to ±1 RL instead of the normal 20% RPD
TNTC	Too numerous to count
W	Weight of sample in some pipette aliquots was below the level required for accurate weighing

Organic Data

*	Flagged value is not within established control limits
A	The reported TIC is a suspected aldol-condensation product
B	This analyte was detected in an associated Method Blank
C	The identification of the analyte is confirmed by GC/MS when the primary analytical method employed is GC/ECD as appropriate
C	The analyte was positively identified on only one of two chromatographic columns. Chromatographic interference prevented a positive identification on the second column
D	The reported value is from a dilution
D1	Surrogate was not detected due to sample extract dilution

E- Estimated concentration calculated for an analyte response above the valid instrument calibration range. Dilution of the sample or extract is required to obtain valid quantification of the analyte.

EMPC Estimated Maximum Possible Concentration (EMPC) defined in EPA Statement of Work DLM02.2 as a value "calculated for 2,3,7,8-substituted isomers for which the quantitation and /or confirmation ion(s) has signal to noise in excess of 2.5, but does not meet identification criteria" **(Dioxin/Furan analysis only)**

F Samples were frozen prior to particle size determination

H Hold time violation – Hold time was exceeded

HC The natural concentration of the spiked analyte is so much greater than the concentration spiked that an accurate determination of spike recovery is not possible

HT The reported value is quantitated using peak heights rather than peak areas

J- Estimated concentration when the value is less than ARI's established reporting limits

L Analyte concentration is <= 5 times the reporting limit and the replicate control limit defaults to +/-RL instead of 20% RPD

M Estimated value for an analyte detected and confirmed by an analyst but with low spectral match parameters. This flag is used only for GC-MS analyses

N The reported TIC has a >= 80% match on the mass spectral library search

NRS This surrogate not reported due to chromatographic interference

P The reported value is greater than 25% difference between the concentrations determined on two GC columns where applicable

P1 The analyte was detected on both chromatographic columns but the quantified values differ by ≥40% RPD with no obvious chromatographic interference

PC Preservation was checked and failed

Q Indicates a detected analyte with an initial or continuing calibration that does not meet established acceptance criteria (<20% RSD, <20% Drift or minimum RRF).

S The reported value is determined using a single-point ICAL by GC/ECD analytical method as appropriate

SM Sample matrix was not appropriate for the requested analysis. Normally refers to samples contaminated with an organic product that interferes with the sieving process and/or moisture content, porosity, and saturation calculations

SS Sample did not contain the proportion of “fines” required to perform the pipette portion of the grainsize analysis

T The total of all fines fractions. This flag is used to report total fines when only sieve analysis is required and balances total grainsize with sample weight

U Indicates that the target analyte was not detected at the reported concentration

Text1 Custom value

X Analyte signal includes interference from polychlorinated diphenyl ethers. **(Dioxin/Furan analysis only)**

X Custom value

Y The analyte is not detected at or above the reported concentration. The reporting limit is raised due to chromatographic interference. The Y flag is equivalent to the U flag with a raised reporting limit.

Y Custom value

Y1 Raised reporting limit due to interference

Z Analyte signal includes interference from the sample matrix or perfluorokerosene ions. **(Dioxin/Furan analysis only)**

Z Custom value

Appendix H

Standards for Personal Conduct

Standards of Conduct

Since effective working relationships depend upon each of us, ARI expects certain minimum standards of personal conduct.

This list highlights general ARI expectations and standards and does not include all possible offenses or types of conduct that may result in discipline or discharge. Management reserves the absolute right to determine the appropriate degree of discipline, including discharge, warranted in individual cases.

Employees engaged in the following activities, or similar activities, may be terminated:

- theft or embezzlement
- disclosure of trade secrets or industrial espionage;
- willful violation of safety or security regulations;
- conviction of a felony;
- working for a competitor or establishing a competing business.

In addition, dismissal may result from other serious offenses such as:

- being intoxicated, under the influence or in possession of illegal drugs on the job;
- falsification of records;
- abuse, destruction, waste or unauthorized use of equipment, facilities or materials;
- gambling on the premises;
- chronic tardiness or absenteeism;
- insubordination;
- unwillingness to perform the job;
- unauthorized requisition of materials from vendors.

There may be no alcoholic beverages consumed on ARI premises, other than at times designated as Company functions, at which non-alcoholic beverages will also be provided.

Personal and corporate honesty and integrity have built the character of ARI. This good character is fundamental to our well-being, future growth and progress. It is vitally important that we avoid both the fact and the appearance of conflicts of personal interest with that of the firm, its clients, and any other professional contacts.

This policy requires that ARI employees have no relationships or engage in any activities that might impair their independence of judgment. Employees must not accept gifts, benefits, or hospitality that might tend to influence them in the performance of their duties. It is expected

that there will be no employment by any competing company, nor any employment by any outside interest or engagement in outside activity which might impair an employee's ability to render the full-time service to the company that employment involves.

If any possible conflict of interest situation arises, the individual concerned must make prior disclosure of the facts so that action may be taken to determine whether a problem exists and, if so, how best to eliminate it. Likewise, any financial interest in an organization doing business with ARI or which competes with us should be revealed to Company management. (Excluded from this requirement is ownership of securities traded in major stock exchanges or other recognized trading markets.)

Our standards are those generally expected of employees in any well-regarded, ethical business organization.

ARI further expects that each employee will:

- Be dressed and groomed appropriately for a business office. Employees in the laboratory areas are expected to dress in compliance with established safety procedures. Specific standards will be discussed with each employee during Health and Safety orientation. Your supervisor and the Administrative Services Manager always are available to answer questions.
- Maintain the confidential nature of Company information. Removal of Company documents, records, stored materials, computer printouts, or any similar information, or copies of such material or information from the office without specific permission is prohibited. Likewise, revealing confidential information to an unauthorized person or using such information in an unauthorized way is prohibited. If there could be any possible question about the applicability of this requirement to a given circumstance, ask your supervisor.
- Use Company computer capabilities and facilities only for authorized business at authorized times and locations; observe strictly all computer security measures and precautions; enter, alter or delete no computer instructions or stored material apart from that required by faithful performance of assigned duties; remove, copy, use or permit to be used no computer software developed for, purchased by, or otherwise used by ARI except as required by faithful performance of assigned duties.
- Conduct business dealings with clients and members of the public in a courteous manner.

Appendix I

Quality Assurance Policies

QUALITY ASSURANCE POLICY

POLICY NUMBER:	**1**
SUBJECT:	**CORRECTIONS TO DATA/BENCHSHEETS**
DATE:	**8/2/96**

Manual corrections made on any raw data, bench sheet, logbook or document used during sample processing will be made in the following manner:

1. Draw a single line through the information to be deleted or corrected. The original information must remain readable.

2. Enter any new information, preferably above the original information.

3. Initial and date the correction.

QUALITY ASSURANCE POLICY

POLICY NUMBER:	**2**
SUBJECT:	**LINING OUT UNUSED BENCHSHEET PORTIONS**
DATE:	**8/2/96**

All unused portions of logbook pages and benchsheets will be lined through so that information cannot be added at a later date. This will be completed in the following manner:

1. Line out unused portions of a logbook page or benchsheet by drawing a single line or "Z" through the unused portions.

2. Initial and date the page beside the lineout.

3. Do not line out a page or section until it is certain that no additional information will be added to the unused portions.

QUALITY ASSURANCE POLICY

POLICY NUMBER: 3

SUBJECT: STOP WORK ORDERS

DATE: 8/28/96

It is the responsibility of all staff members to address situations that may require the issuance of a "stop work order". Potential and actual "stop work orders" will be handled as follows:

1. If an analyst or technician observes a situation which will or may have a negative impact on data quality, that person will notify her/his section supervisor immediately.

2. The section supervisor will assess the situation. If it appears that a "stop work order" may be required, the section supervisor will notify the appropriate manager (inorganic or organic).

3. The supervisor and manager will then decide if a "stop work order" should be issued. The manager will make a final decision on whether or not to issue a "stop work order". The incident will be reported to the Quality Assurance Program Manager using a Corrective Action Request form.

4. If a "stop work order" is issued, the manager will inform the Project Managers and the QA section. The section supervisor will notify section staff of the order.

5. The laboratory manager involved will oversee the development and implementation of a Corrective Action Plan (CAP). Upon completion of the CAP the "stop work order" may be rescinded.

6. Prior to rescinding a "stop work order", verification must be made that control has been regained and that work may begin. Only the inorganic or organic manager may rescind a "stop work order".

7. When the "stop work order" is rescinded, the Project Managers, analytical staff and QA section will be notified. The QA section will require documentation verifying that the procedure is back in control.

QUALITY ASSURANCE POLICY

POLICY NUMBER:	**4**
SUBJECT:	**SOP Review**
DATE:	**9/3/96**

All Standard Operating Procedure (SOP) documents will be reviewed and updated at least annually by qualified staff members. Laboratory management will review and approve all modifications to the SOPs.

QUALITY ASSURANCE POLICY

POLICY NUMBER:	**5**
SUBJECT:	**Reporting Dilutions**
DATE:	**9/11/96**

Dilution factors will be recorded as whole numbers followed by "X" (i.e., 5X, 10X, etc.). This reporting convention will be used on run logs, bench sheets, raw data and final reports for all diluted samples, extracts or digestates or standards.

QUALITY ASSURANCE POLICY

POLICY NUMBER: **6**

SUBJECT: **Formatting for SOPs – Computer Related**

DATE: **1/31/00**

Conventions for formatting computer-related instructions in SOPs

Commands should be indented and formatted as **`bold courier`** and one or two font sizes smaller:

```
USE PARAMS ORDER PARAMS
BROW
```

Many systems and languages are *case-sensitive*, and case should match the syntax and/or stylistic standards of the language.

If only one command, like ***`SET CENTURY ON`***, is needed, it can be included in the rest of the text, so long as it is also italicized.

If the user must substitute a particular value in place of a general descriptor, italicize the descriptor, make it lowercase, and *do not make it bold*:

```
USE PARAMS ORDER PARAMS
COPY TO TEMPARM FOR JOB = 'job' .AND. SAMPLE = 'sample'
```

In general, keywords, variable names, formatting codes, and descriptors should be in *`courier`* and *`italicized`*.

QUALITY ASSURANCE POLICY

POLICY NUMBER:	**7**
SUBJECT:	**Manual Adjustment of Data**
DATE of IMPLEMENTATION:	**1/1/01**

Modern chromatographic instruments include computer software to identify a detector response as a chromatographic peak, characterize that peak and determine the relative height or area of the signal. The software utilizes parameters (threshold, slope, etc) that are adjusted by the instrument operator to optimize the results.

A single set of operator controlled settings that determine peak characteristics for an entire data file is defined as an "automated procedure". An automated procedure often characterizes chromatographic peaks incorrectly. ARI requires that trained analysts identify and resolve these errors using an alternate automated procedure or a "manual adjustment" of the data. Manual adjustment is defined as the process used by an analyst to adjust an individual peak or a subset of data in a chromatographic file.

1. The settings for a routine automated procedure normally used to process chromatographic data must be described in the method Standard Operating Procedure (SOP).

2. Trained analysts may substitute one automated procedure for another in order to optimize peak characteristics. The use of an alternate automated procedure must be permanently documented using either a software generated log file or analyst notes.

3. Manual adjustment of chromatographic peak characteristics will be used to correct the results of an automated procedure that, in a trained analyst's opinion, are clearly incorrect and will result in erroneous peak identification, integration or quantification.

4. Manual adjustment will be implemented in a reasonable and consistent manner. Guidelines for performing manual adjustment will be documented in method SOPs.

5. All manually adjusted data will be clearly identified for approval in the data review process. A permanent record of all manual adjustments will be maintained in both electronic and hardcopy versions of the raw data.

6. Manual adjustment of chromatographic files will not be used to falsify data for any purpose. Falsification of data through the use of manual peak adjustment is unethical, unlawful and will result in termination of the offending analyst.

Approval:

_____

Quality Assurance Program Manager Date

QUALITY ASSURANCE POLICY

POLICY NUMBER:	**8**
SUBJECT:	**Performance Testing Samples**
IMPLEMENTATION DATE:	**1/1/01 (Modified 7/25/17)**

Performance Testing (PT) Samples will be analyzed on a periodic basis to monitor laboratory performance and/or meet the requirements of an external accreditation program. PT samples contain target analytes in concentrations unknown to laboratory personnel. PT samples are purchased from a third-party PT provider that sends graded PT results directly to ARI's Accrediting Bodies.

PT samples will be logged-in, prepared, analyzed and reported as a routine sample without special consideration.

When PT samples are not commercially available, analytical proficiency will be demonstrated using ARI's on-going MDL, LOD and LOQ verification data.

QUALITY ASSURANCE POLICY

POLICY NUMBER:	**9**
SUBJECT:	**Modifications to Analytical Methods Procedures or Reports**
DATE of IMPLEMENTATION:	**8/24/05**

This Policy defines the processes used to initiate and validate modifications to analytical processes, QA/QC protocol, data processing programs and algorithms, data reporting formats or other changes to analytical procedures or SOPs at Analytical Resources Inc. (ARI). The procedures outlined will also be used to validate project specific changes to analytical protocol and new analytical methods.

Changes to analytical procedures must be approved by ARI's Management (Managers and/or Supervisors) and be well documented using the following procedure:

1. Modification may be requested by any staff member. The modification must be requested using ARI's Corrective Actions Tracking System. Corrective Action requests for changes to analytical protocol or reports will assigned to the appropriate manager or supervisor by the initiator. As an alternative the request may be assigned to the QA Section. The Corrective Actions assignee may approve the project or re-assign the request for approval to a third party. The QA Section will monitor the progress of all requests.

2. The requestor must detail and justify the proposed modifications or additions when initiating a Corrective Action issue. Modifications must be approved by ARI management prior to any work performed to establish the modification.

3. The following must be in place before final approval and/or implementation of the proposed modification.

A. A new or revised SOP as appropriate including the modification or new protocol.
B. An Initial Demonstration of Proficiency as defined in ARI SOP 1018S for new or modified analytical procedures.
C. An MDL study following the procedure in ARI SOP 1018S for new or modified analytical procedure.
D. When appropriate, successful analysis of a blind Performance Evaluation Sample using new or modified procedures or data processing protocol.
E. Documentation that new or modified software provides the desired result.

4. ARI staff must have sufficient training to implement the procedural changes.

5. Notification of the modifications must be distributed to all affected personnel including appropriate client personnel.

QUALITY ASSURANCE POLICY

POLICY NUMBER:	**10**
SUBJECT:	**Reporting of Target and Spiked Analytes For Dual Column GC Analyses**
DATE of IMPLEMENTATION:	**8/24/05**

Analytical Resources Inc. uses single injection, dual column gas chromatographs to simultaneously identify and confirm the presence of target or spiked analytes in some GC analyses. Only one quantitative value is reported for each target or spiked analyte. ARI's policy for deciding which value to report is outlined as follows:

1. ARI considers each column equally valid for compound identification and quantification. Both GC columns must be compliant with all quality assurance parameters outlined in ARI's SOPs and LQAP. Both GC columns must produce valid initial and continuing calibrations using the same calibration model.

2. The analytical value reported will be determined by comparison of the quantitative results of confirmed analytes as follows.

a. The relative percent difference (RPD) between the results on the two columns (R_1 & R_2) is calculated using the formula:

$$RPD = \frac{|R_1 - R_2|}{\left(\frac{R_1 + R_2}{2}\right)} \times 10$$

b. If the RPD is less than 40% the greater of the two values is reported for both target analytes and spiked compounds. When required by specific QA protocol, by contract or client request the lower value will be reported for target analytes.

c. If the RPD is greater than 40%, ARI's analyst must examine the chromatogram for anomalies (overlapping peaks, incorrect integration, negative peaks) and either correct the anomalies (i.e. perform manual integrations) or report the most appropriate target analyte value. The higher value will be reported for spiked analytes. ARI's analyst must provide a written evaluation of all analyses where an RPD exceeds 40% and this information must be passed on to ARI's client or the data user.

QUALITY ASSURANCE POLICY

POLICY NUMBER:	**11**
SUBJECT:	**Calculation of Analytical Uncertainty**
DATE of IMPLEMENTATION:	**8/31/06**

Analytical Resources Inc. will use the procedure[1] proposed by Thomas Georgian, PhD to estimate analytical uncertainty. Dr. Georgian's proposes using the formulae below to calculate uncertainty:

For biased corrected analytical results:

100 (c/R)(1± L / R)
Where:
c = Measured concentration of the analyte
R = Average Blank Spike recovery
L = ½ the warning or control range

And for unbiased results i.e. R = 100

c (± L / 100)

Example:

For a 10 ppb analytical result when the mean BS recovery is 50% and the control limits are 20% to 80% an interval for the analytical results is calculated as follows:

100 (10 ppb / 50)(1±30 / 50) = 20 ± 12 ppb

[1] Estimation of Laboratory Analytical Uncertainty Using Laboratory Control Samples, Thomas Georgian, Ph.D., *Environmental Testing & Analysis*, November/December 2000.

QUALITY ASSURANCE POLICY

POLICY NUMBER:	**12**
SUBJECT:	**Rounding of Numbers and Reporting Limits**
DATE of IMPLEMENTATION:	**6/10/14 (modifications proposed)**

I. ARI reports analytical results in concentration units as follows:

A. Values expressed as a concentration (mg/L, µg/Kg etc.) will be reported using 3 significant figures.

B. Values expressed as percent (control limits, RSD etc.) are reported using the appropriate whole number. Examples: 6.38 rounds to 6, 9.95 rounds to 10, 99.93 rounds to 100, 145.48 rounds to 145.

II. ARI rounds numbers to the appropriate level of precision using the following rules:

A. If the figure following those to be retained is greater than or equal to 5, the absolute value of the result is to be rounded up: otherwise, the absolute value of the result is rounded down. Examples: -0.4365 rounds to -0.437 and 2.3564 rounds to -2.356; 11.443 is rounded down to 11.44 and 11.455 is rounded up to 11.46.

B. When a series of multiple operations is performed (add, subtract, divide, multiply), all available significant figures are carried through the calculations and the result is rounded to the appropriate number of significant figures.

III. ARI compares concentration values to reporting limits prior to rounding final concentration values. Example: with an RL of 0.50, 0.499 is undetected at 0.50 (0.50U) and 0.504 is detected at 0.50.

III. ARI will round quality control results prior to determining if the value is in control. Example: for spike recovery limits of ± 10% (90 – 110%), a recovery of 110.47 is in control at 110% and a calculated recovery of 110.50 is out of control at 111%.

QUALITY ASSURANCE POLICY

POLICY NUMBER:	**13**
SUBJECT:	**Use of "J" Flag when Reporting Analytical Data**
DATE of IMPLEMENTATION:	**3/1/09**

1. ARI uses a "J" flag to indicate that a quantitative result chemical analysis is an estimated value. In general, "J" flags note positively identified target analytes that are below an instrument's verified calibrated range.
2. A "J" indicates quantitative values with a high degree of uncertainty. Data users must consider the greater uncertainty when using "J" flagged quantitative values.
3. ARI will not report analytes below the RL ("J" flag is not used) for any single column GC fuel analysis unless there is a positive pattern identified for the fuel (HCID, TPH-D, BTEX, TPH-G.
4. ARI will not report analytes below the RL for any single column GC analysis that quantifies specific analytes or has no pattern (RSK-175, Direct Aqueous Injection)
5. ARI uses "J" flags when reporting results of GC-MS (VOA and SVOA) and dual column GC analyses using the following criteria:
   A. All analyses must meet ARI established QA criteria for calibration and spike recovery.
   B. Analytes must meet method specific identification criteria (i.e. spectral match, retention time and/or relative retention time).
   C. The analyte concentration must exceed the greater of either the MDL or ½ the reporting limit before a "J" flag is applied.
   D. An analyte in a method blank will be "J" flagged only when any associated sample contains the same analyte.
   E. The application of a "J" flag is discretionary, depending on the professional judgment of ARI's data reviewers. GC-MS parameters such as ion ratios, spectral match, background contamination and instrument noise are weighted when considering the application of "J" flags.
6. Some typical circumstances that may warrant the use of a "J" flag:
   A. A compound identified at a concentration between the MDL or ½ RL and ARI's reporting limit (normally the low concentration used to calibrate the instrument).
   B. The quantified values in a dual column GC analysis differ by > 40% with obvious interference on one column. ARI may report the value with the lowest concentration or the least interference.
   C. The analyte is present at low concentration due to extract dilution and identified in a previous analysis of less dilute extract.
   D. Analytes < the RL and reported in previous analyses from the same sampling site.
   E. An analyte is < the RL in a sample and greater than the RL a duplicate or replicate analysis. This often applies to Matrix Spike and Blank Spike samples and their duplicates.

QUALITY ASSURANCE POLICY

POLICY NUMBER:	**14**
SUBJECT:	**Calculation of Holding Times**
DATE of IMPLEMENTATION:	**7/1/13**

1. Holding Time (HT) (Maximum Allowable Holding Time) definition: The maximum elapsed time that samples may be held prior to analysis and still be considered valid or not compromised. (40 CFR Part 136). (DoD Clarification): The time elapsed from the time of sampling to the time of extraction or analysis, or from extraction to analysis, as appropriate. A specific time as defined in this policy will include the year, month, day of the month, hour and minute for each event.

2. Holding times are prescribed in published analytical methods and are normally specified in either days or hours. ARI will determine holding times based on the published time units specified. The time of sample collection is considered time (hour, day etc.) zero.

3. Holding time will commences as follows:
    a. **Environmental Samples**: The moment the sample is separated from its natural environment. ARI will assume this is the sampling time recorded on the Chain of Custody form delivered to the lab with the sample.
    b. **Extracts for Organic Analysis**: The moment the extract is delivered to the instrument laboratory as documented in ARI's chain of custody records.

4. Elapsed holding time will end as follows:
    a. **Samples for VOA Analysis**: At the time trap desorption/GC analysis begins as recorded by the chromatography data system.
    b. **Samples for Solvent Extraction**: The moment the extraction solvent touches the sample. This is a batch process with the beginning and ending time recorded on the extraction bench sheet.
    c. **Samples for Acid Digestion**: The moment acid touches the sample. This is a batch process with the beginning and ending time recorded on the preparation bench sheet.
    d. **Samples for Solids Analysis**: The moment the sample is placed in the oven or filtration begins as recorded on the analysis bench sheet.
    e. **Samples to be Distilled**: At the moment the sample is placed in the distillation flask. This is a batch process with the beginning and ending time recorded on the analysis bench sheet.
    f. **Sediment for Pore Water Extraction**: When the sediment is placed in a centrifuge tube.
    g. **Extracts for Organic Analysis**: The moment the sample, extract or digestate is introduced into the instrument as recorded by the instrument data system.

5. Reporting of Holding Times: The time of sample collection, preparation, and analysis are included in the final laboratory report, regardless of the length of holding time. If the time of the sample collection is not provided, ARI will assume the most conservative time of day. When the date of sampling is not available, the assumed holding time will start when the samples are formally accepted by ARI. For batch processing, the start and stop dates and times of the batch preparation will be reported.

QUALITY ASSURANCE POLICY

POLICY NUMBER:	**15**
SUBJECT:	**Subcontracting Samples**
DATE of IMPLEMENTATION:	**7/1/13**

ARI may subcontract analysis to other laboratories. The following policies are followed to help ensure that data produced by a subcontractor will meet ARI's expectation for quality, defensibility, repeatability and will meet ARI's client's expectations.

1. ARI's client must be made aware that samples will be subcontracted and what laboratory will perform the analyses.
2. Subcontractor laboratories must qualify to perform the analyses using the same criteria applied to ARI. When appropriate, subcontracted laboratories must submit proof of certification or accreditation, quality assurance plans, standard operating procedures, results of method detection limit studies and control limits to ARI.
3. ARI may request that subcontract laboratories analyze, a double-blind performance testing (PT) sample for the subcontracted analysis obtained from commercial vendors at the subcontractor's expense.
4. ARI may at its discretion perform an on-site assessment of a subcontract laboratory. Failure to submit requested documents or refusal of an on-site assessment will disqualify laboratories from subcontracting ARI sample analyses.
5. Department of Defense (DoD) work to be performed under the Quality Systems Manual (DoD-QSM) must be subcontracted to a DoD Environmental Laboratory Accreditation Program (DoD-ELAP) accredited laboratory.
6. The sample information and analytical requirements for subcontracted analyses are first entered into ARI LIMS in the same way that samples for in-house analyses are processed. Subcontractor laboratories are contacted to verify their preparedness, and samples are then submitted to them using ARI chain-of-custody forms.
7. The laboratory must be willing to maintain an annual contract with ARI, and must list ARI as a co-insured on the subcontract laboratory's professional and general liability insurance policies.
8. Financial stability is also evaluated on a lab-by-lab basis.

Appendix J

References

ISO/IEC 17025:2005. General Requirements for the Competence of Testing and Calibration Laboratories.

UNIDO. 2009. Complying with ISO 17025. United Nations Industrial Development Organization.

ISO 9001. Standards for Quality Management Systems.

EPA 2001. EPA Requirements for Quality Management Plans. EPA QA/R-2. EPA/240/B-01/002

ANSI/ASQC E4-1994. Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs. American National Standard.

State of Florida
Department of Health, Bureau of Public Health Laboratories
This is to certify that

E871007

SGS AXYS ANALYTICAL SERVICES LTD.
2045 MILLS ROAD WEST
SIDNEY, BRITISH COLUMBIA, CN V8L 5X2

has complied with Florida Administrative Code 64E-1,
for the examination of environmental samples in the following categories

NON-POTABLE WATER - EXTRACTABLE ORGANICS, NON-POTABLE WATER - PESTICIDES-HERBICIDES-PCB'S, SOLID AND CHEMICAL MATERIALS - EXTRACTABLE ORGANICS, SOLID AND CHEMICAL MATERIALS - PESTICIDES-HERBICIDES-PCB'S, BIOLOGICAL TISSUE - EXTRACTABLE ORGANICS

Continued certification is contingent upon successful on-going compliance with the NELAC Standards and FAC Rule 64E-1 regulations. Specific methods and analytes certified are cited on the Laboratory Scope of Accreditation for this laboratory and are on file at the Bureau of Public Health Laboratories, P. O. Box 210, Jacksonville, Florida 32231. Clients and customers are urged to verify with this agency the laboratory's certification status in Florida for particular methods and analytes.

Date Issued: July 01, 2018 Expiration Date: June 30, 2019

Patty A. Lewandowski, MBA, MT(ASCP)
Chief Bureau of Public Health Laboratories
DH Form 1697, 7/04
NON-TRANSFERABLE E871007-25-07/01/2018
Supersedes all previously issued certificates

Attachment to Certificate #: E871007-25, expiration date June 30, 2019. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E871007** EPA Lab Code: **MC00000** **(250) 655-5800**

E871007
SGS AXYS Analytical Services Ltd.
2045 Mills Road West
Sidney, British Columbia, CN V8L 5X2

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	EPA 1613	Extractable Organics	NELAP	1/1/2007
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	EPA 8290	Extractable Organics	NELAP	1/1/2007
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	EPA 1613	Extractable Organics	NELAP	1/1/2007
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	EPA 8290	Extractable Organics	NELAP	1/1/2007
1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)	EPA 1613	Extractable Organics	NELAP	1/1/2007
1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)	EPA 8290	Extractable Organics	NELAP	1/1/2007
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)	EPA 1613	Extractable Organics	NELAP	1/1/2007
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)	EPA 8290	Extractable Organics	NELAP	1/1/2007
1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)	EPA 1613	Extractable Organics	NELAP	1/1/2007
1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)	EPA 8290	Extractable Organics	NELAP	1/1/2007
1,2,3,4,7,8-Hxcdd	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
1,2,3,4,7,8-Hxcdd	EPA 1613	Extractable Organics	NELAP	1/1/2007
1,2,3,4,7,8-Hxcdd	EPA 8290	Extractable Organics	NELAP	1/1/2007
1,2,3,4,7,8-Hxcdf	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
1,2,3,4,7,8-Hxcdf	EPA 1613	Extractable Organics	NELAP	1/1/2007
1,2,3,4,7,8-Hxcdf	EPA 8290	Extractable Organics	NELAP	1/1/2007
1,2,3,6,7,8-Hxcdd	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
1,2,3,6,7,8-Hxcdd	EPA 1613	Extractable Organics	NELAP	1/1/2007
1,2,3,6,7,8-Hxcdd	EPA 8290	Extractable Organics	NELAP	1/1/2007
1,2,3,6,7,8-Hxcdf	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
1,2,3,6,7,8-Hxcdf	EPA 1613	Extractable Organics	NELAP	1/1/2007
1,2,3,6,7,8-Hxcdf	EPA 8290	Extractable Organics	NELAP	1/1/2007
1,2,3,7,8,9-Hxcdd	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007

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State Laboratory ID: **E871007** EPA Lab Code: **MC00000** **(250) 655-5800**

E871007
SGS AXYS Analytical Services Ltd.
2045 Mills Road West
Sidney, British Columbia, CN V8L 5X2

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,2,3,7,8,9-Hxcdd	EPA 1613	Extractable Organics	NELAP	1/1/2007
1,2,3,7,8,9-Hxcdd	EPA 8290	Extractable Organics	NELAP	1/1/2007
1,2,3,7,8,9-Hxcdf	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
1,2,3,7,8,9-Hxcdf	EPA 1613	Extractable Organics	NELAP	1/1/2007
1,2,3,7,8,9-Hxcdf	EPA 8290	Extractable Organics	NELAP	1/1/2007
1,2,3,7,8-Pecdd	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
1,2,3,7,8-Pecdd	EPA 1613	Extractable Organics	NELAP	1/1/2007
1,2,3,7,8-Pecdd	EPA 8290	Extractable Organics	NELAP	1/1/2007
1,2,3,7,8-Pecdf	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
1,2,3,7,8-Pecdf	EPA 1613	Extractable Organics	NELAP	1/1/2007
1,2,3,7,8-Pecdf	EPA 8290	Extractable Organics	NELAP	1/1/2007
1H, 1H, 2H, 2H-Perfluorodecane Sulfonate (8:2 Fluorotelomersulfonate, 8:2FTS)	AXYS MLA-110/LC-MS-MS	Extractable Organics	NELAP	6/19/2017
1H, 1H, 2H, 2H-Perfluorohexane Sulfonate (4:2 Fluorotelomersulfonate 4:2FTS)	AXYS MLA-110/LC-MS-MS	Extractable Organics	NELAP	6/19/2017
1H, 1H, 2H, 2H-Perfluorooctane Sulfonate (6:2 Fluorotelomersulfonate, 6:2FTS)	AXYS MLA-110/LC-MS-MS	Extractable Organics	NELAP	6/19/2017
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ 206)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ 206)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,4',5,5'-Octachlorobiphenyl (BZ 194)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,4',5,5'-Octachlorobiphenyl (BZ 194)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl (BZ 207)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl (BZ 207)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ 195)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ 195)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,4',5,6'-Octachlorobiphenyl (BZ 196)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,4',5,6'-Octachlorobiphenyl (BZ 196)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ 170)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ 170)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,4',6,6'-Octachlorobiphenyl (BZ 197)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,4',6,6'-Octachlorobiphenyl (BZ 197)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,4',6-Heptachlorobiphenyl (BZ 171)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,4',6-Heptachlorobiphenyl (BZ 171)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014

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State Laboratory ID: **E871007** EPA Lab Code: **MC00000** **(250) 655-5800**

E871007
SGS AXYS Analytical Services Ltd.
2045 Mills Road West
Sidney, British Columbia, CN V8L 5X2

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,2',3,3',4,4'-Hexachlorobiphenyl (BZ 128)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,4'-Hexachlorobiphenyl (BZ 128)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,5,5',6,6'-Nonachlorobiphenyl (BZ 208)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,5,5',6,6'-Nonachlorobiphenyl (BZ 208)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,5,5',6-Octachlorobiphenyl (BZ 198)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,5,5',6-Octachlorobiphenyl (BZ 198)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,5,5',6'-Octachlorobiphenyl (BZ 199)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,5,5',6'-Octachlorobiphenyl (BZ 199)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,5,5'-Heptachlorobiphenyl (BZ 172)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,5,5'-Heptachlorobiphenyl (BZ 172)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,5,6,6'-Octachlorobiphenyl (BZ 200)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,5,6,6'-Octachlorobiphenyl (BZ 200)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,5',6,6'-Octachlorobiphenyl (BZ 201)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,5',6,6'-Octachlorobiphenyl (BZ 201)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,5,6-Heptachlorobiphenyl (BZ 173)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,5,6-Heptachlorobiphenyl (BZ 173)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,5,6'-Heptachlorobiphenyl (BZ 174)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,5,6'-Heptachlorobiphenyl (BZ 174)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,5',6-Heptachlorobiphenyl (BZ 175)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,5',6-Heptachlorobiphenyl (BZ 175)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,5',6'-Heptachlorobiphenyl (BZ 177)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,5',6'-Heptachlorobiphenyl (BZ 177)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,5-Hexachlorobiphenyl (BZ 129)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,5-Hexachlorobiphenyl (BZ 129)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,5'-Hexachlorobiphenyl (BZ 130)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,5'-Hexachlorobiphenyl (BZ 130)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,6,6'-Heptachlorobiphenyl (BZ 176)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,6,6'-Heptachlorobiphenyl (BZ 176)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,6-Hexachlorobiphenyl (BZ 131)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,6-Hexachlorobiphenyl (BZ 131)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014

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E871007
SGS AXYS Analytical Services Ltd.
2045 Mills Road West
Sidney, British Columbia, CN V8L 5X2

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,2',3,3',4,6'-Hexachlorobiphenyl (BZ 132)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,6'-Hexachlorobiphenyl (BZ 132)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4-Pentachlorobiphenyl (BZ 82)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4-Pentachlorobiphenyl (BZ 82)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',5,5',6,6'-Octachlorobiphenyl (BZ 202)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',5,5',6,6'-Octachlorobiphenyl (BZ 202)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',5,5',6-Heptachlorobiphenyl (BZ 178)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',5,5',6-Heptachlorobiphenyl (BZ 178)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',5,5'-Hexachlorobiphenyl (BZ 133)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',5,5'-Hexachlorobiphenyl (BZ 133)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',5,6,6'-Heptachlorobiphenyl (BZ 179)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',5,6,6'-Heptachlorobiphenyl (BZ 179)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',5,6-Hexachlorobiphenyl (BZ 134)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',5,6-Hexachlorobiphenyl (BZ 134)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',5,6'-Hexachlorobiphenyl (BZ 135)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',5,6'-Hexachlorobiphenyl (BZ 135)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',5-Pentachlorobiphenyl (BZ 83)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',5-Pentachlorobiphenyl (BZ 83)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',6,6'-Hexachlorobiphenyl (BZ 136)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',6,6'-Hexachlorobiphenyl (BZ 136)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',6-Pentachlorobiphenyl (BZ 84)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',6-Pentachlorobiphenyl (BZ 84)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3'-Tetrachlorobiphenyl (BZ 40)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3'-Tetrachlorobiphenyl (BZ 40)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,4',5,5',6-Octachlorobiphenyl (BZ 203)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,4',5,5',6-Octachlorobiphenyl (BZ 203)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ 180)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ 180)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,4',5,6,6'-Octachlorobiphenyl (BZ 204)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,4',5,6,6'-Octachlorobiphenyl (BZ 204)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014

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E871007
SGS AXYS Analytical Services Ltd.
2045 Mills Road West
Sidney, British Columbia, CN V8L 5X2

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,2',3,4,4',5,6-Heptachlorobiphenyl (BZ 181)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,4',5,6-Heptachlorobiphenyl (BZ 181)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,4',5,6'-Heptachlorobiphenyl (BZ 182)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,4',5,6'-Heptachlorobiphenyl (BZ 182)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ 183)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ 183)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,4',5-Hexachlorobiphenyl (BZ 137)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,4',5-Hexachlorobiphenyl (BZ 137)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,4',5'-Hexachlorobiphenyl (BZ 138)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,4',5'-Hexachlorobiphenyl (BZ 138)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,4',6,6'-Heptachlorobiphenyl (BZ 184)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,4',6,6'-Heptachlorobiphenyl (BZ 184)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,4',6-Hexachlorobiphenyl (BZ 139)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,4',6-Hexachlorobiphenyl (BZ 139)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,4',6'-Hexachlorobiphenyl (BZ 140)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,4',6'-Hexachlorobiphenyl (BZ 140)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,4'-Pentachlorobiphenyl (BZ 85)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,4'-Pentachlorobiphenyl (BZ 85)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,5,5',6-Heptachlorobiphenyl (BZ 185)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,5,5',6-Heptachlorobiphenyl (BZ 185)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ 187)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ 187)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,5,5'-Hexachlorobiphenyl (BZ 141)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,5,5'-Hexachlorobiphenyl (BZ 141)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4',5,5'-Hexachlorobiphenyl (BZ 146)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4',5,5'-Hexachlorobiphenyl (BZ 146)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,5,6,6'-Heptachlorobiphenyl (BZ 186)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,5,6,6'-Heptachlorobiphenyl (BZ 186)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4',5,6,6'-Heptachlorobiphenyl (BZ 188)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4',5,6,6'-Heptachlorobiphenyl (BZ 188)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014

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State Laboratory ID: **E871007** EPA Lab Code: **MC00000** **(250) 655-5800**

E871007
SGS AXYS Analytical Services Ltd.
2045 Mills Road West
Sidney, British Columbia, CN V8L 5X2

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,2',3,4,5,6-Hexachlorobiphenyl (BZ 142)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,5,6-Hexachlorobiphenyl (BZ 142)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,5,6'-Hexachlorobiphenyl (BZ 143)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,5,6'-Hexachlorobiphenyl (BZ 143)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,5',6-Hexachlorobiphenyl (BZ 144)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,5',6-Hexachlorobiphenyl (BZ 144)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4',5,6-Hexachlorobiphenyl (BZ 147)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4',5,6-Hexachlorobiphenyl (BZ 147)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4',5,6'-Hexachlorobiphenyl (BZ 148)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4',5,6'-Hexachlorobiphenyl (BZ 148)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4',5',6-Hexachlorobiphenyl (BZ 149)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4',5',6-Hexachlorobiphenyl (BZ 149)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,5-Pentachlorobiphenyl (BZ 86)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,5-Pentachlorobiphenyl (BZ 86)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,5'-Pentachlorobiphenyl (BZ 87)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,5'-Pentachlorobiphenyl (BZ 87)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4',5-Pentachlorobiphenyl (BZ 90)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4',5-Pentachlorobiphenyl (BZ 90)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4',5'-Pentachlorobiphenyl (BZ 97)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4',5'-Pentachlorobiphenyl (BZ 97)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,6,6'-Hexachlorobiphenyl (BZ 145)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,6,6'-Hexachlorobiphenyl (BZ 145)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4',6,6'-Hexachlorobiphenyl (BZ 150)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4',6,6'-Hexachlorobiphenyl (BZ 150)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,6-Pentachlorobiphenyl (BZ 88)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,6-Pentachlorobiphenyl (BZ 88)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,6'-Pentachlorobiphenyl (BZ 89)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,6'-Pentachlorobiphenyl (BZ 89)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4',6-Pentachlorobiphenyl (BZ 91)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4',6-Pentachlorobiphenyl (BZ 91)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014

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E871007
SGS AXYS Analytical Services Ltd.
2045 Mills Road West
Sidney, British Columbia, CN V8L 5X2

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,2',3,4',6'-Pentachlorobiphenyl (BZ 98)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4',6'-Pentachlorobiphenyl (BZ 98)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4-Tetrachlorobiphenyl (BZ 41)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4-Tetrachlorobiphenyl (BZ 41)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4'-Tetrachlorobiphenyl (BZ 42)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4'-Tetrachlorobiphenyl (BZ 42)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,5,5',6-Hexachlorobiphenyl (BZ 151)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,5,5',6-Hexachlorobiphenyl (BZ 151)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,5,5'-Pentachlorobiphenyl (BZ 92)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,5,5'-Pentachlorobiphenyl (BZ 92)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,5,6,6'-Hexachlorobiphenyl (BZ 152)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,5,6,6'-Hexachlorobiphenyl (BZ 152)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,5,6-Pentachlorobiphenyl (BZ 93)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,5,6-Pentachlorobiphenyl (BZ 93)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,5,6'-Pentachlorobiphenyl (BZ 94)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,5,6'-Pentachlorobiphenyl (BZ 94)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,5',6-Pentachlorobiphenyl (BZ 95)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,5',6-Pentachlorobiphenyl (BZ 95)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,5-Tetrachlorobiphenyl (BZ 43)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,5-Tetrachlorobiphenyl (BZ 43)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,5'-Tetrachlorobiphenyl (BZ 44)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,5'-Tetrachlorobiphenyl (BZ 44)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,6,6'-Pentachlorobiphenyl (BZ 96)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,6,6'-Pentachlorobiphenyl (BZ 96)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,6-Tetrachlorobiphenyl (BZ 45)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,6-Tetrachlorobiphenyl (BZ 45)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,6'-Tetrachlorobiphenyl (BZ 46)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,6'-Tetrachlorobiphenyl (BZ 46)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3-Trichlorobiphenyl (BZ 16)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3-Trichlorobiphenyl (BZ 16)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014

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State Laboratory ID: **E871007** EPA Lab Code: **MC00000** **(250) 655-5800**

E871007
SGS AXYS Analytical Services Ltd.
2045 Mills Road West
Sidney, British Columbia, CN V8L 5X2

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,2',4,4',5,5'-Hexachlorobiphenyl (BZ 153)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,4',5,5'-Hexachlorobiphenyl (BZ 153)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,4',5,6'-Hexachlorobiphenyl (BZ 154)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,4',5,6'-Hexachlorobiphenyl (BZ 154)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,4',5-Pentachlorobiphenyl (BZ 99)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,4',5-Pentachlorobiphenyl (BZ 99)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,4',6,6'-Hexachlorobiphenyl (BZ 155)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,4',6,6'-Hexachlorobiphenyl (BZ 155)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,4',6-Pentachlorobiphenyl (BZ 100)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,4',6-Pentachlorobiphenyl (BZ 100)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,4'-Tetrachlorobiphenyl (BZ 47)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,4'-Tetrachlorobiphenyl (BZ 47)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,5,5'-Pentachlorobiphenyl (BZ 101)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,5,5'-Pentachlorobiphenyl (BZ 101)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,5,6'-Pentachlorobiphenyl (BZ 102)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,5,6'-Pentachlorobiphenyl (BZ 102)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,5',6-Pentachlorobiphenyl (BZ 103)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,5',6-Pentachlorobiphenyl (BZ 103)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,5-Tetrachlorobiphenyl (BZ 48)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,5-Tetrachlorobiphenyl (BZ 48)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,5'-Tetrachlorobiphenyl (BZ 49)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,5'-Tetrachlorobiphenyl (BZ 49)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,6,6'-Pentachlorobiphenyl (BZ 104)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,6,6'-Pentachlorobiphenyl (BZ 104)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,6-Tetrachlorobiphenyl (BZ 50)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,6-Tetrachlorobiphenyl (BZ 50)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,6'-Tetrachlorobiphenyl (BZ 51)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,6'-Tetrachlorobiphenyl (BZ 51)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4-Trichlorobiphenyl (BZ 17)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4-Trichlorobiphenyl (BZ 17)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014

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E871007
SGS AXYS Analytical Services Ltd.
2045 Mills Road West
Sidney, British Columbia, CN V8L 5X2

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,2',5,5'-Tetrachlorobiphenyl (BZ 52)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',5,5'-Tetrachlorobiphenyl (BZ 52)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',5,6'-Tetrachlorobiphenyl (BZ 53)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',5,6'-Tetrachlorobiphenyl (BZ 53)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',5-Trichlorobiphenyl (BZ 18)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',5-Trichlorobiphenyl (BZ 18)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',6,6'-Tetrachlorobiphenyl (BZ 54)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',6,6'-Tetrachlorobiphenyl (BZ 54)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',6-Trichlorobiphenyl (BZ 19)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',6-Trichlorobiphenyl (BZ 19)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2'-Dichlorobiphenyl (BZ 4)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2'-Dichlorobiphenyl (BZ 4)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,4',5,5',6-Octachlorobiphenyl (BZ 205)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,4',5,5',6-Octachlorobiphenyl (BZ 205)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,4',5,5'-Heptachlorobiphenyl (BZ 189)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,4',5,5'-Heptachlorobiphenyl (BZ 189)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,4',5,6-Heptachlorobiphenyl (BZ 190)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,4',5,6-Heptachlorobiphenyl (BZ 190)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,4',5',6-Heptachlorobiphenyl (BZ 191)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,4',5',6-Heptachlorobiphenyl (BZ 191)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,4',5-Hexachlorobiphenyl (BZ 156)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,4',5-Hexachlorobiphenyl (BZ 156)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,4',5'-Hexachlorobiphenyl (BZ 157)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,4',5'-Hexachlorobiphenyl (BZ 157)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,4',6-Hexachlorobiphenyl (BZ 158)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,4',6-Hexachlorobiphenyl (BZ 158)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,4'-Pentachlorobiphenyl (BZ 105)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,4'-Pentachlorobiphenyl (BZ 105)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,5,5',6-Heptachlorobiphenyl (BZ 192)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,5,5',6-Heptachlorobiphenyl (BZ 192)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014

Attachment to Certificate #: E871007-25, expiration date June 30, 2019. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E871007** EPA Lab Code: **MC00000** **(250) 655-5800**

E871007
SGS AXYS Analytical Services Ltd.
2045 Mills Road West
Sidney, British Columbia, CN V8L 5X2

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,3,3',4',5,5',6-Heptachlorobiphenyl (BZ 193)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4',5,5',6-Heptachlorobiphenyl (BZ 193)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,5,5'-Hexachlorobiphenyl (BZ 159)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,5,5'-Hexachlorobiphenyl (BZ 159)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4',5,5'-Hexachlorobiphenyl (BZ 162)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4',5,5'-Hexachlorobiphenyl (BZ 162)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,5,6-Hexachlorobiphenyl (BZ 160)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,5,6-Hexachlorobiphenyl (BZ 160)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,5',6-Hexachlorobiphenyl (BZ 161)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,5',6-Hexachlorobiphenyl (BZ 161)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4',5,6-Hexachlorobiphenyl (BZ 163)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4',5,6-Hexachlorobiphenyl (BZ 163)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4',5',6-Hexachlorobiphenyl (BZ 164)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4',5',6-Hexachlorobiphenyl (BZ 164)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,5-Pentachlorobiphenyl (BZ 106)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,5-Pentachlorobiphenyl (BZ 106)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4',5-Pentachlorobiphenyl (BZ 107)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4',5-Pentachlorobiphenyl (BZ 107)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,5'-Pentachlorobiphenyl (BZ 108)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,5'-Pentachlorobiphenyl (BZ 108)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4',5'-Pentachlorobiphenyl (BZ 122)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4',5'-Pentachlorobiphenyl (BZ 122)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,6-Pentachlorobiphenyl (BZ 109)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,6-Pentachlorobiphenyl (BZ 109)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4',6-Pentachlorobiphenyl (BZ 110)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4',6-Pentachlorobiphenyl (BZ 110)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4-Tetrachlorobiphenyl (BZ 55)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4-Tetrachlorobiphenyl (BZ 55)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4'-Tetrachlorobiphenyl (BZ 56)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4'-Tetrachlorobiphenyl (BZ 56)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014

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E871007
SGS AXYS Analytical Services Ltd.
2045 Mills Road West
Sidney, British Columbia, CN V8L 5X2

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,3,3',5,5',6-Hexachlorobiphenyl (BZ 165)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',5,5',6-Hexachlorobiphenyl (BZ 165)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',5,5'-Pentachlorobiphenyl (BZ 111)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',5,5'-Pentachlorobiphenyl (BZ 111)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',5,6-Pentachlorobiphenyl (BZ 112)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',5,6-Pentachlorobiphenyl (BZ 112)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',5',6-Pentachlorobiphenyl (BZ 113)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',5',6-Pentachlorobiphenyl (BZ 113)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',5-Tetrachlorobiphenyl (BZ 57)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',5-Tetrachlorobiphenyl (BZ 57)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',5'-Tetrachlorobiphenyl (BZ 58)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',5'-Tetrachlorobiphenyl (BZ 58)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',6-Tetrachlorobiphenyl (BZ 59)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',6-Tetrachlorobiphenyl (BZ 59)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3'-Trichlorobiphenyl (BZ 20)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3'-Trichlorobiphenyl (BZ 20)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4,4',5,5'-Hexachlorobiphenyl (BZ 167)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4,4',5,5'-Hexachlorobiphenyl (BZ 167)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,4,4',5,6-Hexachlorobiphenyl (BZ 166)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,4,4',5,6-Hexachlorobiphenyl (BZ 166)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4,4',5',6-Hexachlorobiphenyl (BZ 168)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4,4',5',6-Hexachlorobiphenyl (BZ 168)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,4,4',5-Pentachlorobiphenyl (BZ 114)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,4,4',5-Pentachlorobiphenyl (BZ 114)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4,4',5-Pentachlorobiphenyl (BZ 118)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4,4',5-Pentachlorobiphenyl (BZ 118)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4,4',5'-Pentachlorobiphenyl (BZ 123)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4,4',5'-Pentachlorobiphenyl (BZ 123)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,4,4',6-Pentachlorobiphenyl (BZ 115)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,4,4',6-Pentachlorobiphenyl (BZ 115)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014

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E871007
SGS AXYS Analytical Services Ltd.
2045 Mills Road West
Sidney, British Columbia, CN V8L 5X2

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,3',4,4',6-Pentachlorobiphenyl (BZ 119)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4,4',6-Pentachlorobiphenyl (BZ 119)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,4,4'-Tetrachlorobiphenyl (BZ 60)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,4,4'-Tetrachlorobiphenyl (BZ 60)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4,4'-Tetrachlorobiphenyl (BZ 66)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4,4'-Tetrachlorobiphenyl (BZ 66)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4,5,5'-Pentachlorobiphenyl (BZ 120)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4,5,5'-Pentachlorobiphenyl (BZ 120)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2',3,4,5,5'-Pentachlorobiphenyl (BZ 124)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4',5,5'-Pentachlorobiphenyl (BZ 124)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4',5,5'-Pentachlorobiphenyl (BZ 124)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,4,5,6-Pentachlorobiphenyl (BZ 116)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,4,5,6-Pentachlorobiphenyl (BZ 116)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,4',5,6-Pentachlorobiphenyl (BZ 117)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,4',5,6-Pentachlorobiphenyl (BZ 117)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4,5',6-Pentachlorobiphenyl (BZ 121)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4,5',6-Pentachlorobiphenyl (BZ 121)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4',5',6-Pentachlorobiphenyl (BZ 125)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4',5',6-Pentachlorobiphenyl (BZ 125)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,4,5-Tetrachlorobiphenyl (BZ 61)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,4,5-Tetrachlorobiphenyl (BZ 61)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,4',5-Tetrachlorobiphenyl (BZ 63)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,4',5-Tetrachlorobiphenyl (BZ 63)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4,5-Tetrachlorobiphenyl (BZ 67)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4,5-Tetrachlorobiphenyl (BZ 67)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4,5'-Tetrachlorobiphenyl (BZ 68)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4,5'-Tetrachlorobiphenyl (BZ 68)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4',5-Tetrachlorobiphenyl (BZ 70)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4',5-Tetrachlorobiphenyl (BZ 70)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014

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E871007
SGS AXYS Analytical Services Ltd.
2045 Mills Road West
Sidney, British Columbia, CN V8L 5X2

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,3',4',5'-Tetrachlorobiphenyl (BZ 76)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4',5'-Tetrachlorobiphenyl (BZ 76)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,4,6,7,8-Hxcdf	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
2,3,4,6,7,8-Hxcdf	EPA 1613	Extractable Organics	NELAP	1/1/2007
2,3,4,6,7,8-Hxcdf	EPA 8290	Extractable Organics	NELAP	1/1/2007
2,3,4,6-Tetrachlorobiphenyl (BZ 62)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,4,6-Tetrachlorobiphenyl (BZ 62)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,4',6-Tetrachlorobiphenyl (BZ 64)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,4',6-Tetrachlorobiphenyl (BZ 64)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4,6-Tetrachlorobiphenyl (BZ 69)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4,6-Tetrachlorobiphenyl (BZ 69)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4',6-Tetrachlorobiphenyl (BZ 71)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4',6-Tetrachlorobiphenyl (BZ 71)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,4,7,8-Pecdf	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
2,3,4,7,8-Pecdf	EPA 1613	Extractable Organics	NELAP	1/1/2007
2,3,4,7,8-Pecdf	EPA 8290	Extractable Organics	NELAP	1/1/2007
2,3,4-Trichlorobiphenyl (BZ 21)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,4-Trichlorobiphenyl (BZ 21)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,4'-Trichlorobiphenyl (BZ 22)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,4'-Trichlorobiphenyl (BZ 22)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4-Trichlorobiphenyl (BZ 25)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4-Trichlorobiphenyl (BZ 25)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4'-Trichlorobiphenyl (BZ 33)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4'-Trichlorobiphenyl (BZ 33)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',5,5'-Tetrachlorobiphenyl (BZ 72)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',5,5'-Tetrachlorobiphenyl (BZ 72)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,5,6-Tetrachlorobiphenyl (BZ 65)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,5,6-Tetrachlorobiphenyl (BZ 65)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',5',6-Tetrachlorobiphenyl (BZ 73)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',5',6-Tetrachlorobiphenyl (BZ 73)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014

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E871007
SGS AXYS Analytical Services Ltd.
2045 Mills Road West
Sidney, British Columbia, CN V8L 5X2

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,3,5-Trichlorobiphenyl (BZ 23)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,5-Trichlorobiphenyl (BZ 23)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',5-Trichlorobiphenyl (BZ 26)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',5-Trichlorobiphenyl (BZ 26)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',5'-Trichlorobiphenyl (BZ 34)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',5'-Trichlorobiphenyl (BZ 34)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,6-Trichlorobiphenyl (BZ 24)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,6-Trichlorobiphenyl (BZ 24)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',6-Trichlorobiphenyl (BZ 27)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',6-Trichlorobiphenyl (BZ 27)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,7,8-TCDD	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
2,3,7,8-TCDD (Dioxin, 2,3,7,8-Tetrachlorodibenzo-p-dioxin)	EPA 1613	Extractable Organics	NELAP	1/1/2007
2,3,7,8-TCDD (Dioxin, 2,3,7,8-Tetrachlorodibenzo-p-dioxin)	EPA 8290	Extractable Organics	NELAP	1/1/2007
2,3,7,8-TCDF	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
2,3,7,8-TCDF	EPA 1613	Extractable Organics	NELAP	1/1/2007
2,3,7,8-TCDF	EPA 8290	Extractable Organics	NELAP	1/1/2007
2,3-Dichlorobiphenyl (BZ 5)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3-Dichlorobiphenyl (BZ 5)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3'-Dichlorobiphenyl (BZ 6)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3'-Dichlorobiphenyl (BZ 6)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,4,4',5-Tetrachlorobiphenyl (BZ 74)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,4,4',5-Tetrachlorobiphenyl (BZ 74)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,4,4',6-Tetrachlorobiphenyl (BZ 75)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,4,4',6-Tetrachlorobiphenyl (BZ 75)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,4,4'-Trichlorobiphenyl (BZ 28)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,4,4'-Trichlorobiphenyl (BZ 28)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,4,5-Trichlorobiphenyl (BZ 29)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,4,5-Trichlorobiphenyl (BZ 29)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,4',5-Trichlorobiphenyl (BZ 31)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014

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State Laboratory ID: **E871007** EPA Lab Code: **MC00000** **(250) 655-5800**

E871007
SGS AXYS Analytical Services Ltd.
2045 Mills Road West
Sidney, British Columbia, CN V8L 5X2

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,4',5-Trichlorobiphenyl (BZ 31)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,4,6-Trichlorobiphenyl (BZ 30)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,4,6-Trichlorobiphenyl (BZ 30)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,4',6-Trichlorobiphenyl (BZ 32)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,4',6-Trichlorobiphenyl (BZ 32)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,4'-DDD	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
2,4'-DDD	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
2,4'-DDD	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
2,4'-DDD	EPA 625	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
2,4'-DDE	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
2,4'-DDE	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
2,4'-DDE	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
2,4'-DDE	EPA 625	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
2,4'-DDT	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
2,4'-DDT	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
2,4'-DDT	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
2,4'-DDT	EPA 625	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
2,4-Dichlorobiphenyl (BZ 7)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,4-Dichlorobiphenyl (BZ 7)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,4'-Dichlorobiphenyl (BZ 8)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,4'-Dichlorobiphenyl (BZ 8)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,5-Dichlorobiphenyl (BZ 9)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,5-Dichlorobiphenyl (BZ 9)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,6-Dichlorobiphenyl (BZ 10)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,6-Dichlorobiphenyl (BZ 10)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2-Chlorobiphenyl (BZ 1)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2-Chlorobiphenyl (BZ 1)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2-Methylnaphthalene	AXYS SOP MLA-021/GC-MS	Extractable Organics	NELAP	3/13/2014
2-Methylnaphthalene	EPA 8270	Extractable Organics	NELAP	3/13/2014
3,3',4,4',5,5'-Hexachlorobiphenyl (BZ 169)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014

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E871007
SGS AXYS Analytical Services Ltd.
2045 Mills Road West
Sidney, British Columbia, CN V8L 5X2

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
3,3',4,4',5,5'-Hexachlorobiphenyl (BZ 169)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,3',4,4',5-Pentachlorobiphenyl (BZ 126)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,3',4,4',5-Pentachlorobiphenyl (BZ 126)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,3',4,4'-Tetrachlorobiphenyl (BZ 77)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,3',4,4'-Tetrachlorobiphenyl (BZ 77)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,3',4,5,5'-Pentachlorobiphenyl (BZ 127)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,3',4,5,5'-Pentachlorobiphenyl (BZ 127)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,3',4,5-Tetrachlorobiphenyl (BZ 78)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,3',4,5-Tetrachlorobiphenyl (BZ 78)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,3',4,5'-Tetrachlorobiphenyl (BZ 79)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,3',4,5'-Tetrachlorobiphenyl (BZ 79)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,3',4-Trichlorobiphenyl (BZ 35)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,3',4-Trichlorobiphenyl (BZ 35)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,3',5,5'-Tetrachlorobiphenyl (BZ 80)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,3',5,5'-Tetrachlorobiphenyl (BZ 80)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,3',5-Trichlorobiphenyl (BZ 36)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,3',5-Trichlorobiphenyl (BZ 36)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,3'-Dichlorobiphenyl (BZ 11)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,3'-Dichlorobiphenyl (BZ 11)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,4,4',5-Tetrachlorobiphenyl (BZ 81)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,4,4',5-Tetrachlorobiphenyl (BZ 81)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,4,4'-Trichlorobiphenyl (BZ 37)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,4,4'-Trichlorobiphenyl (BZ 37)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,4,5-Trichlorobiphenyl (BZ 38)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,4,5-Trichlorobiphenyl (BZ 38)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,4',5-Trichlorobiphenyl (BZ 39)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,4',5-Trichlorobiphenyl (BZ 39)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,4-Dichlorobiphenyl (BZ 12)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,4-Dichlorobiphenyl (BZ 12)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,4'-Dichlorobiphenyl (BZ 13)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014

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E871007
SGS AXYS Analytical Services Ltd.
2045 Mills Road West
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Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
3,4'-Dichlorobiphenyl (BZ 13)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,5-Dichlorobiphenyl (BZ 14)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,5-Dichlorobiphenyl (BZ 14)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3-Chlorobiphenyl (BZ 2)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3-Chlorobiphenyl (BZ 2)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
4,4'-DDD	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
4,4'-DDD	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
4,4'-DDD	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
4,4'-DDD	EPA 625	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
4,4'-DDE	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
4,4'-DDE	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
4,4'-DDE	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
4,4'-DDE	EPA 625	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
4,4'-DDT	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
4,4'-DDT	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
4,4'-DDT	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
4,4'-DDT	EPA 625	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
4,4'-Dichlorobiphenyl (BZ 15)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
4,4'-Dichlorobiphenyl (BZ 15)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
4-Chlorobiphenyl (BZ 3)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
4-Chlorobiphenyl (BZ 3)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Acenaphthene	AXYS SOP MLA-021/GC-MS	Extractable Organics	NELAP	3/13/2014
Acenaphthene	EPA 1625	Extractable Organics	NELAP	3/13/2014
Acenaphthylene	AXYS SOP MLA-021/GC-MS	Extractable Organics	NELAP	3/13/2014
Acenaphthylene	EPA 1625	Extractable Organics	NELAP	3/13/2014
Aldrin	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aldrin	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aldrin	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
Aldrin	EPA 625	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
alpha-BHC (alpha-Hexachlorocyclohexane)	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014

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2045 Mills Road West
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Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
alpha-BHC (alpha-Hexachlorocyclohexane)	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 625	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
alpha-Chlordane	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
alpha-Chlordane	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
alpha-Chlordane	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
alpha-Chlordane	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Anthracene	AXYS SOP MLA-021/GC-MS	Extractable Organics	NELAP	3/13/2014
Anthracene	EPA 1625	Extractable Organics	NELAP	3/13/2014
Aroclor-1016 (PCB-1016)	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1016 (PCB-1016)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1016 (PCB-1016)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1016 (PCB-1016)	EPA 625	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1221 (PCB-1221)	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1221 (PCB-1221)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1221 (PCB-1221)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1221 (PCB-1221)	EPA 625	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1232 (PCB-1232)	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1232 (PCB-1232)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1232 (PCB-1232)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1232 (PCB-1232)	EPA 625	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1242 (PCB-1242)	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1242 (PCB-1242)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1242 (PCB-1242)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1242 (PCB-1242)	EPA 625	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1248 (PCB-1248)	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1248 (PCB-1248)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1248 (PCB-1248)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1248 (PCB-1248)	EPA 625	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1254 (PCB-1254)	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014

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Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Aroclor-1254 (PCB-1254)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1254 (PCB-1254)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1254 (PCB-1254)	EPA 625	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1260 (PCB-1260)	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1260 (PCB-1260)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1260 (PCB-1260)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1260 (PCB-1260)	EPA 625	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Benzo(a)anthracene	AXYS SOP MLA-021/GC-MS	Extractable Organics	NELAP	3/13/2014
Benzo(a)anthracene	EPA 1625	Extractable Organics	NELAP	3/13/2014
Benzo(a)pyrene	AXYS SOP MLA-021/GC-MS	Extractable Organics	NELAP	3/13/2014
Benzo(a)pyrene	EPA 1625	Extractable Organics	NELAP	3/13/2014
Benzo(b)fluoranthene	AXYS SOP MLA-021/GC-MS	Extractable Organics	NELAP	3/13/2014
Benzo(b)fluoranthene	EPA 1625	Extractable Organics	NELAP	3/13/2014
Benzo(g,h,i)perylene	AXYS SOP MLA-021/GC-MS	Extractable Organics	NELAP	3/13/2014
Benzo(g,h,i)perylene	EPA 1625	Extractable Organics	NELAP	3/13/2014
Benzo(k)fluoranthene	AXYS SOP MLA-021/GC-MS	Extractable Organics	NELAP	3/13/2014
Benzo(k)fluoranthene	EPA 1625	Extractable Organics	NELAP	3/13/2014
beta-BHC (beta-Hexachlorocyclohexane)	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
beta-BHC (beta-Hexachlorocyclohexane)	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
beta-BHC (beta-Hexachlorocyclohexane)	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
beta-BHC (beta-Hexachlorocyclohexane)	EPA 625	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Chlordane (tech.)	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Chlordane (tech.)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Chrysene	AXYS SOP MLA-021/GC-MS	Extractable Organics	NELAP	3/13/2014
Chrysene	EPA 1625	Extractable Organics	NELAP	3/13/2014
cis-Nonachlor	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
cis-Nonachlor	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
cis-Nonachlor	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
cis-Nonachlor	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
Decachlorobiphenyl (BZ 209)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014

Attachment to Certificate #: E871007-25, expiration date June 30, 2019. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E871007** EPA Lab Code: **MC00000** **(250) 655-5800**

E871007
SGS AXYS Analytical Services Ltd.
2045 Mills Road West
Sidney, British Columbia, CN V8L 5X2

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Decachlorobiphenyl (BZ 209)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
delta-BHC	AXYS SOP MLA-007/GC-ECD	Pesticides-Herbicides-PCB's	NELAP	2/23/2015
delta-BHC	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
delta-BHC	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
delta-BHC	EPA 608	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Dibenz(a,h)anthracene	AXYS SOP MLA-021/GC-MS	Extractable Organics	NELAP	3/13/2014
Dibenz(a,h)anthracene	EPA 1625	Extractable Organics	NELAP	3/13/2014
Dieldrin	AXYS SOP MLA-007/GC-ECD	Pesticides-Herbicides-PCB's	NELAP	2/23/2015
Dieldrin	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Dieldrin	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
Dieldrin	EPA 608	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Endosulfan I	AXYS SOP MLA-007/GC-ECD	Pesticides-Herbicides-PCB's	NELAP	2/23/2015
Endosulfan I	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Endosulfan I	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
Endosulfan I	EPA 608	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Endosulfan II	AXYS SOP MLA-007/GC-ECD	Pesticides-Herbicides-PCB's	NELAP	2/23/2015
Endosulfan II	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Endosulfan II	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
Endosulfan II	EPA 608	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Endosulfan sulfate	AXYS SOP MLA-007/GC-ECD	Pesticides-Herbicides-PCB's	NELAP	2/23/2015
Endosulfan sulfate	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Endosulfan sulfate	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
Endosulfan sulfate	EPA 608	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Endrin	AXYS SOP MLA-007/GC-ECD	Pesticides-Herbicides-PCB's	NELAP	2/23/2015
Endrin	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Endrin	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
Endrin	EPA 608	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Endrin aldehyde	AXYS SOP MLA-007/GC-ECD	Pesticides-Herbicides-PCB's	NELAP	2/23/2015
Endrin aldehyde	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Endrin aldehyde	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015

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Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Endrin aldehyde	EPA 608	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Endrin ketone	AXYS SOP MLA-007/GC-ECD	Pesticides-Herbicides-PCB's	NELAP	2/23/2015
Endrin ketone	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
Endrin ketone	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
Fluoranthene	AXYS SOP MLA-021/GC-MS	Extractable Organics	NELAP	3/13/2014
Fluoranthene	EPA 1625	Extractable Organics	NELAP	3/13/2014
Fluorene	AXYS SOP MLA-021/GC-MS	Extractable Organics	NELAP	3/13/2014
Fluorene	EPA 1625	Extractable Organics	NELAP	3/13/2014
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 625	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
gamma-Chlordane	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
gamma-Chlordane	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
gamma-Chlordane	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
gamma-Chlordane	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Heptachlor	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Heptachlor	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Heptachlor	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
Heptachlor	EPA 625	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Heptachlor epoxide	AXYS SOP MLA-007/GC-ECD	Pesticides-Herbicides-PCB's	NELAP	2/23/2015
Heptachlor epoxide	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Heptachlor epoxide	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
Heptachlor epoxide	EPA 608	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Hexachlorobenzene	AXYS SOP MLA-007/GC-MS	Extractable Organics	NELAP	3/13/2014
Hexachlorobenzene	AXYS SOP MLA-028/GC-HRMS	Extractable Organics	NELAP	3/13/2014
Hexachlorobenzene	EPA 1625	Extractable Organics	NELAP	3/13/2014
Hexachlorobenzene	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
Indeno(1,2,3-cd)pyrene	AXYS SOP MLA-021/GC-MS	Extractable Organics	NELAP	3/13/2014

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Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Indeno(1,2,3-cd)pyrene	EPA 1625	Extractable Organics	NELAP	3/13/2014
Methoxychlor	AXYS SOP MLA-007/GC-ECD	Pesticides-Herbicides-PCB's	NELAP	2/23/2015
Methoxychlor	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Methoxychlor	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
Methoxychlor	EPA 608	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Mirex	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Mirex	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Mirex	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
Mirex	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Naphthalene	AXYS SOP MLA-021/GC-MS	Extractable Organics	NELAP	3/13/2014
Naphthalene	EPA 1625	Extractable Organics	NELAP	3/13/2014
N-Ethylperfluorooctane sulfonamide (EtFOSA)	AXYS MLA-110/LC-MS-MS	Extractable Organics	NELAP	6/19/2017
N-Methylperfluorooctane sulfonamide (MeFOSA)	AXYS MLA-110/LC-MS-MS	Extractable Organics	NELAP	6/19/2017
Oxychlordane	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
Oxychlordane	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
Oxychlordane	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
Oxychlordane	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
Perfluorobutane sulfonate (PFBS, perfluorobutane sulfonic acid)	AXYS MLA-110/LC-MS-MS	Extractable Organics	NELAP	6/19/2017
Perfluorobutane sulfonate (PFBS, perfluorobutane sulfonic acid)	AXYS SOP MLA-060/HPLC-MS-MS	Extractable Organics	NELAP	1/1/2007
Perfluorobutanoate (PFBA, perfluorobutyric acid)	AXYS MLA-110/LC-MS-MS	Extractable Organics	NELAP	6/19/2017
Perfluorobutanoate (PFBA, perfluorobutyric acid)	AXYS SOP MLA-060/HPLC-MS-MS	Extractable Organics	NELAP	1/1/2007
Perfluorodecane sulfonate (PFDS, perfluorodecane sulfonic acid)	AXYS MLA-110/LC-MS-MS	Extractable Organics	NELAP	6/19/2017
Perfluorodecanoate (PFDA, perfluorodecanoic acid)	AXYS MLA-110/LC-MS-MS	Extractable Organics	NELAP	6/19/2017
Perfluorodecanoate (PFDA, perfluorodecanoic acid)	AXYS SOP MLA-060/HPLC-MS-MS	Extractable Organics	NELAP	1/1/2007
Perfluorododecanoate (PFDoA, perfluorododecanoic acid)	AXYS MLA-110/LC-MS-MS	Extractable Organics	NELAP	6/19/2017
Perfluorododecanoate (PFDoA, perfluorododecanoic acid)	AXYS SOP MLA-060/HPLC-MS-MS	Extractable Organics	NELAP	1/1/2007
Perfluoroheptanesulfonic Acid (PFHpS)	AXYS MLA-110/LC-MS-MS	Extractable Organics	NELAP	6/19/2017

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2045 Mills Road West
Sidney, British Columbia, CN V8L 5X2

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Perfluoroheptanoate (PFHpA, perfluoroheptanoic acid)	AXYS MLA-110/LC-MS-MS	Extractable Organics	NELAP	6/19/2017
Perfluoroheptanoate (PFHpA, perfluoroheptanoic acid)	AXYS SOP MLA-060/HPLC-MS-MS	Extractable Organics	NELAP	1/1/2007
Perfluorohexane sulfonate (PFHxS, perfluorohexane sulfonic acid)	AXYS MLA-110/LC-MS-MS	Extractable Organics	NELAP	6/19/2017
Perfluorohexane sulfonate (PFHxS, perfluorohexane sulfonic acid)	AXYS SOP MLA-060/HPLC-MS-MS	Extractable Organics	NELAP	1/1/2007
Perfluorohexanoate (PFHxA, perfluorohexanoic acid)	AXYS MLA-110/LC-MS-MS	Extractable Organics	NELAP	6/19/2017
Perfluorohexanoate (PFHxA, perfluorohexanoic acid)	AXYS SOP MLA-060/HPLC-MS-MS	Extractable Organics	NELAP	1/1/2007
Perfluorononanesulfonate (PFNS, Perfluorononane sulfonate)	AXYS MLA-110/LC-MS-MS	Extractable Organics	NELAP	6/19/2017
Perfluorononanoate (PFNA, perfluorononanoic acid)	AXYS MLA-110/LC-MS-MS	Extractable Organics	NELAP	6/19/2017
Perfluorononanoate (PFNA, perfluorononanoic acid)	AXYS SOP MLA-060/HPLC-MS-MS	Extractable Organics	NELAP	1/1/2007
Perfluorooctane sulfonamide (PFOSA)	AXYS MLA-110/LC-MS-MS	Extractable Organics	NELAP	6/19/2017
Perfluorooctane sulfonamide (PFOSA)	AXYS SOP MLA-060/HPLC-MS-MS	Extractable Organics	NELAP	1/1/2007
Perfluorooctane sulfonate (PFOS, perfluorooctane sulfonic acid)	AXYS MLA-110/LC-MS-MS	Extractable Organics	NELAP	6/19/2017
Perfluorooctane sulfonate (PFOS, perfluorooctane sulfonic acid)	AXYS SOP MLA-060/HPLC-MS-MS	Extractable Organics	NELAP	1/1/2007
Perfluorooctanoate (PFOA, perfluorooctanoic acid)	AXYS MLA-110/LC-MS-MS	Extractable Organics	NELAP	6/19/2017
Perfluorooctanoate (PFOA, perfluorooctanoic acid)	AXYS SOP MLA-060/HPLC-MS-MS	Extractable Organics	NELAP	1/1/2007
Perfluoropentanoate (PFPeA, perfluoropentanoic acid))	AXYS MLA-110/LC-MS-MS	Extractable Organics	NELAP	6/19/2017
Perfluoropentanoate (PFPeA, perfluoropentanoic acid))	AXYS SOP MLA-060/HPLC-MS-MS	Extractable Organics	NELAP	1/1/2007
Perfluoropentansulfonate (PFPeS, Perfluoro-1-pentansulfonate)	AXYS MLA-110/LC-MS-MS	Extractable Organics	NELAP	6/19/2017
Perfluorotetradecanoate (PFTeDA, perfluorotetradecanoic acid)	AXYS MLA-110/LC-MS-MS	Extractable Organics	NELAP	6/19/2017
Perfluorotridecanoate (PFTriA, perfluorotridecanoic acid)	AXYS MLA-110/LC-MS-MS	Extractable Organics	NELAP	6/19/2017
Perfluoroundecanoate (PFUnA, perfluoroundecanoic acid)	AXYS MLA-110/LC-MS-MS	Extractable Organics	NELAP	6/19/2017
Perfluoroundecanoate (PFUnA, perfluoroundecanoic acid)	AXYS SOP MLA-060/HPLC-MS-MS	Extractable Organics	NELAP	1/1/2007
Phenanthrene	AXYS SOP MLA-021/GC-MS	Extractable Organics	NELAP	3/13/2014
Phenanthrene	EPA 1625	Extractable Organics	NELAP	3/13/2014
Pyrene	AXYS SOP MLA-021/GC-MS	Extractable Organics	NELAP	3/13/2014
Pyrene	EPA 1625	Extractable Organics	NELAP	3/13/2014

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E871007
SGS AXYS Analytical Services Ltd.
2045 Mills Road West
Sidney, British Columbia, CN V8L 5X2

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Total Heptachlorodibenzofuran	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
Total Heptachlorodibenzofuran	EPA 1613	Extractable Organics	NELAP	1/1/2007
Total Heptachlorodibenzofuran	EPA 8290	Extractable Organics	NELAP	1/1/2007
Total Heptachlorodibenzo-p-dioxin	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
Total Heptachlorodibenzo-p-dioxin	EPA 1613	Extractable Organics	NELAP	1/1/2007
Total Heptachlorodibenzo-p-dioxin	EPA 8290	Extractable Organics	NELAP	1/1/2007
Total Hexachlorodibenzofuran	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
Total Hexachlorodibenzofuran	EPA 1613	Extractable Organics	NELAP	1/1/2007
Total Hexachlorodibenzofuran	EPA 8290	Extractable Organics	NELAP	1/1/2007
Total Hexachlorodibenzo-p-dioxin	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
Total Hexachlorodibenzo-p-dioxin	EPA 1613	Extractable Organics	NELAP	1/1/2007
Total Hexachlorodibenzo-p-dioxin	EPA 8290	Extractable Organics	NELAP	1/1/2007
Total Pentachlorodibenzofuran	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
Total Pentachlorodibenzofuran	EPA 1613	Extractable Organics	NELAP	1/1/2007
Total Pentachlorodibenzofuran	EPA 8290	Extractable Organics	NELAP	1/1/2007
Total Pentachlorodibenzo-p-dioxin	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
Total Pentachlorodibenzo-p-dioxin	EPA 1613	Extractable Organics	NELAP	1/1/2007
Total Pentachlorodibenzo-p-dioxin	EPA 8290	Extractable Organics	NELAP	1/1/2007
Total Tetrachlorodibenzofuran	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
Total Tetrachlorodibenzofuran	EPA 1613	Extractable Organics	NELAP	1/1/2007
Total Tetrachlorodibenzofuran	EPA 8290	Extractable Organics	NELAP	1/1/2007
Total Tetrachlorodibenzo-p-dioxin	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
Total Tetrachlorodibenzo-p-dioxin	EPA 1613	Extractable Organics	NELAP	1/1/2007
Total Tetrachlorodibenzo-p-dioxin	EPA 8290	Extractable Organics	NELAP	1/1/2007
trans-Nonachlor	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
trans-Nonachlor	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
trans-Nonachlor	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
trans-Nonachlor	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	12/17/2015

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Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	EPA 8290	Extractable Organics	NELAP	1/1/2007
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	EPA 8290	Extractable Organics	NELAP	1/1/2007
1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)	EPA 8290	Extractable Organics	NELAP	1/1/2007
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)	EPA 8290	Extractable Organics	NELAP	1/1/2007
1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)	EPA 8290	Extractable Organics	NELAP	1/1/2007
1,2,3,4,7,8-Hxcdd	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
1,2,3,4,7,8-Hxcdd	EPA 8290	Extractable Organics	NELAP	1/1/2007
1,2,3,4,7,8-Hxcdf	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
1,2,3,4,7,8-Hxcdf	EPA 8290	Extractable Organics	NELAP	1/1/2007
1,2,3,6,7,8-Hxcdd	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
1,2,3,6,7,8-Hxcdd	EPA 8290	Extractable Organics	NELAP	1/1/2007
1,2,3,6,7,8-Hxcdf	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
1,2,3,6,7,8-Hxcdf	EPA 8290	Extractable Organics	NELAP	1/1/2007
1,2,3,7,8,9-Hxcdd	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
1,2,3,7,8,9-Hxcdd	EPA 8290	Extractable Organics	NELAP	1/1/2007
1,2,3,7,8,9-Hxcdf	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
1,2,3,7,8,9-Hxcdf	EPA 8290	Extractable Organics	NELAP	1/1/2007
1,2,3,7,8-Pecdd	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
1,2,3,7,8-Pecdd	EPA 8290	Extractable Organics	NELAP	1/1/2007
1,2,3,7,8-Pecdf	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
1,2,3,7,8-Pecdf	EPA 8290	Extractable Organics	NELAP	1/1/2007
1H, 1H, 2H, 2H-Perfluorodecane Sulfonate (8:2 Fluorotelomersulfonate, 8:2FTS)	AXYS MLA-110/LC-MS-MS	Extractable Organics	NELAP	6/19/2017
1H, 1H, 2H, 2H-Perfluorohexane Sulfonate (4:2 Fluorotelomersulfonate 4:2FTS)	AXYS MLA-110/LC-MS-MS	Extractable Organics	NELAP	6/19/2017

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2045 Mills Road West
Sidney, British Columbia, CN V8L 5X2

Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
1H, 1H, 2H, 2H-Perfluorooctane Sulfonate (6:2 Fluorotelomersulfonate, 6:2FTS)	AXYS MLA-110/LC-MS-MS	Extractable Organics	NELAP	6/19/2017
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ 206)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ 206)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,4',5,5'-Octachlorobiphenyl (BZ 194)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,4',5,5'-Octachlorobiphenyl (BZ 194)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl (BZ 207)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl (BZ 207)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ 195)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ 195)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,4',5,6'-Octachlorobiphenyl (BZ 196)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,4',5,6'-Octachlorobiphenyl (BZ 196)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ 170)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ 170)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,4',6,6'-Octachlorobiphenyl (BZ 197)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,4',6,6'-Octachlorobiphenyl (BZ 197)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,4',6-Heptachlorobiphenyl (BZ 171)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,4',6-Heptachlorobiphenyl (BZ 171)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,4'-Hexachlorobiphenyl (BZ 128)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,4'-Hexachlorobiphenyl (BZ 128)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,5,5',6,6'-Nonachlorobiphenyl (BZ 208)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,5,5',6,6'-Nonachlorobiphenyl (BZ 208)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,5,5',6-Octachlorobiphenyl (BZ 198)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,5,5',6-Octachlorobiphenyl (BZ 198)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,5,5',6'-Octachlorobiphenyl (BZ 199)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,5,5',6'-Octachlorobiphenyl (BZ 199)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,5,5'-Heptachlorobiphenyl (BZ 172)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,5,5'-Heptachlorobiphenyl (BZ 172)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,5,6,6'-Octachlorobiphenyl (BZ 200)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,5,6,6'-Octachlorobiphenyl (BZ 200)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014

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State Laboratory ID: **E871007** EPA Lab Code: **MC00000** **(250) 655-5800**

E871007
SGS AXYS Analytical Services Ltd.
2045 Mills Road West
Sidney, British Columbia, CN V8L 5X2

Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,2',3,3',4,5',6,6'-Octachlorobiphenyl (BZ 201)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,5',6,6'-Octachlorobiphenyl (BZ 201)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,5,6-Heptachlorobiphenyl (BZ 173)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,5,6-Heptachlorobiphenyl (BZ 173)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,5,6'-Heptachlorobiphenyl (BZ 174)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,5,6'-Heptachlorobiphenyl (BZ 174)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,5',6-Heptachlorobiphenyl (BZ 175)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,5',6-Heptachlorobiphenyl (BZ 175)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,5',6'-Heptachlorobiphenyl (BZ 177)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,5',6'-Heptachlorobiphenyl (BZ 177)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,5-Hexachlorobiphenyl (BZ 129)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,5-Hexachlorobiphenyl (BZ 129)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,5'-Hexachlorobiphenyl (BZ 130)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,5'-Hexachlorobiphenyl (BZ 130)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,6,6'-Heptachlorobiphenyl (BZ 176)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,6,6'-Heptachlorobiphenyl (BZ 176)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,6-Hexachlorobiphenyl (BZ 131)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,6-Hexachlorobiphenyl (BZ 131)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,6'-Hexachlorobiphenyl (BZ 132)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4,6'-Hexachlorobiphenyl (BZ 132)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4-Pentachlorobiphenyl (BZ 82)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',4-Pentachlorobiphenyl (BZ 82)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',5,5',6,6'-Octachlorobiphenyl (BZ 202)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',5,5',6,6'-Octachlorobiphenyl (BZ 202)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',5,5',6-Heptachlorobiphenyl (BZ 178)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',5,5',6-Heptachlorobiphenyl (BZ 178)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',5,5'-Hexachlorobiphenyl (BZ 133)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',5,5'-Hexachlorobiphenyl (BZ 133)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',5,6,6'-Heptachlorobiphenyl (BZ 179)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',5,6,6'-Heptachlorobiphenyl (BZ 179)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014

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E871007
SGS AXYS Analytical Services Ltd.
2045 Mills Road West
Sidney, British Columbia, CN V8L 5X2

Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,2',3,3',5,6-Hexachlorobiphenyl (BZ 134)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',5,6-Hexachlorobiphenyl (BZ 134)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',5,6'-Hexachlorobiphenyl (BZ 135)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',5,6'-Hexachlorobiphenyl (BZ 135)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',5-Pentachlorobiphenyl (BZ 83)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',5-Pentachlorobiphenyl (BZ 83)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',6,6'-Hexachlorobiphenyl (BZ 136)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',6,6'-Hexachlorobiphenyl (BZ 136)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',6-Pentachlorobiphenyl (BZ 84)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3',6-Pentachlorobiphenyl (BZ 84)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3'-Tetrachlorobiphenyl (BZ 40)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,3'-Tetrachlorobiphenyl (BZ 40)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,4',5,5',6-Octachlorobiphenyl (BZ 203)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,4',5,5',6-Octachlorobiphenyl (BZ 203)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ 180)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ 180)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,4',5,6,6'-Octachlorobiphenyl (BZ 204)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,4',5,6,6'-Octachlorobiphenyl (BZ 204)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,4',5,6-Heptachlorobiphenyl (BZ 181)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,4',5,6-Heptachlorobiphenyl (BZ 181)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,4',5,6'-Heptachlorobiphenyl (BZ 182)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,4',5,6'-Heptachlorobiphenyl (BZ 182)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ 183)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ 183)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,4',5-Hexachlorobiphenyl (BZ 137)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,4',5-Hexachlorobiphenyl (BZ 137)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,4',5'-Hexachlorobiphenyl (BZ 138)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,4',5'-Hexachlorobiphenyl (BZ 138)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,4',6,6'-Heptachlorobiphenyl (BZ 184)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,4',6,6'-Heptachlorobiphenyl (BZ 184)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014

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E871007
SGS AXYS Analytical Services Ltd.
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Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,2',3,4,4',6-Hexachlorobiphenyl (BZ 139)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,4',6-Hexachlorobiphenyl (BZ 139)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,4',6'-Hexachlorobiphenyl (BZ 140)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,4',6'-Hexachlorobiphenyl (BZ 140)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,4'-Pentachlorobiphenyl (BZ 85)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,4'-Pentachlorobiphenyl (BZ 85)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,5,5',6-Heptachlorobiphenyl (BZ 185)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,5,5',6-Heptachlorobiphenyl (BZ 185)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ 187)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ 187)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,5,5'-Hexachlorobiphenyl (BZ 141)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,5,5'-Hexachlorobiphenyl (BZ 141)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4',5,5'-Hexachlorobiphenyl (BZ 146)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4',5,5'-Hexachlorobiphenyl (BZ 146)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,5,6,6'-Heptachlorobiphenyl (BZ 186)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,5,6,6'-Heptachlorobiphenyl (BZ 186)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4',5,6,6'-Heptachlorobiphenyl (BZ 188)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4',5,6,6'-Heptachlorobiphenyl (BZ 188)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,5,6-Hexachlorobiphenyl (BZ 142)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,5,6-Hexachlorobiphenyl (BZ 142)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,5,6'-Hexachlorobiphenyl (BZ 143)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,5,6'-Hexachlorobiphenyl (BZ 143)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,5',6-Hexachlorobiphenyl (BZ 144)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,5',6-Hexachlorobiphenyl (BZ 144)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4',5,6-Hexachlorobiphenyl (BZ 147)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4',5,6-Hexachlorobiphenyl (BZ 147)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4',5,6'-Hexachlorobiphenyl (BZ 148)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4',5,6'-Hexachlorobiphenyl (BZ 148)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4',5',6-Hexachlorobiphenyl (BZ 149)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4',5',6-Hexachlorobiphenyl (BZ 149)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014

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Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,2',3,4,5-Pentachlorobiphenyl (BZ 86)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,5-Pentachlorobiphenyl (BZ 86)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,5'-Pentachlorobiphenyl (BZ 87)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,5'-Pentachlorobiphenyl (BZ 87)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4',5-Pentachlorobiphenyl (BZ 90)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4',5-Pentachlorobiphenyl (BZ 90)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4',5'-Pentachlorobiphenyl (BZ 97)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4',5'-Pentachlorobiphenyl (BZ 97)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,6,6'-Hexachlorobiphenyl (BZ 145)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,6,6'-Hexachlorobiphenyl (BZ 145)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4',6,6'-Hexachlorobiphenyl (BZ 150)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4',6,6'-Hexachlorobiphenyl (BZ 150)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,6-Pentachlorobiphenyl (BZ 88)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,6-Pentachlorobiphenyl (BZ 88)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,6'-Pentachlorobiphenyl (BZ 89)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4,6'-Pentachlorobiphenyl (BZ 89)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4',6-Pentachlorobiphenyl (BZ 91)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4',6-Pentachlorobiphenyl (BZ 91)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4',6'-Pentachlorobiphenyl (BZ 98)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4',6'-Pentachlorobiphenyl (BZ 98)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4-Tetrachlorobiphenyl (BZ 41)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4-Tetrachlorobiphenyl (BZ 41)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4'-Tetrachlorobiphenyl (BZ 42)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,4'-Tetrachlorobiphenyl (BZ 42)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,5,5',6-Hexachlorobiphenyl (BZ 151)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,5,5',6-Hexachlorobiphenyl (BZ 151)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,5,5'-Pentachlorobiphenyl (BZ 92)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,5,5'-Pentachlorobiphenyl (BZ 92)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,5,6,6'-Hexachlorobiphenyl (BZ 152)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,5,6,6'-Hexachlorobiphenyl (BZ 152)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014

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State Laboratory ID: **E871007** EPA Lab Code: **MC00000** **(250) 655-5800**

E871007
SGS AXYS Analytical Services Ltd.
2045 Mills Road West
Sidney, British Columbia, CN V8L 5X2

Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,2',3,5,6-Pentachlorobiphenyl (BZ 93)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,5,6-Pentachlorobiphenyl (BZ 93)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,5,6'-Pentachlorobiphenyl (BZ 94)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,5,6'-Pentachlorobiphenyl (BZ 94)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,5',6-Pentachlorobiphenyl (BZ 95)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,5',6-Pentachlorobiphenyl (BZ 95)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,5-Tetrachlorobiphenyl (BZ 43)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,5-Tetrachlorobiphenyl (BZ 43)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,5'-Tetrachlorobiphenyl (BZ 44)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,5'-Tetrachlorobiphenyl (BZ 44)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,6,6'-Pentachlorobiphenyl (BZ 96)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,6,6'-Pentachlorobiphenyl (BZ 96)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,6-Tetrachlorobiphenyl (BZ 45)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,6-Tetrachlorobiphenyl (BZ 45)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,6'-Tetrachlorobiphenyl (BZ 46)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3,6'-Tetrachlorobiphenyl (BZ 46)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3-Trichlorobiphenyl (BZ 16)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',3-Trichlorobiphenyl (BZ 16)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,4',5,5'-Hexachlorobiphenyl (BZ 153)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,4',5,5'-Hexachlorobiphenyl (BZ 153)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,4',5,6'-Hexachlorobiphenyl (BZ 154)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,4',5,6'-Hexachlorobiphenyl (BZ 154)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,4',5-Pentachlorobiphenyl (BZ 99)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,4',5-Pentachlorobiphenyl (BZ 99)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,4',6,6'-Hexachlorobiphenyl (BZ 155)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,4',6,6'-Hexachlorobiphenyl (BZ 155)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,4',6-Pentachlorobiphenyl (BZ 100)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,4',6-Pentachlorobiphenyl (BZ 100)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,4'-Tetrachlorobiphenyl (BZ 47)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,4'-Tetrachlorobiphenyl (BZ 47)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014

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E871007
SGS AXYS Analytical Services Ltd.
2045 Mills Road West
Sidney, British Columbia, CN V8L 5X2

Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,2',4,5,5'-Pentachlorobiphenyl (BZ 101)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,5,5'-Pentachlorobiphenyl (BZ 101)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,5,6'-Pentachlorobiphenyl (BZ 102)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,5,6'-Pentachlorobiphenyl (BZ 102)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,5',6-Pentachlorobiphenyl (BZ 103)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,5',6-Pentachlorobiphenyl (BZ 103)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,5-Tetrachlorobiphenyl (BZ 48)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,5-Tetrachlorobiphenyl (BZ 48)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,5'-Tetrachlorobiphenyl (BZ 49)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,5'-Tetrachlorobiphenyl (BZ 49)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,6,6'-Pentachlorobiphenyl (BZ 104)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,6,6'-Pentachlorobiphenyl (BZ 104)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,6-Tetrachlorobiphenyl (BZ 50)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,6-Tetrachlorobiphenyl (BZ 50)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,6'-Tetrachlorobiphenyl (BZ 51)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4,6'-Tetrachlorobiphenyl (BZ 51)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4-Trichlorobiphenyl (BZ 17)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',4-Trichlorobiphenyl (BZ 17)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',5,5'-Tetrachlorobiphenyl (BZ 52)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',5,5'-Tetrachlorobiphenyl (BZ 52)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',5,6'-Tetrachlorobiphenyl (BZ 53)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',5,6'-Tetrachlorobiphenyl (BZ 53)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',5-Trichlorobiphenyl (BZ 18)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',5-Trichlorobiphenyl (BZ 18)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',6,6'-Tetrachlorobiphenyl (BZ 54)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',6,6'-Tetrachlorobiphenyl (BZ 54)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',6-Trichlorobiphenyl (BZ 19)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2',6-Trichlorobiphenyl (BZ 19)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2'-Dichlorobiphenyl (BZ 4)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,2'-Dichlorobiphenyl (BZ 4)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014

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E871007
SGS AXYS Analytical Services Ltd.
2045 Mills Road West
Sidney, British Columbia, CN V8L 5X2

Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,3,3',4,4',5,5',6-Octachlorobiphenyl (BZ 205)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,4',5,5',6-Octachlorobiphenyl (BZ 205)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,4',5,5'-Heptachlorobiphenyl (BZ 189)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,4',5,5'-Heptachlorobiphenyl (BZ 189)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,4',5,6-Heptachlorobiphenyl (BZ 190)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,4',5,6-Heptachlorobiphenyl (BZ 190)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,4',5',6-Heptachlorobiphenyl (BZ 191)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,4',5',6-Heptachlorobiphenyl (BZ 191)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,4',5-Hexachlorobiphenyl (BZ 156)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,4',5-Hexachlorobiphenyl (BZ 156)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,4',5'-Hexachlorobiphenyl (BZ 157)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,4',5'-Hexachlorobiphenyl (BZ 157)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,4',6-Hexachlorobiphenyl (BZ 158)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,4',6-Hexachlorobiphenyl (BZ 158)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,4'-Pentachlorobiphenyl (BZ 105)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,4'-Pentachlorobiphenyl (BZ 105)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,5,5',6-Heptachlorobiphenyl (BZ 192)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,5,5',6-Heptachlorobiphenyl (BZ 192)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4',5,5',6-Heptachlorobiphenyl (BZ 193)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4',5,5',6-Heptachlorobiphenyl (BZ 193)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,5,5'-Hexachlorobiphenyl (BZ 159)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,5,5'-Hexachlorobiphenyl (BZ 159)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4',5,5'-Hexachlorobiphenyl (BZ 162)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4',5,5'-Hexachlorobiphenyl (BZ 162)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,5,6-Hexachlorobiphenyl (BZ 160)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,5,6-Hexachlorobiphenyl (BZ 160)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,5',6-Hexachlorobiphenyl (BZ 161)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,5',6-Hexachlorobiphenyl (BZ 161)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4',5,6-Hexachlorobiphenyl (BZ 163)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4',5,6-Hexachlorobiphenyl (BZ 163)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014

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E871007
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Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,3,3',4',5',6-Hexachlorobiphenyl (BZ 164)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4',5',6-Hexachlorobiphenyl (BZ 164)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,5-Pentachlorobiphenyl (BZ 106)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,5-Pentachlorobiphenyl (BZ 106)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4',5-Pentachlorobiphenyl (BZ 107)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4',5-Pentachlorobiphenyl (BZ 107)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,5'-Pentachlorobiphenyl (BZ 108)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,5'-Pentachlorobiphenyl (BZ 108)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4',5'-Pentachlorobiphenyl (BZ 122)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4',5'-Pentachlorobiphenyl (BZ 122)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,6-Pentachlorobiphenyl (BZ 109)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4,6-Pentachlorobiphenyl (BZ 109)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4',6-Pentachlorobiphenyl (BZ 110)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4',6-Pentachlorobiphenyl (BZ 110)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4-Tetrachlorobiphenyl (BZ 55)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4-Tetrachlorobiphenyl (BZ 55)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4'-Tetrachlorobiphenyl (BZ 56)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',4'-Tetrachlorobiphenyl (BZ 56)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',5,5',6-Hexachlorobiphenyl (BZ 165)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',5,5',6-Hexachlorobiphenyl (BZ 165)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',5,5'-Pentachlorobiphenyl (BZ 111)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',5,5'-Pentachlorobiphenyl (BZ 111)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',5,6-Pentachlorobiphenyl (BZ 112)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',5,6-Pentachlorobiphenyl (BZ 112)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',5',6-Pentachlorobiphenyl (BZ 113)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',5',6-Pentachlorobiphenyl (BZ 113)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',5-Tetrachlorobiphenyl (BZ 57)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',5-Tetrachlorobiphenyl (BZ 57)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',5'-Tetrachlorobiphenyl (BZ 58)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',5'-Tetrachlorobiphenyl (BZ 58)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014

Attachment to Certificate #: E871007-25, expiration date June 30, 2019. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E871007** EPA Lab Code: **MC00000** **(250) 655-5800**

E871007
SGS AXYS Analytical Services Ltd.
2045 Mills Road West
Sidney, British Columbia, CN V8L 5X2

Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,3,3',6-Tetrachlorobiphenyl (BZ 59)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3',6-Tetrachlorobiphenyl (BZ 59)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3'-Trichlorobiphenyl (BZ 20)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,3'-Trichlorobiphenyl (BZ 20)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4,4',5,5'-Hexachlorobiphenyl (BZ 167)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4,4',5,5'-Hexachlorobiphenyl (BZ 167)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,4,4',5,6-Hexachlorobiphenyl (BZ 166)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,4,4',5,6-Hexachlorobiphenyl (BZ 166)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4,4',5',6-Hexachlorobiphenyl (BZ 168)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4,4',5',6-Hexachlorobiphenyl (BZ 168)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,4,4',5-Pentachlorobiphenyl (BZ 114)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,4,4',5-Pentachlorobiphenyl (BZ 114)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4,4',5-Pentachlorobiphenyl (BZ 118)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4,4',5-Pentachlorobiphenyl (BZ 118)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4,4',5'-Pentachlorobiphenyl (BZ 123)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4,4',5'-Pentachlorobiphenyl (BZ 123)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,4,4',6-Pentachlorobiphenyl (BZ 115)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,4,4',6-Pentachlorobiphenyl (BZ 115)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4,4',6-Pentachlorobiphenyl (BZ 119)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4,4',6-Pentachlorobiphenyl (BZ 119)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,4,4'-Tetrachlorobiphenyl (BZ 60)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,4,4'-Tetrachlorobiphenyl (BZ 60)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4,4'-Tetrachlorobiphenyl (BZ 66)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4,4'-Tetrachlorobiphenyl (BZ 66)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4,5,5'-Pentachlorobiphenyl (BZ 120)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4,5,5'-Pentachlorobiphenyl (BZ 120)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2',3,4,5,5'-Pentachlorobiphenyl (BZ 124)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4',5,5'-Pentachlorobiphenyl (BZ 124)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4',5,5'-Pentachlorobiphenyl (BZ 124)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014

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E871007
SGS AXYS Analytical Services Ltd.
2045 Mills Road West
Sidney, British Columbia, CN V8L 5X2

Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,3,4,5,6-Pentachlorobiphenyl (BZ 116)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,4,5,6-Pentachlorobiphenyl (BZ 116)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,4',5,6-Pentachlorobiphenyl (BZ 117)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,4',5,6-Pentachlorobiphenyl (BZ 117)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4,5',6-Pentachlorobiphenyl (BZ 121)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4,5',6-Pentachlorobiphenyl (BZ 121)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4',5',6-Pentachlorobiphenyl (BZ 125)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4',5',6-Pentachlorobiphenyl (BZ 125)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,4,5-Tetrachlorobiphenyl (BZ 61)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,4,5-Tetrachlorobiphenyl (BZ 61)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,4',5-Tetrachlorobiphenyl (BZ 63)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,4',5-Tetrachlorobiphenyl (BZ 63)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4,5-Tetrachlorobiphenyl (BZ 67)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4,5-Tetrachlorobiphenyl (BZ 67)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4,5'-Tetrachlorobiphenyl (BZ 68)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4,5'-Tetrachlorobiphenyl (BZ 68)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4',5-Tetrachlorobiphenyl (BZ 70)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4',5-Tetrachlorobiphenyl (BZ 70)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4',5'-Tetrachlorobiphenyl (BZ 76)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4',5'-Tetrachlorobiphenyl (BZ 76)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,4,6,7,8-Hxcdf	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
2,3,4,6,7,8-Hxcdf	EPA 8290	Extractable Organics	NELAP	1/1/2007
2,3,4,6-Tetrachlorobiphenyl (BZ 62)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,4,6-Tetrachlorobiphenyl (BZ 62)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,4',6-Tetrachlorobiphenyl (BZ 64)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,4',6-Tetrachlorobiphenyl (BZ 64)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4,6-Tetrachlorobiphenyl (BZ 69)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4,6-Tetrachlorobiphenyl (BZ 69)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4',6-Tetrachlorobiphenyl (BZ 71)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4',6-Tetrachlorobiphenyl (BZ 71)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014

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E871007
SGS AXYS Analytical Services Ltd.
2045 Mills Road West
Sidney, British Columbia, CN V8L 5X2

Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,3,4,7,8-Pecdf	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
2,3,4,7,8-Pecdf	EPA 8290	Extractable Organics	NELAP	1/1/2007
2,3,4-Trichlorobiphenyl (BZ 21)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,4-Trichlorobiphenyl (BZ 21)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,4'-Trichlorobiphenyl (BZ 22)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,4'-Trichlorobiphenyl (BZ 22)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4-Trichlorobiphenyl (BZ 25)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4-Trichlorobiphenyl (BZ 25)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4'-Trichlorobiphenyl (BZ 33)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',4'-Trichlorobiphenyl (BZ 33)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',5,5'-Tetrachlorobiphenyl (BZ 72)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',5,5'-Tetrachlorobiphenyl (BZ 72)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,5,6-Tetrachlorobiphenyl (BZ 65)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,5,6-Tetrachlorobiphenyl (BZ 65)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',5',6-Tetrachlorobiphenyl (BZ 73)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',5',6-Tetrachlorobiphenyl (BZ 73)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,5-Trichlorobiphenyl (BZ 23)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,5-Trichlorobiphenyl (BZ 23)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',5-Trichlorobiphenyl (BZ 26)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',5-Trichlorobiphenyl (BZ 26)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',5'-Trichlorobiphenyl (BZ 34)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',5'-Trichlorobiphenyl (BZ 34)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,6-Trichlorobiphenyl (BZ 24)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,6-Trichlorobiphenyl (BZ 24)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',6-Trichlorobiphenyl (BZ 27)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3',6-Trichlorobiphenyl (BZ 27)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3,7,8-TCDD	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
2,3,7,8-TCDD (Dioxin, 2,3,7,8-Tetrachlorodibenzo-p-dioxin)	EPA 8290	Extractable Organics	NELAP	1/1/2007
2,3,7,8-TCDF	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007

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E871007
SGS AXYS Analytical Services Ltd.
2045 Mills Road West
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Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,3,7,8-TCDF	EPA 8290	Extractable Organics	NELAP	1/1/2007
2,3-Dichlorobiphenyl (BZ 5)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3-Dichlorobiphenyl (BZ 5)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3'-Dichlorobiphenyl (BZ 6)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,3'-Dichlorobiphenyl (BZ 6)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,4,4',5-Tetrachlorobiphenyl (BZ 74)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,4,4',5-Tetrachlorobiphenyl (BZ 74)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,4,4',6-Tetrachlorobiphenyl (BZ 75)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,4,4',6-Tetrachlorobiphenyl (BZ 75)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,4,4'-Trichlorobiphenyl (BZ 28)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,4,4'-Trichlorobiphenyl (BZ 28)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,4,5-Trichlorobiphenyl (BZ 29)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,4,5-Trichlorobiphenyl (BZ 29)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,4',5-Trichlorobiphenyl (BZ 31)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,4',5-Trichlorobiphenyl (BZ 31)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,4,6-Trichlorobiphenyl (BZ 30)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,4,6-Trichlorobiphenyl (BZ 30)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,4',6-Trichlorobiphenyl (BZ 32)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,4',6-Trichlorobiphenyl (BZ 32)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,4'-DDD	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
2,4'-DDD	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
2,4'-DDD	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
2,4'-DDD	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
2,4'-DDE	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
2,4'-DDE	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
2,4'-DDE	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
2,4'-DDE	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
2,4'-DDT	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
2,4'-DDT	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
2,4'-DDT	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015

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Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,4'-DDT	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
2,4-Dichlorobiphenyl (BZ 7)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,4-Dichlorobiphenyl (BZ 7)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,4'-Dichlorobiphenyl (BZ 8)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,4'-Dichlorobiphenyl (BZ 8)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,5-Dichlorobiphenyl (BZ 9)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,5-Dichlorobiphenyl (BZ 9)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,6-Dichlorobiphenyl (BZ 10)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2,6-Dichlorobiphenyl (BZ 10)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2-Chlorobiphenyl (BZ 1)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2-Chlorobiphenyl (BZ 1)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
2-Methylnaphthalene	EPA 8270	Extractable Organics	NELAP	3/13/2014
3,3',4,4',5,5'-Hexachlorobiphenyl (BZ 169)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,3',4,4',5,5'-Hexachlorobiphenyl (BZ 169)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,3',4,4',5-Pentachlorobiphenyl (BZ 126)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,3',4,4',5-Pentachlorobiphenyl (BZ 126)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,3',4,4'-Tetrachlorobiphenyl (BZ 77)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,3',4,4'-Tetrachlorobiphenyl (BZ 77)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,3',4,5,5'-Pentachlorobiphenyl (BZ 127)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,3',4,5,5'-Pentachlorobiphenyl (BZ 127)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,3',4,5-Tetrachlorobiphenyl (BZ 78)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,3',4,5-Tetrachlorobiphenyl (BZ 78)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,3',4,5'-Tetrachlorobiphenyl (BZ 79)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,3',4,5'-Tetrachlorobiphenyl (BZ 79)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,3',4-Trichlorobiphenyl (BZ 35)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,3',4-Trichlorobiphenyl (BZ 35)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,3',5,5'-Tetrachlorobiphenyl (BZ 80)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,3',5,5'-Tetrachlorobiphenyl (BZ 80)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,3',5-Trichlorobiphenyl (BZ 36)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,3',5-Trichlorobiphenyl (BZ 36)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014

Attachment to Certificate #: E871007-25, expiration date June 30, 2019. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E871007** EPA Lab Code: **MC00000** **(250) 655-5800**

E871007
SGS AXYS Analytical Services Ltd.
2045 Mills Road West
Sidney, British Columbia, CN V8L 5X2

Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
3,3'-Dichlorobiphenyl (BZ 11)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,3'-Dichlorobiphenyl (BZ 11)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,4,4',5-Tetrachlorobiphenyl (BZ 81)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,4,4',5-Tetrachlorobiphenyl (BZ 81)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,4,4'-Trichlorobiphenyl (BZ 37)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,4,4'-Trichlorobiphenyl (BZ 37)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,4,5-Trichlorobiphenyl (BZ 38)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,4,5-Trichlorobiphenyl (BZ 38)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,4',5-Trichlorobiphenyl (BZ 39)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,4',5-Trichlorobiphenyl (BZ 39)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,4-Dichlorobiphenyl (BZ 12)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,4-Dichlorobiphenyl (BZ 12)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,4'-Dichlorobiphenyl (BZ 13)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,4'-Dichlorobiphenyl (BZ 13)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,5-Dichlorobiphenyl (BZ 14)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3,5-Dichlorobiphenyl (BZ 14)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3-Chlorobiphenyl (BZ 2)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
3-Chlorobiphenyl (BZ 2)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
4,4'-DDD	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
4,4'-DDD	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
4,4'-DDD	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
4,4'-DDD	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
4,4'-DDE	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
4,4'-DDE	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
4,4'-DDE	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
4,4'-DDE	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
4,4'-DDT	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
4,4'-DDT	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
4,4'-DDT	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
4,4'-DDT	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/13/2014

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State Laboratory ID: **E871007** EPA Lab Code: **MC00000** **(250) 655-5800**

E871007
SGS AXYS Analytical Services Ltd.
2045 Mills Road West
Sidney, British Columbia, CN V8L 5X2

Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
4,4'-Dichlorobiphenyl (BZ 15)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
4,4'-Dichlorobiphenyl (BZ 15)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
4-Chlorobiphenyl (BZ 3)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
4-Chlorobiphenyl (BZ 3)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Acenaphthene	AXYS SOP MLA-021/GC-MS	Extractable Organics	NELAP	3/13/2014
Acenaphthene	EPA 8270	Extractable Organics	NELAP	3/13/2014
Acenaphthylene	AXYS SOP MLA-021/GC-MS	Extractable Organics	NELAP	3/13/2014
Acenaphthylene	EPA 8270	Extractable Organics	NELAP	3/13/2014
Aldrin	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aldrin	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aldrin	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
Aldrin	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
alpha-BHC (alpha-Hexachlorocyclohexane)	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
alpha-BHC (alpha-Hexachlorocyclohexane)	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
alpha-Chlordane	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
alpha-Chlordane	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
alpha-Chlordane	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
alpha-Chlordane	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Anthracene	AXYS SOP MLA-021/GC-MS	Extractable Organics	NELAP	3/13/2014
Anthracene	EPA 8270	Extractable Organics	NELAP	3/13/2014
Aroclor-1016 (PCB-1016)	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1016 (PCB-1016)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1016 (PCB-1016)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1016 (PCB-1016)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1221 (PCB-1221)	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1221 (PCB-1221)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1221 (PCB-1221)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1221 (PCB-1221)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/13/2014

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State Laboratory ID: **E871007** EPA Lab Code: **MC00000** **(250) 655-5800**

E871007
SGS AXYS Analytical Services Ltd.
2045 Mills Road West
Sidney, British Columbia, CN V8L 5X2

Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Aroclor-1232 (PCB-1232)	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1232 (PCB-1232)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1232 (PCB-1232)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1232 (PCB-1232)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1242 (PCB-1242)	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1242 (PCB-1242)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1242 (PCB-1242)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1242 (PCB-1242)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1248 (PCB-1248)	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1248 (PCB-1248)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1248 (PCB-1248)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1248 (PCB-1248)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1254 (PCB-1254)	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1254 (PCB-1254)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1254 (PCB-1254)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1254 (PCB-1254)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1260 (PCB-1260)	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1260 (PCB-1260)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1260 (PCB-1260)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Aroclor-1260 (PCB-1260)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Benzo(a)anthracene	AXYS SOP MLA-021/GC-MS	Extractable Organics	NELAP	3/13/2014
Benzo(a)anthracene	EPA 8270	Extractable Organics	NELAP	3/13/2014
Benzo(a)pyrene	AXYS SOP MLA-021/GC-MS	Extractable Organics	NELAP	3/13/2014
Benzo(a)pyrene	EPA 8270	Extractable Organics	NELAP	3/13/2014
Benzo(b)fluoranthene	AXYS SOP MLA-021/GC-MS	Extractable Organics	NELAP	3/13/2014
Benzo(b)fluoranthene	EPA 8270	Extractable Organics	NELAP	3/13/2014
Benzo(g,h,i)perylene	AXYS SOP MLA-021/GC-MS	Extractable Organics	NELAP	3/13/2014
Benzo(g,h,i)perylene	EPA 8270	Extractable Organics	NELAP	3/13/2014
Benzo(k)fluoranthene	AXYS SOP MLA-021/GC-MS	Extractable Organics	NELAP	3/13/2014
Benzo(k)fluoranthene	EPA 8270	Extractable Organics	NELAP	3/13/2014

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E871007
SGS AXYS Analytical Services Ltd.
2045 Mills Road West
Sidney, British Columbia, CN V8L 5X2

Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
beta-BHC (beta-Hexachlorocyclohexane)	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
beta-BHC (beta-Hexachlorocyclohexane)	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
beta-BHC (beta-Hexachlorocyclohexane)	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
beta-BHC (beta-Hexachlorocyclohexane)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Chlordane (tech.)	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Chlordane (tech.)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Chrysene	AXYS SOP MLA-021/GC-MS	Extractable Organics	NELAP	3/13/2014
Chrysene	EPA 8270	Extractable Organics	NELAP	3/13/2014
cis-Nonachlor	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
cis-Nonachlor	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
cis-Nonachlor	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
cis-Nonachlor	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
Decachlorobiphenyl (BZ 209)	AXYS SOP MLA-010/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Decachlorobiphenyl (BZ 209)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
delta-BHC	AXYS SOP MLA-007/GC-ECD	Pesticides-Herbicides-PCB's	NELAP	2/23/2015
delta-BHC	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
delta-BHC	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
delta-BHC	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Dibenz(a,h)anthracene	AXYS SOP MLA-021/GC-MS	Extractable Organics	NELAP	3/13/2014
Dibenz(a,h)anthracene	EPA 8270	Extractable Organics	NELAP	3/13/2014
Dieldrin	AXYS SOP MLA-007/GC-ECD	Pesticides-Herbicides-PCB's	NELAP	2/23/2015
Dieldrin	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Dieldrin	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
Dieldrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Endosulfan I	AXYS SOP MLA-007/GC-ECD	Pesticides-Herbicides-PCB's	NELAP	2/23/2015
Endosulfan I	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Endosulfan I	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
Endosulfan I	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Endosulfan II	AXYS SOP MLA-007/GC-ECD	Pesticides-Herbicides-PCB's	NELAP	2/23/2015

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Analyte	Method/Tech	Category	Certification Type	Effective Date
Endosulfan II	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Endosulfan II	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
Endosulfan II	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Endosulfan sulfate	AXYS SOP MLA-007/GC-ECD	Pesticides-Herbicides-PCB's	NELAP	2/23/2015
Endosulfan sulfate	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Endosulfan sulfate	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
Endosulfan sulfate	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Endrin	AXYS SOP MLA-007/GC-ECD	Pesticides-Herbicides-PCB's	NELAP	2/23/2015
Endrin	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Endrin	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
Endrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Endrin aldehyde	AXYS SOP MLA-007/GC-ECD	Pesticides-Herbicides-PCB's	NELAP	2/23/2015
Endrin aldehyde	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Endrin aldehyde	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
Endrin aldehyde	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Endrin ketone	AXYS SOP MLA-007/GC-ECD	Pesticides-Herbicides-PCB's	NELAP	2/23/2015
Endrin ketone	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Endrin ketone	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
Endrin ketone	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Fluoranthene	AXYS SOP MLA-021/GC-MS	Extractable Organics	NELAP	3/13/2014
Fluoranthene	EPA 8270	Extractable Organics	NELAP	3/13/2014
Fluorene	AXYS SOP MLA-021/GC-MS	Extractable Organics	NELAP	3/13/2014
Fluorene	EPA 8270	Extractable Organics	NELAP	3/13/2014
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
gamma-Chlordane	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
gamma-Chlordane	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014

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Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
gamma-Chlordane	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
gamma-Chlordane	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Heptachlor	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Heptachlor	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Heptachlor	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
Heptachlor	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Heptachlor epoxide	AXYS SOP MLA-007/GC-ECD	Pesticides-Herbicides-PCB's	NELAP	2/23/2015
Heptachlor epoxide	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Heptachlor epoxide	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
Heptachlor epoxide	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Hexachlorobenzene	AXYS SOP MLA-007/GC-MS	Extractable Organics	NELAP	3/13/2014
Hexachlorobenzene	AXYS SOP MLA-028/GC-HRMS	Extractable Organics	NELAP	3/13/2014
Hexachlorobenzene	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
Hexachlorobenzene	EPA 8270	Extractable Organics	NELAP	3/13/2014
Indeno(1,2,3-cd)pyrene	AXYS SOP MLA-021/GC-MS	Extractable Organics	NELAP	3/13/2014
Indeno(1,2,3-cd)pyrene	EPA 8270	Extractable Organics	NELAP	3/13/2014
Methoxychlor	AXYS SOP MLA-007/GC-ECD	Pesticides-Herbicides-PCB's	NELAP	2/23/2015
Methoxychlor	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Methoxychlor	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
Methoxychlor	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Mirex	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Mirex	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Mirex	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
Mirex	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/13/2014
Naphthalene	AXYS SOP MLA-021/GC-MS	Extractable Organics	NELAP	3/13/2014
Naphthalene	EPA 8270	Extractable Organics	NELAP	3/13/2014
N-Ethylperfluorooctane sulfonamide (EtFOSA)	AXYS MLA-110/LC-MS-MS	Extractable Organics	NELAP	6/19/2017
N-Methylperfluorooctane sulfonamide (MeFOSA)	AXYS MLA-110/LC-MS-MS	Extractable Organics	NELAP	6/19/2017
Oxychlordane	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	12/17/2015

Attachment to Certificate #: E871007-25, expiration date June 30, 2019. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E871007** EPA Lab Code: **MC00000** **(250) 655-5800**

E871007
SGS AXYS Analytical Services Ltd.
2045 Mills Road West
Sidney, British Columbia, CN V8L 5X2

Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Oxychlordane	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
Oxychlordane	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
Oxychlordane	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
Perfluorobutane sulfonate (PFBS, perfluorobutane sulfonic acid)	AXYS MLA-110/LC-MS-MS	Extractable Organics	NELAP	6/19/2017
Perfluorobutane sulfonate (PFBS, perfluorobutane sulfonic acid)	AXYS SOP MLA-041/HPLC-MS-MS	Extractable Organics	NELAP	1/1/2007
Perfluorobutanoate (PFBA, perfluorobutyric acid)	AXYS MLA-110/LC-MS-MS	Extractable Organics	NELAP	6/19/2017
Perfluorobutanoate (PFBA, perfluorobutyric acid)	AXYS SOP MLA-041/HPLC-MS-MS	Extractable Organics	NELAP	1/1/2007
Perfluorodecane sulfonate (PFDS, perfluorodecane sulfonic acid)	AXYS MLA-110/LC-MS-MS	Extractable Organics	NELAP	6/19/2017
Perfluorodecanoate (PFDA, perfluorodecanoic acid)	AXYS MLA-110/LC-MS-MS	Extractable Organics	NELAP	6/19/2017
Perfluorodecanoate (PFDA, perfluorodecanoic acid)	AXYS SOP MLA-041/HPLC-MS-MS	Extractable Organics	NELAP	1/1/2007
Perfluorododecanoate (PFDoA, perfluorododecanoic acid)	AXYS MLA-110/LC-MS-MS	Extractable Organics	NELAP	6/19/2017
Perfluorododecanoate (PFDoA, perfluorododecanoic acid)	AXYS SOP MLA-041/HPLC-MS-MS	Extractable Organics	NELAP	1/1/2007
Perfluoroheptanesulfonic Acid (PFHpS)	AXYS MLA-110/LC-MS-MS	Extractable Organics	NELAP	6/19/2017
Perfluoroheptanoate (PFHpA, perfluoroheptanoic acid)	AXYS MLA-110/LC-MS-MS	Extractable Organics	NELAP	6/19/2017
Perfluoroheptanoate (PFHpA, perfluoroheptanoic acid)	AXYS SOP MLA-041/HPLC-MS-MS	Extractable Organics	NELAP	1/1/2007
Perfluorohexane sulfonate (PFHxS, perfluorohexane sulfonic acid)	AXYS MLA-110/LC-MS-MS	Extractable Organics	NELAP	6/19/2017
Perfluorohexane sulfonate (PFHxS, perfluorohexane sulfonic acid)	AXYS SOP MLA-041/HPLC-MS-MS	Extractable Organics	NELAP	1/1/2007
Perfluorohexanoate (PFHxA, perfluorohexanoic acid)	AXYS MLA-110/LC-MS-MS	Extractable Organics	NELAP	6/19/2017
Perfluorohexanoate (PFHxA, perfluorohexanoic acid)	AXYS SOP MLA-041/HPLC-MS-MS	Extractable Organics	NELAP	1/1/2007
Perfluorononanesulfonate (PFNS, Perfluorononane sulfonate)	AXYS MLA-110/LC-MS-MS	Extractable Organics	NELAP	6/19/2017
Perfluorononanoate (PFNA, perfluorononanoic acid)	AXYS MLA-110/LC-MS-MS	Extractable Organics	NELAP	6/19/2017
Perfluorononanoate (PFNA, perfluorononanoic acid)	AXYS SOP MLA-041/HPLC-MS-MS	Extractable Organics	NELAP	1/1/2007
Perfluorooctane sulfonamide (PFOSA)	AXYS MLA-110/LC-MS-MS	Extractable Organics	NELAP	6/19/2017
Perfluorooctane sulfonamide (PFOSA)	AXYS SOP MLA-041/HPLC-MS-MS	Extractable Organics	NELAP	1/1/2007
Perfluorooctane sulfonate (PFOS, perfluorooctane sulfonic acid)	AXYS MLA-110/LC-MS-MS	Extractable Organics	NELAP	6/19/2017
Perfluorooctane sulfonate (PFOS, perfluorooctane sulfonic acid)	AXYS SOP MLA-041/HPLC-MS-MS	Extractable Organics	NELAP	1/1/2007

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State Laboratory ID: **E871007** EPA Lab Code: **MC00000** **(250) 655-5800**

E871007
SGS AXYS Analytical Services Ltd.
2045 Mills Road West
Sidney, British Columbia, CN V8L 5X2

Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Perfluorooctanoate (PFOA, perfluorooctanoic acid)	AXYS MLA-110/LC-MS-MS	Extractable Organics	NELAP	6/19/2017
Perfluorooctanoate (PFOA, perfluorooctanoic acid)	AXYS SOP MLA-041/HPLC-MS-MS	Extractable Organics	NELAP	1/1/2007
Perfluoropentanoate (PFPeA, perfluoropentanoic acid))	AXYS MLA-110/LC-MS-MS	Extractable Organics	NELAP	6/19/2017
Perfluoropentanoate (PFPeA, perfluoropentanoic acid))	AXYS SOP MLA-041/HPLC-MS-MS	Extractable Organics	NELAP	1/1/2007
Perfluoropentansulfonate (PFPeS, Perfluoro-1-pentansulfonate)	AXYS MLA-110/LC-MS-MS	Extractable Organics	NELAP	6/19/2017
Perfluorotetradecanoate (PFTeDA, perfluorotetradecanoic acid)	AXYS MLA-110/LC-MS-MS	Extractable Organics	NELAP	6/19/2017
Perfluorotridecanoate (PFTriA, perfluorotridecanoic acid)	AXYS MLA-110/LC-MS-MS	Extractable Organics	NELAP	6/19/2017
Perfluoroundecanoate (PFUnA, perfluoroundecanoic acid)	AXYS MLA-110/LC-MS-MS	Extractable Organics	NELAP	6/19/2017
Perfluoroundecanoate (PFUnA, perfluoroundecanoic acid)	AXYS SOP MLA-041/HPLC-MS-MS	Extractable Organics	NELAP	1/1/2007
Phenanthrene	AXYS SOP MLA-021/GC-MS	Extractable Organics	NELAP	3/13/2014
Phenanthrene	EPA 8270	Extractable Organics	NELAP	3/13/2014
Pyrene	AXYS SOP MLA-021/GC-MS	Extractable Organics	NELAP	3/13/2014
Pyrene	EPA 8270	Extractable Organics	NELAP	3/13/2014
Total Heptachlorodibenzofuran	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
Total Heptachlorodibenzofuran	EPA 8290	Extractable Organics	NELAP	11/19/2008
Total Heptachlorodibenzo-p-dioxin	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
Total Heptachlorodibenzo-p-dioxin	EPA 8290	Extractable Organics	NELAP	11/19/2008
Total Hexachlorodibenzofuran	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
Total Hexachlorodibenzofuran	EPA 8290	Extractable Organics	NELAP	11/19/2008
Total Hexachlorodibenzo-p-dioxin	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
Total Hexachlorodibenzo-p-dioxin	EPA 8290	Extractable Organics	NELAP	11/19/2008
Total Pentachlorodibenzofuran	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
Total Pentachlorodibenzofuran	EPA 8290	Extractable Organics	NELAP	11/19/2008
Total Pentachlorodibenzo-p-dioxin	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
Total Pentachlorodibenzo-p-dioxin	EPA 8290	Extractable Organics	NELAP	11/19/2008
Total Tetrachlorodibenzofuran	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
Total Tetrachlorodibenzofuran	EPA 8290	Extractable Organics	NELAP	11/19/2008
Total Tetrachlorodibenzo-p-dioxin	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007

Laboratory Scope of Accreditation

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State Laboratory ID: **E871007** EPA Lab Code: **MC00000** **(250) 655-5800**

E871007
SGS AXYS Analytical Services Ltd.
2045 Mills Road West
Sidney, British Columbia, CN V8L 5X2

Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Total Tetrachlorodibenzo-p-dioxin	EPA 8290	Extractable Organics	NELAP	11/19/2008
trans-Nonachlor	AXYS SOP MLA-007/GC-MS	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
trans-Nonachlor	AXYS SOP MLA-028/GC-HRMS	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
trans-Nonachlor	EPA 1699	Pesticides-Herbicides-PCB's	NELAP	12/17/2015
trans-Nonachlor	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	12/17/2015

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State Laboratory ID: **E871007** EPA Lab Code: **MC00000** **(250) 655-5800**

E871007
SGS AXYS Analytical Services Ltd.
2045 Mills Road West
Sidney, British Columbia, CN V8L 5X2

Matrix: **Biological Tissue**

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	EPA 8290	Extractable Organics	NELAP	1/1/2007
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	EPA 8290	Extractable Organics	NELAP	1/1/2007
1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)	EPA 8290	Extractable Organics	NELAP	1/1/2007
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)	EPA 8290	Extractable Organics	NELAP	1/1/2007
1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)	EPA 8290	Extractable Organics	NELAP	1/1/2007
1,2,3,4,7,8-Hxcdd	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
1,2,3,4,7,8-Hxcdd	EPA 8290	Extractable Organics	NELAP	1/1/2007
1,2,3,4,7,8-Hxcdf	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
1,2,3,4,7,8-Hxcdf	EPA 8290	Extractable Organics	NELAP	1/1/2007
1,2,3,6,7,8-Hxcdd	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
1,2,3,6,7,8-Hxcdd	EPA 8290	Extractable Organics	NELAP	1/1/2007
1,2,3,6,7,8-Hxcdf	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
1,2,3,6,7,8-Hxcdf	EPA 8290	Extractable Organics	NELAP	1/1/2007
1,2,3,7,8,9-Hxcdd	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
1,2,3,7,8,9-Hxcdd	EPA 8290	Extractable Organics	NELAP	1/1/2007
1,2,3,7,8,9-Hxcdf	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
1,2,3,7,8,9-Hxcdf	EPA 8290	Extractable Organics	NELAP	1/1/2007
1,2,3,7,8-Pecdd	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
1,2,3,7,8-Pecdd	EPA 8290	Extractable Organics	NELAP	1/1/2007
1,2,3,7,8-Pecdf	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
1,2,3,7,8-Pecdf	EPA 8290	Extractable Organics	NELAP	1/1/2007
2,3,4,6,7,8-Hxcdf	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
2,3,4,6,7,8-Hxcdf	EPA 8290	Extractable Organics	NELAP	1/1/2007

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State Laboratory ID: **E871007** EPA Lab Code: **MC00000** **(250) 655-5800**

E871007
SGS AXYS Analytical Services Ltd.
2045 Mills Road West
Sidney, British Columbia, CN V8L 5X2

Matrix: **Biological Tissue**

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,3,4,7,8-Pecdf	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
2,3,4,7,8-Pecdf	EPA 8290	Extractable Organics	NELAP	1/1/2007
2,3,7,8-TCDD	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
2,3,7,8-TCDD (Dioxin, 2,3,7,8-Tetrachlorodibenzo-p-dioxin)	EPA 8290	Extractable Organics	NELAP	1/1/2007
2,3,7,8-TCDF	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
2,3,7,8-TCDF	EPA 8290	Extractable Organics	NELAP	1/1/2007
Perfluorobutane sulfonate (PFBS, perfluorobutane sulfonic acid)	AXYS SOP MLA-043/HPLC-MS-MS	Extractable Organics	NELAP	1/1/2007
Perfluorobutanoate (PFBA, perfluorobutyric acid)	AXYS SOP MLA-043/HPLC-MS-MS	Extractable Organics	NELAP	1/1/2007
Perfluorodecanoate (PFDA, perfluorodecanoic acid)	AXYS SOP MLA-043/HPLC-MS-MS	Extractable Organics	NELAP	1/1/2007
Perfluorododecanoate (PFDoA, perfluorododecanoic acid)	AXYS SOP MLA-043/HPLC-MS-MS	Extractable Organics	NELAP	1/1/2007
Perfluoroheptanoate (PFHpA, perfluoroheptanoic acid)	AXYS SOP MLA-043/HPLC-MS-MS	Extractable Organics	NELAP	1/1/2007
Perfluorohexane sulfonate (PFHxS, perfluorohexane sulfonic acid)	AXYS SOP MLA-043/HPLC-MS-MS	Extractable Organics	NELAP	1/1/2007
Perfluorohexanoate (PFHxA, perfluorohexanoic acid)	AXYS SOP MLA-043/HPLC-MS-MS	Extractable Organics	NELAP	1/1/2007
Perfluorononanoate (PFNA, perfluorononanoic acid)	AXYS SOP MLA-043/HPLC-MS-MS	Extractable Organics	NELAP	1/1/2007
Perfluorooctane sulfonamide (PFOSA)	AXYS SOP MLA-043/HPLC-MS-MS	Extractable Organics	NELAP	1/1/2007
Perfluorooctane sulfonate (PFOS, perfluorooctane sulfonic acid)	AXYS SOP MLA-043/HPLC-MS-MS	Extractable Organics	NELAP	1/1/2007
Perfluorooctanoate (PFOA, perfluorooctanoic acid)	AXYS SOP MLA-043/HPLC-MS-MS	Extractable Organics	NELAP	1/1/2007
Perfluoropentanoate (PFPeA, perfluoropentanoic acid))	AXYS SOP MLA-043/HPLC-MS-MS	Extractable Organics	NELAP	1/1/2007
Perfluoroundecanoate (PFUnA, perfluoroundecanoic acid)	AXYS SOP MLA-043/HPLC-MS-MS	Extractable Organics	NELAP	1/1/2007
Total Heptachlorodibenzofuran	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
Total Heptachlorodibenzofuran	EPA 8290	Extractable Organics	NELAP	11/19/2008
Total Heptachlorodibenzo-p-dioxin	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
Total Heptachlorodibenzo-p-dioxin	EPA 8290	Extractable Organics	NELAP	11/19/2008
Total Hexachlorodibenzofuran	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
Total Hexachlorodibenzofuran	EPA 8290	Extractable Organics	NELAP	11/19/2008
Total Hexachlorodibenzo-p-dioxin	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
Total Hexachlorodibenzo-p-dioxin	EPA 8290	Extractable Organics	NELAP	11/19/2008

Laboratory Scope of Accreditation

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State Laboratory ID: **E871007** EPA Lab Code: **MC00000** **(250) 655-5800**

E871007
SGS AXYS Analytical Services Ltd.
2045 Mills Road West
Sidney, British Columbia, CN V8L 5X2

Matrix: **Biological Tissue**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Total Pentachlorodibenzofuran	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
Total Pentachlorodibenzofuran	EPA 8290	Extractable Organics	NELAP	11/19/2008
Total Pentachlorodibenzo-p-dioxin	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
Total Pentachlorodibenzo-p-dioxin	EPA 8290	Extractable Organics	NELAP	11/19/2008
Total Tetrachlorodibenzofuran	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
Total Tetrachlorodibenzofuran	EPA 8290	Extractable Organics	NELAP	11/19/2008
Total Tetrachlorodibenzo-p-dioxin	AXYS SOP MLA-017/GC-HRMS	Extractable Organics	NELAP	1/1/2007
Total Tetrachlorodibenzo-p-dioxin	EPA 8290	Extractable Organics	NELAP	11/19/2008

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Quality Assurance/Quality Control (QA/QC) Policies and Procedures Manual

QDO-001 Revision No. 28
06-Apr-2017

SGS AXYS Analytical Services Ltd

2045 Mills Road
Sidney, British Columbia
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Management Approval:

Approved 30-Mar-2017	**John Cosgrove, VP and Senior Technical Director, SGS AXYS** **Shea Hewage, Director of Operations** **Dale Hoover, QA Manager**

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RESPONSIBILITY, DISTRIBUTION AND CONTROL

The QA/QC Policies and Procedures Manual (Quality Manual) has been prepared under the direction of the Quality Assurance (QA) Manager. The QA Manager is responsible for maintaining currency and distributing the manual and has final authority for approving all content.

The Quality Manual is catalogued under the laboratory document control system. The manual is identified with a unique document identifier, a revision number and a date. The QA Manager, the Senior Technical Director and the Director of Operations of SGS AXYS sign the manual electronically to indicate their endorsement.

Only approved, official copies of the manual are distributed to staff. The Quality Manual is available to all staff in electronic 'read only' format and bound hardcopies are controlled with a unique copy number.

The policies, procedures and responsibilities documented in this manual, and the documents referenced therein, have the full support of the management of SGS AXYS Analytical Services and are binding on all employees of the company.

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AMENDMENTS

Amendments are made to the Quality Manual as required. The Director or Manager of each work area submits recommendations and requests for amendments to the QA Manager. The QA Manager approves all amendments. The Quality Manual is reviewed at least annually and is revised and reissued as warranted to maintain currency.

A revision history of the Quality Manual is presented in Appendix E.

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I. INTRODUCTION

1. CORPORATE HISTORY

SGS AXYS Analytical Services Ltd, located in Sidney, British Columbia, Canada, was founded in 1974 under the name of Seakem Oceanography Ltd to carry out trace metal and hydrocarbon analysis in the marine environment. Seakem Oceanography Ltd expanded and improved its capabilities in trace organic analysis in response to the demands and environmental issues of the 1970s and 1980s. The analysis service was incorporated in 1988 as a separate company, Seakem Analytical Services Ltd, and its mandate was broadened in order to offer full service contracts to an expanded client base. In 1991 the parent company reorganized, resulting in a name change to AXYS Analytical Services Ltd. In October 2016 ownership of the company transferred to SGS Canada Inc. and in February 2017 the name of the company changed to SGS AXYS Analytical Services Ltd.

SGS AXYS Analytical provides ultra trace analysis of persistent organic pollutants and emerging organic contaminants, and measurement of endogenous metabolites (metabolomics).

2. COMPANY DESCRIPTION

SGS AXYS is a complete service analytical laboratory specializing in routine and custom trace organic analyses of environmental, industrial and biological samples. Permanent analytical facilities are located in Sidney, British Columbia and include modern laboratory facilities and state-of-the-art instrumentation. SGS AXYS employs approximately 100 highly trained chemists, chemical technologists and support staff. SGS AXYS has clients worldwide and is recognized for its expertise in trace organic analyses.

The scope of routine and speciality analyses offered by SGS AXYS are presented in Table 1. The instrumentation owned and operated by SGS AXYS is presented in Table 2.

Normal business hours are 8:00 a.m. to 4:30 p.m. PST/PDT, Monday through Friday. Individual work areas are staffed outside these hours as required. The switchboard is operated 8:00 am – 4:00 pm.

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TABLE 1 SCOPE OF PRODUCTS

The following list shows test class products that are available to clients subject to default commercial guidance contained in the SGS AXYS "Product and Service Guidelines". Note that other analyses not listed here may exist/be archived and may be reinstated conditionally by management approval. Tests offered on a regular, routine basis are validated and managed as fully developed analyses. Specialty tests have more stringent commercial guidance.

Analyses Offered

Polychlorinated biphenyls (PCB) congeners and Aroclors by GC-LRMS (gas chromatography-low resolution mass spectrometry)

Polychlorinated biphenyls (PCB) congeners and Aroclors by GC-HRMS (gas chromatography-high resolution mass spectrometry)

Polychlorinated dibenzodioxins/furans (PCDD/F) by GC-HRMS

Organochlorine pesticides (OCP) including Toxaphene by GC-LRMS

Organochlorine pesticides (OCP) by GC-ECD (gas chromatography-electron capture detection)

Organochlorine pesticides (OCP) including Toxaphene by GC-HRMS

Multi residue (MRES) pesticides by GC-HRMS

Polycyclic aromatic hydrocarbons (PAH) parents and alkylated PAHs by GC-LRMS

Per- and polyfluoroalkyl substances (PFAS) by LC-MS/MS

Pharmaceutical and personal care products (PPCP) by LC-MS/MS

Metabolites (targeted metabolomics)

Polybrominated diphenyl ethers (PBDE) by GC-HRMS

Octylphenol & nonylphenols by GC-LRMS and LC-MS/MS

Chloroparaffins by GC-LRMS

Alkanes by GC-LRMS

Dioxin/furan precursors by GC-LRMS or GC-HRMS

Chloronaphthalenes by GC-HRMS

Acid Extractable herbicides by GC-HRMS

Pyrethroids by GC-HRMS

Carbamates by LC-MS/MS

Glyphosate by LC-MS/MS

Mono phthalate esters by LC-MS/MS

Bisphenol A & conjugates by LC-MS/MS

Triclosan & conjugates by LC-MS/MS

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Triclosan by LC-MS/MS

Sterols & hormones by GC-HRMS

Hexabromocyclododecane (HBCD) by LC-MS/MS

Hormones by LC-MS/MS

Naphthenic acids by LC-MS/MS

Tetrabromobisphenol A (TBBPA) by LC-MS/MS

Fluorotelomer sulfonates (FTS) by LC-MS/MS

Polyfluorinated phosphonates (PFPA) by LC-MS/MS

Perfluoroalkyl precursors (PrePFAA) by LC-MS/MS

Parabens by LC-MS/MS

Organophosphate (OP) flame retardants by LC-MS/MS

Chlorinated and brominated flame retardants by GC-(ECNI)-MS

Hydroxy-polycyclic aromatic hydrocarbons (OH-PAH) by GC-HRMS

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TABLE 2 INSTRUMENTATION

1	Micromass AutoSpec Ultima Series V High Resolution Mass Spectrometer System equipped with a Hewlett Packard 5890 Series II High Resolution Gas Chromatograph, a CTC A200S autosampler and an Alpha workstation.
3	Micromass AutoSpec Ultima Series M High Resolution Mass Spectrometer Systems equipped with a Hewlett Packard 6890 series High Resolution Gas Chromatograph, a CTC A200S autosampler and an Alpha workstation.
2	Micromass AutoSpec Ultima Series M High Resolution Mass Spectrometer Systems equipped with a Hewlett Packard 6890 or 6890N series High Resolution Gas Chromatograph, a CTC GC-PAL autosampler and an Alpha workstation.
1	Waters Premier Series High Resolution Mass Spectrometer System equipped with a Hewlett Packard 6890N series High Resolution Gas Chromatograph, a CTC GC-PAL autosampler and an Alpha workstation.
3	Agilent 5973 Network Mass Selective Detectors equipped with an Agilent 6890N Network Gas Chromatograph, a CTC GC-PAL series autosampler and a workstation running Chemstation software.
1	Agilent 5975 Network Mass Selective Detector equipped with Agilent 6890N Network Gas Chromatograph, a CTC GC-PAL series auto sampler and a workstation running Chemstation software
1	Agilent 6890N Gas Chromatograph equipped with two Agilent G2397A Electron Capture Detectors, an Agilent 7683 autosampler and a workstation running Chemstation software.
3	Waters 2795 High Performance Liquid Chromatograph equipped with a Micromass Quattro Ultima Mass Spectrometer and workstations running QuanLynx/ Masslynx software.
1	Waters 2690 High Performance Liquid Chromatograph equipped with a Micromass Quattro Ultima Mass Spectrometer and workstations running QuanLynx/ Masslynx software.
1	Agilent 1100 High Performance Liquid Chromatograph equipped with an Applied Biosystems API 4000 Mass Spectrometer running Analyst software
1	Waters Acquity Ultrahigh pressure liquid chromatograph equipped with a Waters TQ-S mass spectrometer running TargetLynx/Masslynx software
1	Waters Acquity Ultrahigh pressure liquid chromatograph equipped with a Waters TQ-S micro mass spectrometer running TargetLynx/Masslynx software

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3. ACCREDITATION SUMMARY

SGS AXYS is accredited to ISO17025:2005, The NELAC Institute (2009-TNI), and the US Department of Defense Environmental Laboratory Program (DoD ELAP) quality standards, for testing of specific compounds. SGS AXYS also holds accreditation against state quality standards programs. The accreditation scope is summarized below; a compound specific scope of accreditation is maintained in SGS AXYS document ACC-101 'Accreditation Scope'.

	Methods		Accrediting Organizations										
Compound Class	**SGS AXYS**	**EPA**	**CALA**	**NYSDH**	**SNJDEP**	**FLDH**	**SWADE**	**MDH**	**VDCLS**	**MDHHS**	**ANAB**	**CDPH**	**PDEP**
Organochlorine Pesticides (LRMS/ECD)	MLA-007	625, 608 8270, 8081	W S T Ser	W (NP) S		W (NP) S	S		W (NP) S	W (NP) S	W (NP) S	W (NP) S	
Organochlorine Pesticides (HRMS)	MLA-028	1699	W S T Ser			W (NP) S	W (NP) S				W (NP) S		
Polychlorinated Biphenyls (PCBs, LRMS)	MLA-007	625 8270	W S T	W (NP) S		W (NP) S	S		W (NP) S	W (NP)	W (NP) S	W (NP) S	
	MLA-901		Ser										
Polychlorinated Biphenyls (PCBs, HRMS)	MLA-010	1668	W S T Ser	W (NP) S	W (NP) S	W (NP) S	W (NP) S		W (NP) S	W (NP) S	W (NP) [2] S [2] T [2]		W (NP)
Chlorinated Dioxins/Furans	MLA-017	1613 8290	W S T Pulp Ser	W (NP) S	W (NP) S T	W (NP) S T	W (NP) S		W (NP) S T	W (NP) S	W (NP) [2] S [2] T [2]	W (NP) S	
Polycyclic Aromatic Hydrocarbons (PAH)	MLA-021	1625 8270	W S T	W (NP) S		W (NP) S			W (NP) S	W (NP) S	W (NP) S	W (NP) S	
Perfluorinated Organic Compounds (PFC)	MLA-060		W		W (NP)	W (NP)		W (NP)			W (NP) [1,2]		
	MLA-041		S		S	S		S			S [1,2]		
	MLA-043		T		T	T		T			T [1,2]		
	MLA-042		Ser										

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	Methods		Accrediting Organizations										
Fluorotelomer Sulfonates (FTS)	MLA-081										W [1,2]		
	MLA-089										S [1,2]		
Polybrominated Diphenyl Ethers (PBDPE)	MLA-033	1614	W S T Ser				W (NP) S						
Hexabromocyclo-dodecane (HBCDD)	MLA-070		Ser										
Bisphenol A (BPA)	MLA-059		Urine										
Phthalate Ester Metabolites (mPE)	MLA-059		Urine										
Tetrabromobis-phenol A (TBBPA)	MLA-079		Ser										
Pharmaceutical and Personal Care Products (PPCP)	MLA-075	1694	W S							W (NP) S			
Metabolites (targeted metabolomics)	MLM-001		T Ser Urine										

CALA : Canadian Association for Laboratory Accreditation Inc., LAB ID A2637
NYSDH: New York State Department of Health, LAB ID 11674
SNJDEP: State of New Jersey Department of Environmental Protection, LAB ID CANA005
FLDH: State of Florida Department of Health, LAB ID E871007
SWADE: State of Washington Department of Ecology, LAB ID C404
MDH: Minnesota Department of Health, Lab ID 232-999-430
VDCLS: Commonwealth of Virginia, Department of General Services, Division of Consolidated Laboratory Services, LAB ID 460224
MDHHS: Maine Department of Health and Human Services, LAB ID CN00003
ANAB: ANSI-ASQ National Accreditation Board, Cert. No. ADE-1861
CDPH: California Department of Public Health, Cert. No. 2911
PDEP: Pennsylvania Department of Environmental Protection, Lab ID 68-05420
[1] Accreditation for EPA method 537 modified
[3] Includes accreditation to DoD-ELAP standard

Matrices:
W: Water/aqueous samples (NP = non-potable)
S: Solid samples
T: Tissue samples
Ser: Serum/Plasma samples

Notes: CALA accreditation is against the SGS AXYS method shown (EPA methods in this case are method references). US accreditation is against the EPA method shown, with the exception of FLDH and ANAB (the ANSI-ASQ National Accreditation Board) for which accreditation is against EPA and SGS AXYS methods.

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II. QUALITY SYSTEM OVERVIEW

1. QUALITY OBJECTIVE AND POLICIES

SGS AXYS Analytical Services Ltd's objective is to provide analytical data that meet established standards for consistency, accuracy, defensibility and fitness for purpose, at a fair price, providing the best possible value to the client. SGS AXYS provides services to its clients in a professional, confidential, honest and forthright manner and adheres to the highest levels of business ethics. SGS AXYS management is committed to the following quality policies to meet the objective.

1. To continually improve management systems and data quality, a QA Manager will oversee management of a quality assurance (QA) program. The QA Manager will be responsible for documenting the QA program in a Quality Manual and the Technical Director will ensure that this manual and supporting documentation are available to all staff. Staff will be required to be familiar with the quality system documentation and to implement the policies and procedures in their areas.
2. SGS AXYS quality management policies, procedures and practices will comply with the requirements of the current version of the ISO 17025 standard, the current version of the Canadian Association for Laboratory Accreditation (CALA) standard, the current version of the TNI-National Environmental Laboratory Accreditation Program (NELAP) standard and where applicable to work, the current version of the US DoD standard for environmental laboratories. SGS AXYS will comply with applicable regulatory requirements. The QA Manager, Technical Directors, and Director of Operations have overall responsibility for ensuring adherence to this standard. Internal audits will be performed to ensure compliance with the documented quality practices, which incorporate the above standards.
3. Management systems will ensure that sufficient resources and trained staff are available to meet contractual commitments.
4. Staff will be trained in analytical methods, data integrity procedures, ethical and legal responsibilities, security procedures and in the purpose and use of the QA/QC program. Staff training records are maintained.
5. Documented sample handling and security procedures will ensure sample integrity from time of sample receipt to acceptance of the final data report.
6. SGS AXYS will use validated, reliable and rugged test methods that are fit for purpose. Method precision, accuracy, detection limits and uncertainty estimates will be determined using recognized procedures. Method and laboratory performance will be monitored against established statistical control limits. SGS AXYS will participate in interlaboratory comparison studies and performance evaluation programs, where available, to continually monitor the accuracy of data.
7. Samples will be analyzed in batches containing quality control (QC) samples. The results of batch QC samples will be used to assess the sample data quality and are routinely provided to clients with sample results.

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8. Only materials, reagents and supplies that meet required quality specifications will be used. Standard solutions used in methods will be validated against primary solutions of known purity and concentration.
9. To ensure traceability of results, only Class A volumetric glassware or equivalent, and syringes with demonstrated accuracy (bias and precision), will be used for the preparation of standard solutions, spiking of standard solutions to samples and all other volumetric measurements that can influence analytical accuracy. The accuracy of variable volume pipettes, balances and thermometers will be traceable to ISO17025:2005 compliant calibration or National Institute of Standards Technology (NIST) standards.
10. Data will be handled in accordance with documented data management protocols that ensure reports and statements to clients are accurate, impartial, include any necessary opinions and interpretations, and protect client and data confidentiality. Traceability of results will be maintained through the use of software audit trail processes to retain original data where manual adjustments or corrections have been made. Staff will receive training in data integrity procedures, in sign binding confidentiality, and in legal and ethical responsibility agreements.
11. A company wide security program will ensure security of samples, data, records and laboratory premises.
12. Records will be stored in a permanent form and retained on file following systematic data archival procedures in a secure environment. Hardcopy records (or exact electronic image) and electronic data are retained for a minimum of ten years.

2. QUALITY DOCUMENTATION

The quality system includes documented policies and procedures that apply to all aspects of the operations carried out at SGS AXYS. These policies and procedures describe a comprehensive quality assurance/quality control program designed to ensure sample integrity, accuracy of results, traceability of results, client confidentiality, and the quality of goods and services.

The quality system in place at SGS AXYS is described in a series of documents. Quality system documents are written and maintained in the English language only. A schematic diagram of the quality system documentation is presented in Figure 1.

2.1 QA/QC Policies and Procedures Manual

The QA/QC Policies and Procedures Manual (Quality Manual) describes the QA/QC policies and procedures that make up the quality system and serves as a QA/QC training guide for employees. This manual refers to SGS AXYS' Analytical Methods and SGS AXYS' Standard Operating Procedures (SOPs), which contain the standard operating procedures required to carry out all activities related to analyses performed at SGS AXYS. The Quality Manual is a controlled document authorized by the QA Manager, the Senior Technical Director and the Director of Operations. Controlled copies of the Quality Manual are available to all staff.

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2.2 Analytical Methods

SGS AXYS uses validated methods that have been demonstrated to be rugged, reliable and adequate for the intended application. These methods are taken from several sources: recognized standard methods, methods mandated by regulation, literature methods and methods developed by SGS AXYS based on literature methods. Each analysis is documented in an Analytical Method that describes the analytical process including sample storage, sample preparation, sample extraction and cleanup, instrumental analysis, data reduction, and calculation of final results. Each analytical method is approved by the QA Manager, the Senior Technical Director, the Director of Operations, appropriate department Managers and designated senior staff.

Controlled (numbered) copies of Analytical Methods are issued to specific work areas and are available to all staff. Analytical Methods are available electronically to all staff. Distribution lists for all Analytical Methods are maintained.

Analytical methods are documented in a standard format, described in Appendix C.

2.3 Standard Operating Procedures

SGS AXYS' Standard Operating Procedures (SOPs) describe operating procedures required to perform tasks related to the analysis of samples. Each standard operating procedure is approved by the QA Manager, Senior Technical Director, and Manager of the work area in which the SOP is used. Controlled (numbered) copies of SOPs are issued to specific work areas and are available to all staff. SOPs are also available electronically to all staff. Distribution lists for all SOPs are maintained.

SOPs are documented in a standard format, described in Appendix C.

2.4 Quality System Records

Records of performance evaluation testing, internal and external audits, management review, and corrective and preventative actions are maintained on file by the QA Manager and are used as input to process improvements.

2.5 Document Reviews

Methods and technical SOPs required for DoD work are reviewed annually. All other method documents and SOPs are reviewed every three years. The results of the reviews are recorded and retained in the Q-Pulse document control system.

The QA/QC Policies and Procedures Manual is reviewed annually.

Documents are also reviewed and revised any time a documentation deficiency has been identified.

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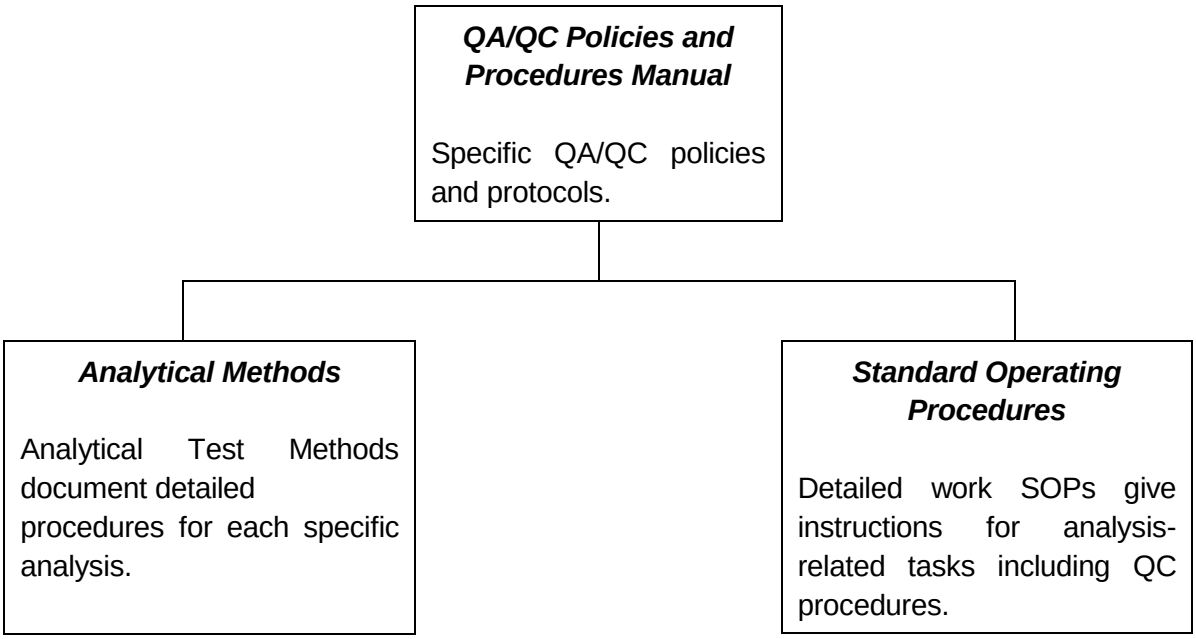
FIGURE 1 QUALITY SYSTEM DOCUMENTATION



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3. DOCUMENT CONTROL PROCEDURES

SGS AXYS uses a software program called Q-Pulse to manage quality program documentation. Built-in program modules are used for managing the document control system, for documenting employee training, and for documenting non-conformances. Access to each module and the elements within is limited to designated staff as specified by the QA Manager.

A QA Chemist oversees the daily maintenance of the Q-Pulse system. Q-Pulse is used to perform the following functions:

- Maintain a directory of current documents, accessible to all staff as 'read only' documents.
- Maintain a directory of draft documents, accessible to staff responsible for reviewing and approving documents.
- Maintain a directory of previous versions of current documents, accessible to staff as required.
- Maintain a directory of archived (out of use) documents accessible only to documentation staff.
- Maintain a list of all documents in each directory.
- Maintain a distribution list for each document.
- Maintain a change request directory.
- Increment the revision (or version) number when a document is revised.
- Assign a new document number when one is created.
- Notify staff when a new document or new revision has been activated.
- Track staff acknowledgement of the new or revised document.
- Maintain a history of changes to each document.
- Maintain a record of the documents distributed to each staff member.
- Record comments on draft documents and approval by each designated approver.
- Maintain a record of requests for revisions to documents.
- Store supporting information for new and revised methods and SOPs attached with the pertaining change requests.

Document control procedures are used to identify, distribute, and control the documents that are part of the quality system. Each controlled document is assigned an identification number, revision/version number and date of issue. Each distributed hardcopy is controlled with a copy number. Document control procedures are designed to ensure that only current copies of documents are in use. The QA Manager is responsible for the implementation of document control procedures and for ensuring that the procedures are followed.

A QA Chemist oversees the document control system, assigning document numbers, issuing new and revised documents, removing outdated documents from circulation, and maintaining the document control system. The document control system consists of all current documents as well as all previous versions, draft and archived documents. A master list of all documents in use is maintained.

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The organization of the document control system is described in Appendix C.

SGS AXYS' policies for the control of quality documentation are as follows:

1. Staff are required to work from current, controlled copies of quality documentation. Controlled copies of analytical methods, standard operating procedures and other required documents are electronically distributed to SGS AXYS' staff, and staff are required to acknowledge that they have read, understood and agree to follow the procedures. Controlled paper copies of the Quality Manual are numbered and bound.
2. Upon leaving SGS AXYS' employ, employees must return all quality documentation issued to them.
3. All quality documentation is the property of SGS AXYS and is considered Proprietary and Confidential Business Information. Distribution of the quality documentation outside of SGS AXYS requires the permission of the QA Manager or the Technical Director. The following statements must accompany documents released outside the company:

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Internal hardcopies of the Quality Manual are provided as controlled documents; copies of the Quality Manual released externally are not controlled and are not updated.

Copies of revised method SOP documents are provided to accrediting organizations in compliance with the accrediting body requirements, and in all cases within 30 days of the document revision.

3.1 Document Preparation

The QA Chemist is responsible for the preparation and maintenance of the quality documentation under the supervision of the QA Manager. The Quality Manual, analytical methods and standard operating procedures are prepared by the QA Chemist according to the formats described in Appendix C, and procedures described in Standard Operating Procedures.

SQA-004	Document Control Procedures
SQA-005	Creation of New Documents
SQA-006	Revision of Documents

The QA Chemist is responsible for electronic distribution of new quality documentation to designated staff, retaining of outdated documentation, and maintenance of document control files.

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4. DEPARTURE FROM DOCUMENTED PROCEDURES

Employees are required to follow all documented procedures routinely, but in some circumstances it may be necessary to deviate from documented procedures. In such cases, the following policies apply.

- Requests for customized contaminants testing are submitted by Account Managers or Project Managers to the Product Group. The Product Group reviews requests in the context of technical/operational feasibility and requirements, and business rationale, and provides a recommendation to proceed or to not proceed. Recommendations requiring new methods, or additional analytes for an existing method, are forwarded by the Product Group to the Product Council for approval; approved requests are then forwarded to the Director of Operations for operational approval. Recommendations limited to expansion of current methods to similar matrices are forwarded by the Product Group to the Director of Operations for approval. Details on the number, value, and purpose of incremental QC samples, paid tests or trials are provided by the Product Group for the Account or Project Manager to communicate to the client in order to obtain agreement prior to completion of the approval process. The authorization of procedures and the date of approval, if applicable, are recorded in the Project Notes. Further procedure details are documented in the Product and Service Guide:

  PSG-001 Product and Service Guide

- Decisions on customization of metabolomics analysis are approved by the Manager, Metabolomics Services.
- Reporting of results not meeting all method specifications, documented quality specifications or contract requirements requires assessment of the fitness for purpose by the Project Manager and/or the Account Manager. Where results are determined to be fit for purpose, the results may be reported with the necessary explanation and qualification. Approval to report the data is documented in the LIMS workgroup notes with the name of the approving individuals and the date.

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III. ORGANIZATIONAL STRUCTURE

SGS AXYS Analytical Services Ltd is a privately owned company registered in British Columbia, Canada. The organizational structure is documented on the current version of the organizational chart, available in the Q-Pulse controlled document directory:

QDO-005 SGS AXYS Organizational Chart

The Vice President (VP) SGS AXYS is responsible for the overall management of the company and serves as Senior Technical Director. The Director of Operations, the Director of Sales, Marketing and Service, the Quality Assurance (QA) Manager, the Manager, Metabolomics Services, The Information Technology Manager, the Administration/Accounting Supervisor and the Scientific Director (Technical Transfer) report to the Vice President. Each of these individuals is responsible for the management and operation of a designated work area. Each has access to resources and has the authority to hire staff and purchase goods and services subject to approved planning limits. Managers/Supervisors are responsible for defining staff qualifications (education, experience, skills), staff training, ensuring that staff have demonstrated competency, monitoring staff performance, resolution of problems and ensuring that policies and procedures are followed in their area of responsibility.

1. VICE PRESIDENT AND SENIOR TECHNICAL DIRECTOR

The Vice President has overall authority and responsibility for management of SGS AXYS Analytical Services Ltd. and serves as the Senior Technical Director for operation of the laboratory. The primary accreditation body is notified in writing should the Vice President be absent for more than 35 consecutive calendar days. In case of absence, the Director of Operations performs the Vice President's management duties with assistance of the Delegated Back-up Technical Director.

1.1 Delegated Back-up Technical Directors

The Manager, Metabolomics Services or the Instrumental Analysis Manager serve as the Technical Director for any absences of the Senior Technical Director exceeding 15 consecutive calendar days.

2. DIRECTOR OF SALES, MARKETING, AND SERVICE

The Director of Sales, Marketing, and Service, reporting to the Vice President, develops business contacts, seeks business opportunities and markets SGS AXYS' services. In case of absence, the Vice President acts for the Director of Sales, Marketing, and Service.

2.1 Senior Scientific Specialist

The Senior Scientific Specialist maintains and develops relationships between SGS AXYS and key clients, providing support to Project Managers, Client Services and Operations, through

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their technical knowledge and experience. Participation in technical marketing initiatives via scientific presentations and papers supporting the company competencies is integral to the role.

3. DIRECTOR OF OPERATIONS

The Director of Operations is responsible for the daily operation of the laboratory. The Client Services Manager, the Laboratory Supervisor-Analyst Group, the Laboratory Supervisor-Technical Group, the Instrumental Analysis Manager, the Advanced Product Development Scientist, the Health and Safety Coordinator, the Purchaser and the Facilities Manager report to the Director of Operations. The Director of Operations monitors laboratory performance to ensure that work is conducted in accordance with proper procedures and that quality performance standards are met. In the case of absence the Vice President, or designate, acts in the role of Director of Operations.

3.1 Client Services Manager

The Client Services Manager reports to the Director of Operations and is responsible for the Client Services department, which carries out project management and data reporting, and supervises the LIMS group. The Client Services Manager monitors data production to ensure that work is conducted in accordance with proper procedures and that quality performance standards are met. In case of absence, a Senior Project Manager acts for the Client Services Manager.

3.1.1 Laboratory Information System (LIMS) Technician

The LIMS Technician is responsible for the maintenance of the LIMS, the development of new procedures and their implementation into the workflow of the company. The Laboratory Information Management System (LIMS) Technician reports to the Client Services Manager (with secondary report to the Vice President). The Data Support Scientist acts as back-up for the LIMS Analyst/Programmer in case of absence.

3.2 Laboratory Supervisor, Analyst Group

The Laboratory Supervisor, Analyst Group, reports to the Director of Operations and is responsible for overall operation of the Sample and Extract Preparation Laboratory. The Laboratory Supervisor monitors laboratory performance to ensure that work is conducted in accordance with proper procedures and that quality performance standards are met. In the case of absence, the Director of Operations acts for the Laboratory Supervisor, Analyst Group.

3.2.1 Lab Schedule Coordinator

The Lab Schedule Coordinator is responsible for scheduling work in the analysis and sample prep lab and is assigning analysis batches, determining the analytical requirements of each batch and communicating the requirements to staff on analysis Batch Lists. In the case of absence, an experienced Chemist from the Extraction Lab acts for the Coordinator.

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3.3 Laboratory Supervisor, Technical Group

The Laboratory Supervisor, Technical Group, reports to the Director of Operations and is responsible for overall supervision of the Laboratory Technicians and the Sample Receiving Chemists. The Laboratory Supervisor monitors laboratory performance to ensure that work is conducted in accordance with proper procedures and that quality performance standards are met. In the case of absence, the Director of Operations acts for the Laboratory Supervisor, Technical Group.

3.4 Instrumental Analysis Manager

The Instrumental Analysis Manager is responsible for management of instrumental analysis and data production. The Instrumental Analysis Manager monitors laboratory performance to ensure that work is conducted in accordance with proper procedures and that quality performance standards are met. In case of absence, the Director of Operations acts for the Instrumental Analysis Manager.

3.4.1 Operations Coordinator

The Operations Coordinator reports to the Director of Operations and the Instrumental Analysis Manager and works with client services to co-ordinate incoming work as well as being responsible for scheduling Instrumental Analysis Chemists' work. In the case of absence, an experienced Instrumental Analysis Chemist acts for the Operations Coordinator.

3.5 Advanced Product Development Scientist

The Advanced Product Development Scientist reports to the Director of Operations and directs Chemists in the development of new methods and communicates with the Product Group and the Product Council to optimize development and transfer of new products to routine operations. In case of absence, the Manager, Metabolomics Services, acts for the Advanced Product Development Scientist.

4. MANAGER, METABOLOMICS SERVICES

The Manager, Metabolomics Services heads operations, projects and scientific development for the Metabolomics department of SGS AXYS Analytical services, and works with the Department Business Head (Vice President) to coordinate sales and business development for the department. The Manager monitors laboratory performance to ensure that work is conducted in accordance with proper procedures and that quality performance standards are met. In case of absence, the Vice President acts for the Manager, Metabolomics Services.

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5. QUALITY ASSURANCE (QA) MANAGER

The QA Manager is responsible for the quality program and operates independently of daily laboratory operations. The QA Manager has training in laboratory assessment and the expertise to evaluate analytical processes and data independently. The QA Manager conducts internal laboratory audits, monitors corrective actions, and has the authority to suspend or amend operations. The QA Manager reports to the Vice President. In case of absence, the QA Chemist acts for the QA Manager.

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IV. HUMAN RESOURCES

SGS AXYS Analytical Services Ltd employs only qualified staff with the education, experience and expertise necessary for the job function. The Technical Director certifies that staff qualifications meet or exceed the minimum standards, which are documented in job descriptions maintained on file in the central computer system. Job descriptions define the minimum job qualifications, responsibility for planning and performing tests, scope for evaluation of results including reporting opinions or interpretations, responsibility for method development, validation, or modification and managerial duties.

Managers and certain Supervisors record performance evaluations and job descriptions in personnel files. The QA documentation system encompasses training records including a signed Ethical and Legal Responsibilities Statement, a Basic Training Checklist and, where applicable, certificates of Demonstration of Capability.

Individual personnel files are maintained for all staff. Each personnel file contains a signed non-disclosure agreement, a career résumé, an orientation record, and an employment record. In addition, staff résumés, summarizing relevant experience, are maintained by SGS AXYS administrative staff and are used for inclusion in work proposals.

Employees are issued a copy of the SGS AXYS Employee Guide that documents the SGS AXYS company policies, employee benefits, safety procedures and employee responsibilities. Employees are required to read SGS AXYS' Safety Manual (SAF-001) describing safety equipment and procedures.

1. STAFF TRAINING

All SGS AXYS staff receive on-the-job training. The training program has three components.

- Orientation
- Job training
- QA/QC training

1.1. Orientation and Basic Training

All new employees are familiarized with the overall operation of SGS AXYS during an orientation process conducted during the first day of employment and must complete a Basic Training within 30 days of employment. At this time, administrative documents, including a non-disclosure (confidentiality) form and an IT policies form, are completed and the Employee Guide is reviewed with the Manager/Supervisor. The employee receives instruction on data integrity procedures and signs an Ethical and Legal Responsibilities Statement. Safety features and procedures, and security procedures, as described in the SGS AXYS' Safety Manual (SAF-001)

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are reviewed. The Manager documents the Basic Training by checking the applicable items in FQA-010 (Basic Training Checklist). After completion the Basic Training Checklist is saved in the employees training record.

The signed non-disclosure and IT Policies forms are kept by the Human Resources Department in the employee's personnel file. The signed Ethical and Legal Responsibilities Statement is filed with the employee's training record.

Details of the orientation process are described in the following Standard Operating Procedures.

SQA-016	Training in Data Integrity, Ethical and Legal Responsibilities
SAF-001	Safety Manual
FQA-010	Basic Training Checklist

1.2. Job Training

Each staff member undergoes an initial training period under direction of the work-area Manager/Supervisor. Initial training procedures include the following:

- working closely with the Manager/Supervisor or an experienced analyst to acquire the skills and understanding necessary to the job function;
- supervision of all work;
- monitoring of all results to evaluate the effectiveness of training;
- testing of competency and understanding;
- documentation of training; and
- authorization to work independently.

Each Lab Chemist and Instrumental Analyst must prove his/her competence on test samples by completing a demonstration of competency initially and annually. Department Managers/Supervisors and the QA department maintain records of the initial training period as well as additional training or expertise gained. Where required, analyst capability is documented on an annual basis.

Job training is a continuous process. SGS AXYS conducts seminars on a variety of analysis-related topics and workshops on specific methods.

Training procedures are documented in the following Standard Operating Procedures.

SLA-032	Training a Laboratory Chemist
SLA-138	Training of Laboratory Technicians
SIN-015	Training Procedures for an Instrumental Analytical Chemist
SQA-017	Documentation of Chemist Training and Competence
SQA-016	Training in Data Integrity, Ethical and Legal Responsibilities

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1.3. QA/QC Training

Staff are trained in quality assurance and quality control practices and the use of quality documentation. They receive on-the-job QA/QC training by their Manager/Supervisor following guidelines established by the QA Manager. All staff are required to read the Quality Manual and to electronically sign a Quality Manual acknowledgement, which indicates that they understand and agree to follow SGS AXYS' quality policies and procedures.

2. DATA INTEGRITY AND ETHICAL AND LEGAL RESPONSIBILITIES

An employee's Manager is responsible for providing initial training in data integrity, ethical and legal responsibilities, for ensuring that these responsibilities are fully understood and for updating training in this area when changes are made. In addition employees are required to renew their training in data integrity, ethical and legal responsibilities on an annual basis.

Data integrity procedures are documented in the following Standard Operating Procedure:

SQA-024 Data Integrity Procedures

Employees are required to conduct their work responsibly, in accordance with the ethical and legal requirements described below. Employees must:

1) Adhere to the confidentiality policies described in the non-disclosure agreement signed by each employee.
2) Perform work in accordance with documented analytical testing, QA/QC, and security policies and procedures. Ensure that any deviations from documented practices have been authorized.
3) Follow all documented record-keeping practices and adhere to documentation policies as described in the standard operating procedure SQA-019 "General Documentation Policies".
4) Report promptly to the department or QA Manager non-conforming practices, non-conforming data, and any situations or circumstances that could compromise data quality or defensibility.
5) Be honest, fair and impartial in quotes, reports and statements to clients.
6) Report to the QA Manager and Technical Director, in confidence, any undue commercial, financial, or other pressures that might adversely affect quality of work or create a conflict of interest. A conflict of interest arises when an employee has any interest beyond a professional interest in a sample, which may be perceived to affect the employee's professional judgement or objectivity.

Consequences of non-compliance with these guidelines could include termination of employment and civil or criminal prosecution.

The QA Manager monitors operational activities and data to ensure compliance with these requirements, Data integrity policy, procedures, application and effectiveness are reviewed annually by the QA Manager and Senior Technical Director.

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V. FACILITIES

SGS AXYS Analytical Services Ltd consists of well-equipped laboratories (~8000 sq ft), technical staff offices (~7000 sq ft), meeting rooms, stationery (storage, photocopier), general reception, sample receiving, sample storage (4°C, <-10°C and -80°C) and solvent storage (new and waste solvent). SGS AXYS' facilities are housed in three separate buildings, at the same location. Floor plans of the facilities are presented in Appendix G. The total area of SGS AXYS' facilities is ~22,000 sq ft.

The ground floor of the north building houses the first aid room, glassware cleaning room, six wet chemistry laboratories, the sample preparation labs, laboratory staff office, the standard solution preparation room equipped with vented, locked cupboards for standards storage, and the standards storage room equipped with refrigerators, freezers and vented storage cabinets for storage of working standards. Each wet chemistry laboratory is equipped with at least one fumehood, hot and cold running water and overhead fluorescent lighting. All laboratories are equipped with at least one electronic balance. The "New" laboratory (April 2000) is equipped with vacuum pumps for the rotary evaporators, minimizing the solvent loss to the environment, and a chilled, recirculating water system.

The upper floor of the north building contains SGS AXYS' reception area and offices for management, technical staff, general accounting and administrative staff. In addition, washroom facilities, a meeting area and a lunch area are located on the second floor.

The ground floor of the south building houses the instrument laboratories.

The upper floor of the south building houses offices for Instrumental Analysis staff, offices for primary and secondary validation staff, and the server room for IT.

The west building houses metabolomics laboratory space (approx. 600 sq ft) with separate controlled access to ensure isolated operation, computer support services, facilities for sample receiving and storage, and purchasing and shipping/receiving offices.

Samples requiring refrigeration are stored in walk-in coolers (combined capacity ~3000 cubic feet), samples and extracts requiring frozen storage are stored in walk-in freezers (combined capacity ~5000 cubic feet), or in -80°C freezers, as required.

As a safety feature, excess new solvent is stored in an isolated facility (capacity ~1440 cubic feet). Waste solvent is stored in barrels and removed weekly by a waste disposal company.

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1. QA SPECIFICATIONS OF FACILITIES

The analysis of samples for environmental contaminants and metabolomics at SGS AXYS requires that some operating conditions be controlled in order to ensure sample integrity, to eliminate sources of contamination, and to maintain instrument stability.

1.1 Sample Storage

Samples received for analysis are stored under conditions appropriate to the matrix and analysis type. The following Standard Operating Procedure describes the sample storage requirements in detail.

SLA-003 Sample Receipt and Login

- Tissue samples, soil/sediment/sludge samples, ambient air sampling media (PUF, filter, XAD), and solvent extracts are generally stored frozen, at a nominal temperature of <-10°C.
- Aqueous samples, XAD-2 resin columns with associated filters, and wet pulp are stored cool, at a nominal temperature of 4°C but not warmer than 6°C.
- Dry pulp, and oil/defoamer samples for dioxin precursor analyses are stored at ambient temperature in cupboards. Freeze-dried reference samples may be stored at ambient temperature where specified by the issuing agency.
- Samples for metabolomics analysis are stored in a freezer at -80ºC.

In order to prevent possible reactions initiated by light, samples are stored in the dark.

The temperature of all the cold sample storage facilities is monitored every business day. The following Standard Operating Procedures describe the procedures for monitoring the sample storage areas and the action to be taken when specified conditions are not met.

SLA-026 Monitoring Temperature of Freezers, Coolers and Refrigerators

Freezers and Coolers

Freezers are maintained at a nominal temperature of <-20°C (walk-in type) or <-10°C (upright type); ultra-low temperature freezers are maintained at a nominal temperature of -80°C, the walk-in coolers and refrigerators are maintained at a nominal temperature of 4°C. A security company monitors the freezers and coolers and the alarm is triggered if the air temperature at the top of the freezer or cooler exceeds a specified temperature; designated staff are alerted by the security company should an alarm trigger at any time. The freezer and cooler temperatures are also monitored every business day by SGS AXYS staff. The walk-in freezers and coolers are kept locked.

Freezers and coolers used for sample storage are protected from power loss by back-up generator.

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Refrigerators

Several of the laboratories are equipped with refrigerators. The temperatures of both the freezer and refrigerator units are monitored every business day by a Lab staff member, except for refrigerators in the Instrument area, which are monitored by an Instrumental Analysis Chemist.

1.2 Facilities Maintenance

Good housekeeping to ensure that the work areas are free of sources of contamination is conducted on a regular schedule through contracted services. Maintenance service is available to staff at all times. Service outside regular business hours is available by contacting the appropriate individual on the After Hours Contact List.

QLI-020 After Hours Contacts List

1.3 Laboratory Conditions

Laboratories must be free of sources of contamination. Procedural blanks, analyzed with each batch of samples, are carefully monitored and checked for the presence of laboratory background and interferences that may come from reagents, lab equipment, or the air. In order to eliminate possible sources of contamination, the following conditions must be satisfied for each laboratory.

1. The air entering the laboratories is cleaned by filtration of the intake air. The filters are inspected and replaced on an established schedule.
2. The use of plastic laboratory equipment is limited to approved analyses and lab areas.
3. Workbench surfaces must be made of non-porous materials. An alternate to a non-porous surface is to cover the lab bench in aluminum foil prior to starting an analysis.
4. Flooring materials must be made of hard, washable materials. Chairs or bench tops must be made of impervious material – the use of foam-padded chairs is not permitted.
5. The Director of Operations must approve cleaning products used in the laboratory.
6. No pesticides or herbicides shall be used in the SGS AXYS buildings or on SGS AXYS property without the written permission of the Technical Director or the QA Manager.
7. Samples known to be, or suspected to be, "ultra high level" samples are worked up using glassware that has received special pre-cleaning before having been processed through the normal cleaning procedure.
8. The ventilation system, chemical storage, and safety features in each laboratory must satisfy WorkSafeBC specifications. Refer to the SGS AXYS Safety Manual SAF-001 for further details.
9. Any special environmental conditions and procedures required for custom work will be implemented and monitored as necessary.

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1.4 Additional Conditions for Instrument Laboratories

In addition to the above-specified conditions for laboratories, instrument rooms must satisfy the manufacturer's specifications for the individual instrument. Details of the specifications are found in the instrument manuals kept in each instrument room.

1. The instrument rooms must be air conditioned to maintain a room temperature of 18-25°C, stable to within ±3°C. The absolute room temperature is not as critical to instrument stability as the variation in room temperature. A variation of ±3°C has been shown not to affect instrument stability.

2. All instruments must be on individual electrical breakers. In addition, all high resolution instruments must be on their own panels.

2. SAFETY FEATURES

Each laboratory has at least one fire extinguisher, one heat detector and an eyewash station. Laboratories 1, 4 and the “New” lab are also equipped with overhead showers. The main hallway through the wet chemistry laboratories is equipped with a dry chemical extinguisher, a CO_2 extinguisher, emergency lighting, smoke detector, and the main fire alarm. There is also a well-equipped first aid room in Laboratory 1.5. Each laboratory is equipped with wall attachments to secure pressurized gas cylinders. A spill kit for handling chemical spills is kept in Laboratory 1 and in the “New” laboratory facility. There is an Automated External Defibrillator (AED) located at the South entrance of the North Building.

3. SAFETY PROCEDURES

Upon employment at SGS AXYS, all staff are briefed on the Company safety policies and familiarized with safety features such as eye wash stations, fire extinguishers, first aid kit, safety showers and spill kit. In addition lab staff are briefed on lab safety policies, namely routine use of lab coats, safety glasses, closed toe shoes and fume hoods, as well as use of goggles, masks, respirators, and/or gloves when appropriate.

The SGS AXYS Analytical Services Joint Health and Safety Committee is constituted and administered in compliance with current, applicable health and safety regulatory requirements (including those of WorkSafeBC). Its function is to ensure at a minimum regulatory compliance and, also to enhance workplace safety beyond minimum standards. It meets monthly to address safety issues, review processes and set policy.

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The AXYS Safety Manual is available to every employee. Employees must acknowledge that they have read and understood the document in Q-Pulse. The Safety Manual provides detailed information on all safety equipment and procedures.

SAF-001 Safety Manual

4. SECURITY FEATURES

Each building is monitored during non-work hours by a security system, which includes motion detectors and door alarms (which must be deactivated in order to enter the building). The last person to leave the building activates the security system. Smoke detectors, located in each building, are continuously monitored by a security system. Except for the main door of the west building leading to the IT Department, the doors to buildings are locked at all times. All building doors are locked during non-business hours. Each employee is issued an individually numbered key that permits access to the buildings.

5. SECURITY POLICY

The purpose of SGS AXYS' security policy is to maintain the security of SGS AXYS' facilities, integrity of samples submitted for analysis, and confidentiality of client data and other information. In order to achieve these goals the following policies and procedures are in place.

5.1 Security of Facilities

1. All exterior doors are always locked except the front doors to the west building, which are open Monday – Friday 7:00 a.m. – 5:00 p.m. Laboratory work areas in the west building are locked at all times and staff use issued key permits for entry.

2. Visitors are required to report to reception, wear a visitor's badge and be escorted by a staff member while in SGS AXYS' facilities.

3Work areas containing data or client information are kept locked outside regular work hours.

5.2 Security of Samples

1. All samples are identified with an SGS AXYS ID number that is a unique descriptor that is assigned by the LIMS. This ID number is attached to each sample container as soon as it is logged in at SGS AXYS.

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2. Samples are always kept in a secure storage facility maintained at appropriate atmospheric conditions until time of analysis. Access is limited to designated staff, each with a key to the storage facilities. The Accounting Department maintains a list of authorized key holders.

3. The storage location of samples is recorded. Sample Receiving Chemists are responsible for retrieving and returning samples to storage facilities.

3. Samples are under the direct care of a Lab Chemist when being worked on. The sample extracts are kept under the care of a Lab Chemist at his/her workplace until they are ready for instrumental analysis. The extracts are then transferred to the Instrument group who keeps the extracts in secure storage in the Instrument Lab.

5.3 Security of Data

SGS AXYS has established the following data security policies that are the basis of SGS AXYS' data security procedures. Details of data security procedures are describe in the following standard operating procedure:

SAD-028 Electronic Data - Security Policies and Features

1. Physical access to SGS AXYS premises is restricted to authorized staff.
2. Separate and unique user ID/passwords are used to access the SGS AXYS network and the LIMS. Network passwords are changed every 90 days and LIMS passwords every 180 days. Passwords must be a unique combination of 8 or more numeric plus alphabetical characters; they must also include characters from three of the following four categories: a) uppercase English letters; b) lowercase English letters; c) numbers; and, d) non-alphanumeric characters (e.g. ! @ # $, etc). Staff are required to keep passwords confidential.
3. Individual workstations are additionally protected with a screen saver password with a 5 minute time-out feature.
4. Assigned group login procedures are used as necessary for shared instrument computer workstations.
5. Access to computer systems is controlled on an 'as needed' basis using user-name/password login procedures and role assignments.
6. Alterations to data are tracked through audit trails that can be monitored.
7. Procedures that authorize and track changes to software and hardware are required. Hardware maintenance must be documented.
8. Unauthorized access to SGS AXYS' network from external sources is prevented through the use of up-to-date firewall technology.

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9. All data must be backed up in a secure manner on a regular schedule. Archival backup must be readily retrievable.
10. All staff must sign a confidentiality agreement and receive annual training in data integrity, legal and ethical responsibilities.
11. Staff will receive data integrity training on an annual basis.
12. Staff will receive training on security features associated with instrument software as appropriate by use.

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6. COMPUTING CAPABILITIES

Computer workstations are in use throughout the operation of SGS AXYS Analytical Services. The workstations are networked to servers (Windows Server 2008/2012) which are maintained by the Information Technology (IT) Department. These servers are protected against power fluctuations and outages by Uninterruptible Power Supplies (UPS). Every employee has a unique login/password that provides the appropriate level of access for that employee to carry out his or her job function. Network password changes are required at least once every 90 days. All employees have access to e-mail. All workstations run Symantec EndPoint software for protection against computer viruses. This software is updated automatically from a central server. SGS AXYS also maintains a secure FTP site for the transfer of client data. The SGS AXYS network is Internet-connected and firewalled through a secure SonicWALL gateway appliance.

SGS AXYS also operates a Laboratory Information Management System (LIMS) used to log in and track samples and report results. Separate LIMS databases are maintained for contaminants and metabolomics analysis. The LIMS consists of a PowerEdge R510 server with UNIX Server software as the operating system and Oracle as the database. The LIMS software is LV Environmental LIMS (Seedpak) developed by LabVantage Solutions. SGS AXYS' file server is fully backed up monthly; differential backup is performed every night (Mon-Fri).

SAD-031	LIMS Applications: Control and Life Cycle Management
SAD-024	Computer Network Management and Security
SAD-019	Computer Backup

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VI. CONTRACT AND PRODUCT MANAGEMENT

1. CONTRACT MANAGEMENT

1.1 Bidding Process

SGS AXYS carries out the analysis of samples on a fee-for-service basis. SGS AXYS generally undertakes analyses of samples under written client instructions ("Contract") and authorization. The Contract may be a "Standing Offer" (a fixed price contract for a defined period of time) or a specific contract for a client's project. Contracts for work may be obtained through a competitive bidding process in which proposals are solicited from qualified laboratories, but may also be secured by an authorized quote plus relevant technical and project specifications prepared by the Sales, Marketing and Service Department. Guidance on pricing, products, services and authorization limits are located in the product and service guide.

SGS AXYS' project management team, including Operations staff, Scientific Directors, the QA Manager, and the LIMS group as necessary, review Requests for Proposals (RFP). Reviews evaluate the requirements of the proposed work against SGS AXYS' technology, methodology, available capacity, resources and staffing levels. The team determines if SGS AXYS can meet the requirements of the quote, request, or proposal and a decision is made whether or not to proceed with a bid. The proposal requirements and review considerations are documented in the formal proposal response to the RFP or in Project Notes and/or by e-mail.

To generate a quote or bid on a proposal, the assigned Project Manager, the Internal Sales, or the Sales and Marketing Co-ordinator in consultation with the Account Manager, prepares a quote/proposal document and opens a dedicated quote/proposal file. The quote/proposal document presents SGS AXYS' capabilities and price bid to the client. The proposal file contains all information related to the bid, including additional information received, amendments, records of the proposal review, and records of discussions with the client.

A successful proposal results in the awarding of a contract. The assigned Account Manager (or designate), with support from the Client Services Manager, Operations staff, and/or Scientific Directors as necessary, reviews the contract to verify the technical requirements, the price, and project specific business clauses.

All new/renewal contracts are submitted to SGS Legal for approval before they are executed.

To aid in that process, Account and Project Managers review the contract and provide context and background information for SGS Legal, including:

- Client type (new or existing)
- Client or account size

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- Any intellectual property (method, etc) created and the estimated property value to SGS AXYS in serving other customers
- Any non-standard terms, or any unfamiliar terms
- Contract scope
- Potential/past conflicts of relevance
- Any specific concerns

The review process is formally completed and documented by either rejection of the contract or execution by signature as per the authorization levels below.

Authorization to Execute Contracts (estimated US dollar contact value) by Organizational Role:

- In excess of $500,000 Chief Operating Officer of SGS North America Inc.
- Up to $500,000, Senior Vice President (member of Regional Operations Council; and/or regional head of business unit or support function). Must be approved as an officer by the Board of Directors.
- Up to $100,000 Vice President (responsible for a comprehensive area or department within a line of business or support organization). Must be approved as an officer by the Board of Directors.
- Up to $25,000 Director (within the line of business or support function) with regional responsibilities.
- Non-Disclosure Agreements. Manager (within the line of business or support function) with local responsibilities, subject to Senior Technical Director authorization.

Documents in the quote/proposal file are saved in a contract file, including any documentation of the contract review. In cases where SGS AXYS carries out ongoing routine work for a client, the contract need only be reviewed at the initial stage, provided the contract requirements remain unchanged. Re-review by Project Managers and the Technical Director occurs in response to material changes in contractual terms, as necessary.

Departures from standard methods, standard operating procedures and standard matrices are managed as described in 'Departures from Documented Procedures' in Ch. II, section 4.

Specifically for work under DoD accreditation waivers from DoD QSM requirements must be requested in writing from the appropriate DoD Chemist or Contractor Project Chemist (however named) on a project-specific basis and shall include technical justification relating to the specific project for the waiver. Documentation of approval for the waiver must be maintained by the laboratory and readily available for review. The use of a non-standard or modified reference methods must be pre-approved by the DOD client.

Contracts secured on the basis of a price quote or a standing offer may be reviewed and approved by Project Managers in accordance with their approval limits (as per Table 5 PSG-001 Product and Service Guide), provided the work is either "routine", or has been previously performed for the client under approved terms, and provided there is sufficient operational

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capacity. Otherwise the Client Services Manager, Director of Sales, Marketing and Service or Vice President performs the review and may approve subject to their relevant approval limits. Once the contract has been approved, a contract file is opened and a Project Manager is assigned.

No review process other than operational capacity constraints is required for the analysis of in-house QC samples or performance evaluation samples that are approved by management as part of maintaining SGS AXYS' accreditation status or business strategy.

1.2 Project Management

Project Managers are assigned to contracts. They obtain all necessary information on the expected work from the Account (Sales) Manager. The Account Manager (AM), or Project Manager (PM), consults with the client about the receipt of samples, types of analyses to be completed, method selection, subcontractors, reporting of data, special needs or custom procedures, and maintain records of all correspondence and conversations. The Project Manager reviews the sampling and sample receipt information, ensure the samples have been preserved and handled appropriately and finalize details of the project requirements with the client. Project Notes, which summarize the details of the project, are completed and made available electronically to all staff. Project Managers may participate in priorities meetings to review project work status. Project Managers with appropriate training may also perform certain data checking duties carried out by Instrumental Analysts.

SOP SAD-020 Project Management

1.3 Workload Management

For contaminants analysis the Director of Operations, Operations Coordinator and the Lab Schedule Coordinator are responsible for establishing work priorities. Weekly priority meetings are held with the Director of Operations, the Instrumental Analysis Manager, the Laboratory Supervisor, Analyst Group, the Operations Coordinator, the Lab Schedule Coordinator and the Client Services Manager to monitor progress of work, assess the overall workload, and confirm weekly work project schedules. The ability to take on additional work is also reviewed.

Metabolomics workload assignments are handled by the Manager, Metabolomics Services.

1.4 Work Scheduling

The Lab Schedule Coordinator and the Operations Coordinator determine daily schedules for their work areas based on information or direction provided in the priority meetings and on deadlines entered into LIMS. Available resources (e.g. glassware, equipment and instruments), staffing levels and staff expertise are considered in the preparation of the daily schedule. Also taken into account are resources required to accommodate potential extract re-injections, recolumning and dilutions. The Director of Operations discusses potential work and schedules

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with the Laboratory Supervisor, Analyst Group, the Laboratory Supervisor, Technical Group, and the Instrumental Analysis Manager. The departmental Managers/Supervisors and departmental Coordinators discuss to ensure feasibility and appropriate updating to the departmental production schedules to keep other all areas informed.

2. PRODUCT MANAGEMENT

Product development is managed and controlled via two groups, the Product Council (PC) and the Product Group (PG). The PC, consisting of senior management representatives from operations, sales, QA, finance, product development and the Vice President is responsible for overall strategy and direction setting, review of the product portfolio, and decisions on individual products. The PC meets at least once per quarter. The PG, consisting of product scientists, representatives from operations, and sales/marketing support manages individual products, generates plans and business cases for new/existing products, and makes recommendations for product advances to the PC. The PG meets at least once every two weeks.

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VII. SAMPLE HANDLING PROCEDURES

1. SUBMISSION OF SAMPLES

The Sales, Marketing and Service department arranges with a client for the submission of samples for analysis. Each client is assigned a unique contract number and a client file is created. The contract number is non-identifying and assures the anonymity of a client.

A Sample Receiving Chemist is informed of the expected shipment of samples and of any special requests from a client concerning the handling/storage of samples. Upon request, clients are advised of the proper methods for collecting, preserving, and shipping samples. SGS AXYS will arrange for sample collection if requested by a client or required by a grant-supported project.

SGS AXYS may be requested to analyze samples that are considered agricultural hazards or biological hazards. SGS AXYS is required to have a permit, issued by the Canadian Food Inspection Agency (CFIA), to import samples that are identified as agricultural hazards. These samples are a potential hazard to the local ecosystem and local agriculture and are handled and disposed of according to CFIA protocols. These procedures are described in an SGS AXYS standard operating procedure. Samples that are identified as biological hazards are a health concern to SGS AXYS staff and must be handled and disposed of according to standard operating procedures. The SGS AXYS Analytical Safety Manual describes SGS AXYS policies for protecting staff from potential biological hazards.

SLA-079	Agricultural Hazard Protocols for Soils
SLA-082	Handling of Human Biohazardous Samples
SAD-014	Sample Disposal
SAF-001	Safety Manual

Appropriate sample containers are provided to a client upon request. Glass containers with fluoropolymer or foil-lined lids are used for most organic analyses; HDPE containers are used for a number of LC analyses. Glass containers, purchased with a certificate of cleanliness, are proofed on a lot basis prior to acceptance as suitable for sample containers. Approved sample containers are shipped to the client. Alternatively, a client may request that certified clean jars be shipped directly from the distributor, without SGS AXYS' proofing procedures. Each analytical method describes the sample requirements including appropriate sample container, preservation requirements and storage conditions of samples.

Bottle labels, analyses request forms and chain-of-custody forms are provided with the containers. Complete sampling kits (stainless steel scoops, scalpels, rinse solvents, etc.) and instructions for proper sampling and preservation are also included upon request. These instructions are communicated to the client by the Project Manager and are consistent with sample handling requirements detailed in each method.

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Procedures for assigning contract numbers and the proofing and shipping of sample containers are described in the following Standard Operating Procedures.

SLA-003	Sample Receipt and Login
SAD-013	Shipping and Receiving Procedures
SLA-094	Procedures for Proofing Equipment, Sampling Media, Solvents and Sample Containers

2. SAMPLE CONTROL PROCEDURES

Sample control procedures include procedures for sample receipt, sample log-in, sample storage, sample handling, and sample disposal. The procedures used at SGS AXYS are in place to ensure samples are properly identified and stored, and the location known.

2.1 Sample Acceptance Criteria

Samples received by SGS AXYS are checked for compliance with the following sample acceptance criteria:

1. Documentation:
   - i. A chain-of-custody or sample log accompanies the samples.
   - ii. Chain-of-custody is signed at receipt, and contains the following information:
     - Sample identification
     - *Location, date and time of collection
     - Collector's name
     - Preservation type
     - Sample matrix
     - Analyses requested
   - iii. If soil samples:
     - Soil permit number (for any foreign country)
     - Domestic movement certificate number (or confirmation of non-requirement)

   *All of the above information must be provided for samples being analyzed under NELAP standards. Otherwise, the requirement for location, date and time of collection and collector's name is provided at the discretion of the client.

2. Samples are submitted in the containers appropriate to the analytical method.

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3. Samples are individually labelled, in ink, with a unique sample identification. The sample identification on the sample container must match the sample identification on the custody papers.

4. The samples are received in good condition, meaning the following criteria are satisfied:
   i. Sample containers are tightly sealed with no sign of leakage, breakage or other damage or contamination.
   ii. Custody seals (where present) are intact.
   iii. Samples are received at the temperature appropriate to the analytical method.
   iv. There is adequate sample for the analysis.
   v. Holding times for the analytical method have not been exceeded.

The client is contacted in all cases where the sample acceptance criteria are not satisfied. Where possible, remedial action is taken. Remedial action may include the following:

- client provides additional documentation
- client provides a replacement sample
- SGS AXYS transfers sample to another container
- client provides additional sample
- SGS AXYS returns sample to client
- SGS AXYS disposes of sample

SGS AXYS will proceed with the analysis, despite the failure of the samples to meet criteria, upon client approval. Where necessary, data are flagged as not meeting sample acceptance criteria, indicating specifically the non-conformance. The flag appears as a footnote on the data report or in the narrative accompanying the report.

2.2 Receipt of Samples

The Sample Receiving Chemist signs for incoming samples. The Sample Receiving Chemist collects the shipping and chain-of-custody documents, and verifies the sample count and identification against a client's sample log sheet. If a client has not provided a list, the Sample Receiving Chemist generates one at the time. The Sample Receiving Chemist inspects the samples for physical damage, loss due to leakage, breakage of seals, contamination by foreign materials, evidence of storage under improper conditions, etc. The Sample Receiving Chemist checks that the samples meet the sample acceptance criteria. Receipt of the samples and their condition are documented. The details of receipt date/time, courier, waybill number, type of sample, condition of sample, and analysis requested are entered into the LIMS Sample Receiving Log by the Sample Receiving Chemist. As proof of receipt to both the client and the laboratory, a sample acknowledgement is sent to the client and a copy is placed in the client file.

If any of the sample acceptance criteria are not met, the Sample Receiving Chemist notifies the Project Manager who determines the appropriate action based on their specific knowledge of contract requirements and customer needs.

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Where necessary, a Sample Receiving Chemist adds preservatives to a sample, according to standard operating procedures. The Sample Receiving Chemist also documents the sample preservation.

Procedures for receiving samples are described in the following Standard Operating Procedures.

SLA-003 Sample Receipt and Login

2.3 Sample Log-In

Using the LIMS, the Sample Receiving Chemist logs in each sample under the client's contract number, recording the analyses requested, client's sample identification information, type of sample container, storage location of sample, date and time received, and date due. The LIMS assigns a unique number to each sample. A LIMS-generated chain-of-custody (COC) is printed. The LIMS COC must be approved by the Project Manager prior to distribution and release of the samples for analysis. The Sample Receiving Chemist labels each sample with the contract number and SGS AXYS sample number. The labels are generated by the LIMS. Where the long-term integrity of the LIMS generated label is in question, an additional back-up label using an alternate labelling medium is attached.

2.4 Sample Storage and Retrieval

A Sample Receiving Chemist places samples in storage. Procedures for the logging, labelling, and storage of samples are described in the following Standard Operating Procedures. Sample storage requirements are specified in each analytical method.

SLA-003 Sample Receipt and Login
SLA-004 Sample Control Procedures

When samples are needed for analysis, a Sample Receiving Chemist retrieves the samples from the storage location. A Chemist in the Sample Preparation Lab Group sub-samples the appropriate quantity for the analysis and returns the remaining sample to the Sample Receiving Chemist for storage.

2.5 Sample Preparation

Samples are prepared for contaminants analysis in the Sample Preparation area. The samples are homogenized according to procedures described in the following Standard Operating Procedures. Chemists who carry out sample preparation document the sample preparation procedures. A Sample Receiving Chemist returns the samples to storage when the preparation procedures are complete.

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Procedures for the preparation of samples are described in the following Standard Operating Procedures.

SLA-011	Compositing Samples
SLA-012	Dissection of Samples
SLA-013	Procedures for Homogenization of Solids and Tissues

Metabolomics samples are prepared in the metabolomics lab.

2.6 Consumption of Samples

It is SGS AXYS policy to retain unused portions of samples until disposal procedures apply.

Should a Lab Chemist conclude that there is insufficient sample for all requested analyses, they notify a Project Manager. A Lab Chemist may not consume a sample without the permission of the Project Manager. This permission is not given unless the client has given approval.

It is the responsibility of the Lab Chemist to inform a Sample Receiving Chemist that a sample has been consumed in the analytical process. The Sample Receiving Chemist records the information in the LIMS.

2.7 Disposal of Samples

All samples and sample extracts remain under specified storage conditions until such time as the sample is disposed of or returned to the client.

SGS AXYS policy to retain samples and extracts is outlined in SAD-014.

SAD-014	Sample Disposal

Should a client request that SGS AXYS hold samples and extracts for a specified time or dispose of them differently, SGS AXYS, will negotiate in good faith to meet the request.

3. CHAIN-OF-CUSTODY PROCEDURES

All samples received at SGS AXYS are subject to chain-of-custody procedures. The SGS AXYS standard chain-of-custody is established by SGS AXYS' security policies and sample receipt and log-in procedures, whereby:

1) access to SGS AXYS facilities is controlled;
2) access to sample storage areas is limited;

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3) upon receipt, samples are signed for and logged-in with laboratory assigned identification numbers. An audit trail for the process is maintained.

Samples are received at the laboratory in closed sample containers that in turn are packed in a sealed box or cooler. The samples are carefully examined by the Sample Receiving Chemist to ascertain whether they have been tampered with and stored/shipped appropriately. Any discrepancies are noted on the login records. Preservatives are added as required. Samples are then stored in secure storage facilities under sample appropriate storage conditions, until analyzed. Maximum holding times prior to analysis (as described in the analytical method) are strictly adhered to.

Chain-of-custody documents are maintained and record each transfer of the samples and sample extracts and who has possession of the samples. Access to laboratories and instrument rooms is limited and subject to SGS AXYS' security policies (Chapter V, Section 5). Samples and sample extracts remain in locked storage facilities until the client indicates that samples may be disposed of. Data are stored in secure files under anonymous code numbers. In addition, SGS AXYS' facilities are protected by an electronic security system as part of routine security measures.

Chain-of-custody procedures are described in the following Standard Operating Procedures.

SLA-003	Sample Receipt and Login
SAD-034	Analytical Contracts for Legal Counsel

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VIII. ANALYTICAL TESTING PROCEDURES

1. METHOD MANAGEMENT

The methods used by SGS AXYS are the responsibility of the QA Manager and the Technical Director. Methods must be approved and signed prior to use by the QA Manager, the Technical Director, and the appropriate department Manager(s)/Supervisor(s). Only current copies of controlled documents may be used by staff to control processes.

Revisions to methods must have the approval of the QA Manager, the Technical Director and the Director of Operations. Procedures for the request, approval and revision of methods are described in Standard Operating Procedures.

SQA-005	Creation of New Documents
SQA-006	Revision of Documents

1.1 Method Validation

Methods are validated using data from the analysis of multiple samples (spiked matrix samples, spiked blanks and/or certified reference materials) prior to routine implementation. Statistical treatment of the data generates precision and recovery statements. Method validation data are compiled and kept on file by the QA Manager. Evaluation includes scope of application, calibration, interferences/contamination, qualitative identification, quantification, selectivity, trueness, and precision. Procedures for the validation of a method are described in the following Standard Operating Procedures.

SQA-002	Method Validation Requirements
SLM-003	Metabolomics Novel Matrix Validation

Methods are also validated on an ongoing basis by monitoring the QC samples analyzed with every batch of samples. Methods are re-validated when changes are made to stoichiometry, detection technology, quantification ions or acceptance criteria.

1.1.1 Detection Limits

Detection limits are determined using the appropriate protocol for the application. Protocols and application are described in Appendix D, Section 2.

1.2 Measurement Uncertainty

Uncertainty estimations are determined for accredited methods using recognized procedures.

Uncertainty estimates are reported if required:

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- by the client,
- to establish data as "fit for purpose",
- for compliance with regulation.

Procedures for the determination of measurement uncertainty are described in the following standard operating procedure.

SQA-022 Estimation of Measurement Uncertainty

1.3 Method Control

All methods are the property of SGS AXYS and are considered proprietary information. These methods cannot be reproduced without the permission of the QA Manager or the Technical Director. Each method has a document number and is printed on SGS AXYS second-page letterhead stationery. Each copy is controlled with a unique copy number and the copyholder is recorded. Photocopies of the methods are not permitted for use. It is the responsibility of the QA Chemist to ensure that only current methods are distributed for use and the responsibility of each Manager/Supervisor and analyst to ensure that only current method documentation is used.

1.4 Method Numbers

Each method is assigned a unique SGS AXYS method number, which includes a revision number. The method number is the same as the document number. The system for naming documents is described in Appendix B. The method number is reported on the final analysis report.

1.5 Method Specifications

Each method contains method performance specifications including detection limits, surrogate standard recoveries, blank levels, agreement between duplicate tests, reference sample recoveries, and instrumental calibration and performance criteria. The specifications are referred to by Instrumental Analysts, to confirm the acceptability of data. Method performance criteria are the responsibility of the QA Manager who may revise the performance specifications based on changes in methodology. Method performance is monitored through examination of analysis data and associated QA/QC results.

1.6 Custom Methods

Clients may request a customized analysis requiring the use of non-routine procedures. The customized procedures must be approved according to SGS AXYS' policies for departures from documented procedures (Chapter II, Section 4). The sample is analyzed using the analytical method closest in methodology to the customization requested. Where required, deviations from documented methods are described in the narrative of a data package sent to a client. Any

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special environmental condition requirements and procedures will be implemented and monitored as necessary.

The extent of validation of the customized procedures is dependent upon contract requirements and is directed by the QA Manager or Technical Director.

1.7 Methods Inventory

An inventory of all current analytical methods is maintained in Q-Pulse and is available to all staff.

2. TEST PROCEDURES

Samples received for analytical testing are logged in, labelled with SGS AXYS ID numbers, and stored by a Sample Receiving Chemist, as described in Chapter VII, Sample Handling Procedures. Samples are analyzed in batches consisting of test samples and quality control (QC) samples. Each batch usually consists of up to 20 test samples, a procedural blank and QC samples as specified by the method (a duplicate, CRM, IRM, matrix spike or spiked sample). The Lab Schedule Coordinator is responsible for determining the composition of analysis batches, including the samples to be analyzed and the accompanying QC samples as well as for assigning an analysis batch to a Lab Chemist. The analysis batch is assigned a unique batch number (work group) by the LIMS. All information pertaining to the batch is recorded on a Batch List that accompanies the samples during work-up and instrumental analysis, and accompanies the analytical data during data interpretation, validation and reporting.

The analysis of samples involves sample preparation procedures, laboratory extraction procedures, instrumental analysis of extracts, interpretation of instrumental data and calculation of results, data validation and final report preparation. The analytical process is presented in the form of a flow diagram (Figure 3). The steps involved are described below.

2.1 Sample Preparation Procedures

Chemists in the Sample Preparation area carry out sample preparation procedures. These procedures may include sample preservation, dissection, homogenization, and preparation of sample composites. Procedures are described in the following Standard Operation Procedures.

SLA-011	Compositing Samples
SLA-012	Dissection of samples
SLA-013	Procedures for Homogenization of Solids and Tissues
SLA-014	Thawing Solid, Tissue and Blood/Plasma/Serum Samples
SLA-043	Removing Sampling Media from Field Sampling Equipment
SLA-077	Sample Transfer Procedures
SLA-084	Preparation of Aqueous samples for Extraction
SLA-085	Subsampling Procedures for Solids and Tissues

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2.2 Extraction Procedures

Extraction procedures are described in detail in SGS AXYS' analytical method documents. They are carried out by trained Lab Chemists. Most extraction procedures involve the following steps:

- addition of surrogate standards;
- extraction of organic compounds from the sample matrix with appropriate solvents or solid phase extraction (SPE);
- clean up of the extract by a variety of techniques to remove interferences;
- the concentration of the extract to a small volume in preparation for instrumental analysis; and
- the addition of recovery standard to extract in order to monitor surrogate recovery.

It is the responsibility of each Lab Chemist to perform the extraction procedure according to the approved, written analytical method.

The quality, reproducibility, and reliability of analytical results depend upon the consistent use of the same analytical procedures, reagents, and techniques. Deviations from the written method are not permitted unless specified in writing by the Project Manager (or Manager Metabolomics Services, as appropriate), QA Manager, or Technical Director (see Chapter II-4; Departures from Documented Procedures).

The Lab Chemist documents the extraction procedure by completing a Batch List and appropriate work-up sheets covering all procedures. Each critical step of the analysis procedure is documented, initialled and dated by the analyst. A second analyst verifies that the correct standard solution was used to spike each sample batch by inspecting the vial of standard used and initialling the Batch List. The work-up sheets and Batch List accompany the extracts to instrumental analysis and final data review. All comments, additional work and corrective actions are documented on the work-up sheets or in the LIMS. Work-up sheets are kept on file for future reference. When the extraction procedure is complete, the analyst updates the LIMS to indicate the extracts are ready for instrumental analysis.

Procedures for completing a Batch List and completing worksheets are described in the following Standard Operating Procedures.

SLA-027	Completing a Worksheet
SLA-033	Procedures for Making an Analysis Batch
SLM-006	Project Management, Metabolomics Studies

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2.3 Instrumental Analysis Procedures

Instrumental analyses are routinely performed by GC/MS, high-resolution GC/MS, GC/ECD, and LC/MS/MS under the supervision of the Instrumental Analysis Manager. The instrumental analyses are performed only by trained Instrumental Analysts, following the procedures in the instrument Operating Manuals and in the SGS AXYS Analytical Methods.

Instrumental Analysts are responsible for ensuring that the instruments used in the analysis of samples are properly maintained, tuned, calibrated, correctly set up for the specific analysis, and meet all specifications established by the analytical method and instrument manufacturer. In addition, a number of specific QA/QC checks are performed as part of each analytical method. Instruments must satisfy the calibration and performance specifications outlined in the method prior to commencing the analysis. Typically, samples within a workgroup (including QC samples) are run consecutively. Once the analysis is complete, Instrumental Analysts update the LIMS to indicate that data are available for interpretation.

Procedures for performing the instrument QA/QC checks are described in the following Standard Operating Procedures.

SIN-012	Checking Quality of GC/MS Data
SIN-020	Determination of GC Column Resolution
SIN-021	Window an Analysis
SIN-022	Instrument Sensitivity Checks
SIN-023	GC/LRMS Calibration and Demonstration of Linearity
SIN-028	Initial Calibration Frequency and Verification – GC/MS
SIN-032	HR GC/MS Determination of Linearity
SIN-036	Monitoring LC Column Performance
SIN-037	Initial Calibration Frequency and Verification - LC/MS/MS
SLM-002	Metabolomics Data Processing, Checking and Reporting

Instrumental Analysts perform a number of routine checks on a regular basis to keep the instruments in good operational order.

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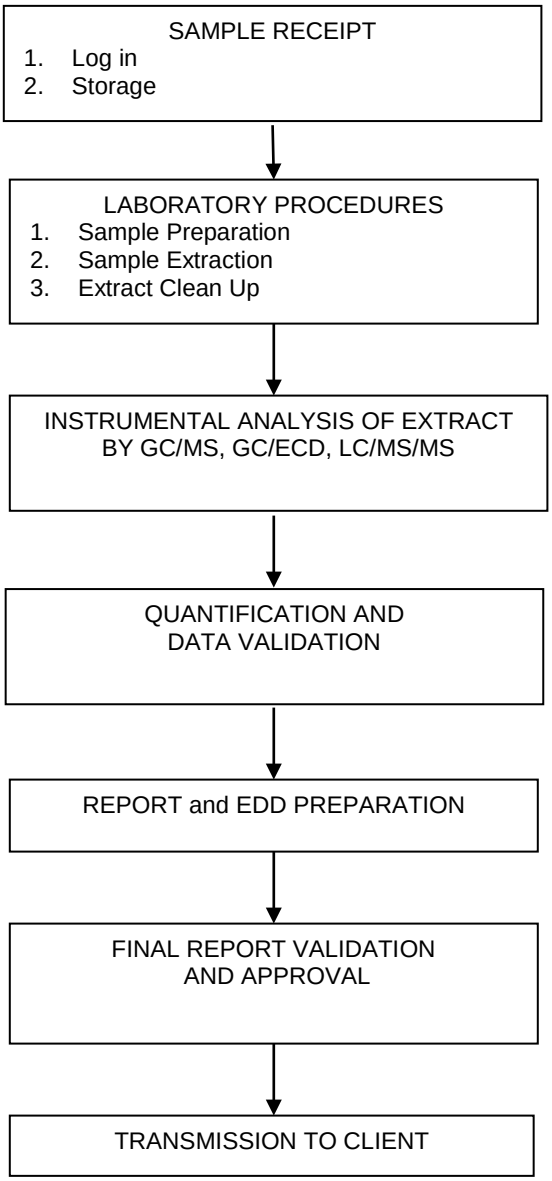
FIGURE 2 FLOW DIAGRAM OF TESTING PROCEDURES



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2.3.1 Operational Checks

Mass Calibration/Mass Resolution

The quadrupole mass spectrometers, (low resolution, GC/LRMS) are mass calibrated a minimum of twice weekly or more frequently if required by instrument changes or special requirements. Instrumental tuning to unit mass resolution at m/e 219 is performed daily; fragmentation resolution is demonstrated using DFTPP where required by method or contract.

An Instrumental Analyst verifies the high resolution mass spectrometer (GC/HRMS) tuning prior to any analysis. The tune is considered acceptable if it meets the specific method's mass resolution specification. If the tune is not acceptable, the mass spectrometer is retuned and fully mass calibrated. For specific USEPA method applications, mass calibration is viewed and verified every twelve hours, as described in the following standard operating procedure.

SIN-011 Mass Calibration and Initiating an Analysis Run – HR GC/MS
SIN-029 Tuning and Mass Calibration of Low Resolution MS, Including the Use of a Tuning Standard
SIN-034 Mass Calibration of Waters-Micromass Quattro Ultima MS/MS

Initial calibration of the LC/MS/MS is performed by analysis of a series of calibration solutions covering the working response range and is repeated as necessary to maintain consistency of response for the calibration verification test (single point) analyzed at least every 20 samples. Mass calibration and tuning are verified with every initial linearity calibration.

2.3.2 Preventive Maintenance Procedures

Gas Chromatographs

Routine maintenance of gas chromatographs is performed as required. Maintenance includes changing the septa, cleaning the injectors, and installing new silylated injection liners. The columns are changed, trimmed, or restored as needed to meet GC resolution standards.

Mass Spectrometers

The mass spectrometers are maintained routinely as required to retain good sensitivity and consistent mass calibration and tuning parameters. The sources and the quadrupole rods are cleaned and the transmission efficiency checked regularly. Operators maintain the vacuum systems as required; the rotary vacuum pumps are serviced at least twice a year.

Electron Capture Detector (ECD)

Routine maintenance of ECD detectors is performed as required. When the background signal becomes elevated outside operating parameters the detector lines are flushed with solvent. Micro ECD inserts are replaced as required.

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Liquid Chromatograph/Mass Spectrometer (LC/MS/MS)

The liquid chromatograph is regularly flushed with solvent to maintain cleanliness and proper working order. Fluid levels for refrigeration systems and vacuum pumps are routinely checked. Mass spectrometer maintenance includes cleaning of the extraction cone and cover as well as the baffle, probe and affected areas. Cleaning is carried out as necessary. Columns are changed as necessary.

Maintenance Logs

Routine instrument maintenance for the high resolution GC/MS instruments is recorded on instrument run lists that are retained. Non-routine instrument service and any instrument repair are recorded in instrument logbooks. For all other instrumentation, logbooks are used to record all maintenance and repairs. Logbooks are retained.

2.4 Primary Data Validation Procedures

Instrumental Analysis Chemists are responsible for assessing the overall quality and acceptability of the instrumental data prior to commencing data interpretation procedures. They follow Standard Operating Procedures to examine the chromatograms and to identify individual compounds by comparison with calibration standards analyzed before and after the sample.

1. Instrumental sensitivity, chromatographic quality, GC column separation, peak width, instrument linearity, and evidence of contamination from high level samples are checked to ensure they meet quality standards.
2. The Instrumental Analysis Chemist verifies sample IDs, correct addition of quantification standards and correct bracketing of samples with calibration standards.
3. The Instrumental Analysis Chemist checks to ensure compliance with method QC specifications such as detection limits, surrogate recoveries, procedural blank levels, relative response factor stability, target recoveries and duplicates agreement.

Sample extracts with incomplete data or unacceptable chromatograms are sent back for additional laboratory work-up, instrumental analysis or repeat analysis. Instrumental Analysis Chemits record in detail all requests for additional laboratory work-up, instrumental analysis or repeat analysis in a LIMS Request for Additional Work form. A note of the request is also entered into the LIMS Work Group Notes and must be verified and signed off by the Project Manager.

Instrumental data that are acceptable are then coded for the target analytes. Only peaks that satisfy the identification criteria are quantified. Data are coded and quantified automatically by the computer. The results are verified by an Instrumental Analysis Chemist to confirm correct peak assignment. Peak integrations are corrected for any cases where the chromatography software has not performed the integration properly and the error in the integration is apparent from inspection of the chromatogram. These errors may typically arise from incorrect target peak selection due to the presence of closely eluting peaks, incorrect estimation of the noise threshold by the computer due to the presence of peaks eluting close to the noise determination window, or peak shouldering. For all cases of manual re-integration the raw data file showing the original integrations as performed by the chromatography system are retained on file at SGS AXYS such

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that this information could be provided to data validators if requested. Manual integration is never performed arbitrarily or to compensate for sub-standard chromatography.

SCO-022 Manual Integration of Chromatographic Peaks

Where changes to data past the original chromatography system results are required, the results are edited in the LIMS database by the Instrumental Analysis Chemist and the original and modified results are retained in LIMS under a GALP Level 3 audit process.

The following Standard Operating Procedures describe the procedures for evaluating and editing instrumental data. Procedures for interpreting data specific to a particular analysis are described in the instrumental method documents.

SCO-025 Instrumental GC Data Evaluation Procedures
SCO-026 Instrumental LC Data Evaluation Procedures
SLM-002 Metabolomics Data Processing, Checking and Reporting

Verified data are submitted for final reporting prior to a check by an Instrumental Analyst.

2.5 Calculation of Results

The internal standard (or isotope dilution) method of quantification is preferentially used to calculate the final concentrations of target analytes. The calculations used are documented in Appendix A. The identification of target analytes and the calculation of their concentrations are carried out using HP Enviroquant/Prolab, VG OPUSquan, TargetLynx/QuanLynx or AB Sciex Analyst software. An Instrumental Analyst verifies the identification and calculations.

The following steps are performed during the calculation:

- correlate the individual chromatographic run with calibration standards run before and after the sample;
- calculate the relative response factors for each analyte from the calibration standards;
- calculate the concentrations (in units appropriate for the matrix, e.g. ng/g, µg/L, etc.) of the individual compounds in the samples;
- calculate the detection limit for each analyte based on a minimum area coded for each analyte; and
- report the percent recovery of the internal standards where applicable.

For each specific analysis and set of standards, a quantification method is written. A unique alphanumeric number identifies each quantification method. The creation of quantification methods is the responsibility of a Senior Instrumental Analysis Chemist. The quantification routine is prepared by one individual in the group and checked by another. Each method is checked by hand and then checked on test samples prior to use.

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Procedures for the calculation of concentration, detection limits and surrogate recoveries are described in Standard Operating Procedures.

The Standards Use List presents a summary of the quantification methods currently in use. This list is prepared by the Senior Instrumental Analysis Chemists and is retained on file as a controlled document.

FST-012 Standards Use List

2.6 Data Validation

Instrumental Analysis Chemists who are trained in secondary validation procedures review data to ensure they meet method, laboratory and contract performance standards and verify that the final data reports are accurate. Instrumental Analysis Chemists who are trained in secondary validation procedures are authorized to approve final data reports.

Where quantification of a native compound is performed using alternate ions other than the primary ions specified in the method, the following data flagging conventions apply:

i) If quantification using the alternate ions has been validated and documented (i.e. in an IPR report), a comment in the narrative (or batch cover page for non-DP reports) is sufficient notification of the use of alternate ions. No other flagging is required.
ii) If quantification has not been validated (i.e. not summarized in an IPR report), the H-'information value' flag will be applied to the reported results and explained in a narrative comment.

In cases where results do not meet method and project specifications, appropriate corrective action is performed. This may include a repeat of instrumental analysis, additional clean up of the extract, or a repeat extraction. If necessary, the client is contacted to obtain additional sample or to discuss the corrective measures.

In situations where it is necessary to report non-conforming data, the data are flagged and qualified with footnotes on the analysis report explaining the non-conformance and the limitations or impact on interpretation of the results. In addition or alternately, the non-conformance and the limitations or impact on interpretation of the results are described in a narrative that accompanies the data.

Pertinent QC information and comments related to an analysis batch are recorded in the Work Group Notes by the Laboratory Supervisor, Analyst Group, Lab Chemists, and Instrumental Analysis Chemists. Instrumental Analysis Chemists are responsible for ensuring that any deviations from documented procedures or from acceptance specification, any extra work and any data quality decisions are documented in the LIMS work group notes and that all deviations and non-conformances are identified and explained in the final data reports.

The following checks are carried out on each analysis batch.

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2.6.1 Quality Control Samples

The results of quality control samples analyzed with the batch must meet specifications presented in the analytical method.

2.6.2 Detection Limits

Detection limits on a sample-specific basis must meet method or contract specifications, or be sufficient for detection of target compounds.

2.6.3 Percent Recovery of Surrogate Standards

The ratio of the internal standard (or surrogate) response to the recovery standard response is used to determine the percent recoveries of the internal standards (or surrogates). The percent recoveries are used as an in-lab quality control parameter. Concentrations from isotope dilution analyses are automatically corrected for incomplete surrogate recovery, and surrogate recoveries are an indication of overall data quality and must fall within ranges specified in the analytical method or contract.

Standard Operating Procedures describe data validation and release authorization.

SQA-001	Data Validation Procedures
SLM-002	Metabolomics Data Processing, Checking and Reporting

2.7 Data Reporting

Final data reports are generated by the LIMS, with the exception of final data reports that require a high degree of customization, which are prepared by Data Reporters. Electronic files of all final results are maintained.

Data reports, including preliminary data, require authorization by an Instrumental Analysis Chemist qualified in secondary data validation, the QA Manager or the Technical Director for reporting to the client. A final data report is issued for each sample, including QC samples (procedural blanks, duplicates, reference samples). All final sample data reports are signed (hand written or electronic signature) to document the authorization for reporting. All preliminary data reports are clearly identified as “Preliminary Data”.

It is SGS AXYS' policy that where both an original signed hard copy and electronic copy of the data report exist, the hard copy is the authorized report. Should any discrepancies arise between electronic data and the authorized report, the hard copy is deemed to be correct. Authorized data are reported using confidential data transmission procedures.

Authorized data are initially reported to clients by e-mail or, rarely, FAX. Original final data reports are mailed or sent by courier to clients soon thereafter. If requested, data are reported in an electronic format acceptable to the client. Confidential data transmission procedures are

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described in the Standard Operating Procedure. Data Reporters prepare hard copy data reports and electronic data deliverables.

SAD-005	Transmission of Reports
SLM-002	Metabolomics Data Processing, Checking and Reporting

A final data report contains the following minimum information:

- all sample information including SGS AXYS ID number, client ID, sample size;
- analysis information including method number, type of instrument used;
- analyte concentrations in the samples and the sample basis on which they are reported, i.e. wet, dry, lipid, etc.;
- additional analytical data if requested; i.e., percent moisture, percent lipid;
- detection limits for each analyte;
- percent recovery of surrogate standards (where applicable);
- footnotes which qualify for any deficiencies against method or contract specifications;
- footnotes explaining terminology;
- signature and title of person authorizing data;
- a statement on whether results are compliant with NELAP accreditation requirements (US customers) or CALA accreditation requirements (Canadian customers).
- Information on accreditation held including the method, matrix and compound, the accreditation standard, and the accrediting body with any applicable logos (this may be provided in a supplemental report, referenced on the main report).
- the report issue date;
- for solids samples, specification of dry weight basis reporting;
- where required by accreditation standard or contract, date of sample receipt, date and time of sample collection, date of sample preparation and sample analysis (for US DoD work, if the time of collection is not provided it will be reported as 12:00 AM);
- a statement that the results reported relate only to the sample tested;
- name of SGS AXYS contact with phone number;
- a statement on estimated measurement uncertainty of the test where it is requested by the customer, required for regulation compliance, or relevant to validity or application of test results;
- where appropriate or necessary, clearly identified opinions and interpretations, and the basis on which they were made;
- where necessary for interpretation, and where provided by client, details of sampling and location.

Data reports are prepared according to standard procedures.

SAD-030	Preparation of Final Reports using LIMS
SLM-002	Metabolomics Data Processing, Checking and Reporting

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Additionally, reports of for work under DoD accreditation must include:

- Information on any non-standard conditions that may have affected the quality of the results, including the use and definitions of data qualifiers or any manual integration.
- Where management system requirements are met, a statement of compliance/ noncompliance requirements and/or specifications, including identification of test results derived from any sample that did not meet sample acceptance requirements such as improper container, holding time, or temperature.

Upon request, a client will be provided with the following additional information:

- description of the analytical method and QA/QC protocols;
- other QA/QC data or checks such as instrument response control charts;
- chromatograms and all work and calculation sheets; and
- a data package with supporting information, prepared as described in the following standard operating procedure.

SAD-023 Data Package Preparation

The format of a final data report and data reporting criteria are described in Appendix C. SGS AXYS also provides results in a format specified by the client or by the analytical method.

SGS AXYS will provide customized data reporting by prior arrangement with the customer. For US DoD contract work where the report format has not been specified by the customer, the reporting format specified in Appendix A of the current version of the DoD quality systems manual will be followed.

Where reports provided customers require amendment, a replacement report will be provided to the customer, identified as a revision to the original report, with a description of the changes made.

2.8 Record Keeping

For each sample received and analyzed at SGS AXYS Analytical Services Ltd, test records are kept. These records include:

- sample receipt records
- sample preparation records
- LIMS Chain-of-custody
- sample work-up sheets
- chromatograms
- instrumental data file records
- calculated results

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- Batch Lists
- final reports
- related QC sample analysis records

These test records ensure the ability to trace a sample test result through the analytical process, including the date and processing times. Hard copies and electronic test records are kept for ten years, or longer if required by contract.

Client records that include correspondence, invoices and contracts, are retained for 10 years. SGS AXYS adheres to applicable regulatory and state legal requirements for records retention.

In the event of a transfer of ownership or if the company ceases business SGS AXYS would contact customers to arrange for transfer of retained records as required.

Record management protocols are documented in the following SOP:

SAD-022 Record Management

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IX. QUALITY CONTROL MEASURES

The following section applies to contaminants analysis, any metabolomics specific procedures are identified as such and further described in SGS AXYS method MLM-001.

MLM-001 Determination of Metabolites in Biological Samples (Targeted Metabolomics)

1. QUALITY CONTROL SAMPLES

Quality Control (QC) samples are analyzed routinely to monitor method performance. The choice of QC samples depends on method QC requirements, a client's requirements and batch size. The QC samples analyzed at SGS AXYS are described below. The results for QC samples, and sample surrogate recoveries, are compared with method or contract specified limits for compliance. For DoD contract work the QC requirements and acceptance limits are as documented in the most recent version of the DoD quality systems manual. Where not specified by contract, laboratory developed acceptance limits apply.

1.1 Procedural Blank (BLK)

A procedural blank is a sample that is analyzed in a manner identical to the test samples. The sample contains a matrix known to be free of target analytes. A minimum of one procedural blank is analyzed with every batch of samples.

The purpose of a procedural blank is to monitor the level of target analytes present in the laboratory background or reagents and materials used in the analysis.

For contaminants analysis, should a procedural blank exceed the method specified limit, method and contract requirements will dictate whether the analytical batch is re-analyzed or whether results are flagged or explained in a narrative that accompanies the data. Procedural blank results less than 1/10 of the sample concentrations are generally considered acceptable and reported with an explanatory note. For work subject to US DoD ELAP accreditation, procedural blanks higher than ½ the LOQ or greater than 1/10 the sample concentration or regulatory limit will be considered contaminated and affected samples will be re-analyzed or qualified results will be reported, as appropriate for contract.

If procedural blank contamination persists, the analysis is halted until the source of contamination is found and eliminated.

For metabolomics analysis, analytical batches typically consist of three blanks. If the mean concentration of the metabolite in the samples is less than three times the mean concentration in the blanks, the analytes are flagged in the narrative as being affected by blank background levels with a note on whether levels in the samples are below, at, or above the limit of quantitation.

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1.2 Laboratory Sample Duplicate

A laboratory sample duplicate is a sample that is analyzed twice in the same analysis batch. This involves analyzing two separate sub-samples taken from a single sample container provided by the client for analysis.*

A laboratory sample duplicate is analyzed with every non-aqueous batch of seven to twenty test samples, provided sufficient sample is available. Analysis of laboratory sample duplicates for aqueous samples is performed only with prior negotiation with the client.

Results are evaluated against defined precision limits for acceptability.*. Procedures for defining control limits are documented in Standard Operating Procedures.

SQA-002 Method Validation Procedures

Should the results for sample duplicates exceed precision limits, the cause is determined and remedial action as appropriate to correct any analytical deficiencies is performed.

* Note: Precision limits apply only to sample duplicate sub-samples taken from a single sample container provided by the client. Samples designated by the client as duplicate samples but submitted in individual containers are designated as client (field) duplicates and are not subject to laboratory precision limits.

1.3 Reference Samples

A reference sample is a sample that contains "known" quantities of some or all of the target analytes. Reference samples are used to demonstrate the accuracy of methods and the on-going laboratory performance. There are many different types of reference samples used at SGS AXYS Analytical Services. A reference sample is analysed with every batch of samples.

1.3.1 Certified Reference Materials (CRMs)

These are reference materials that are accompanied by a certificate of analysis and are supplied by internationally recognized agencies. These certified values have been determined by multiple laboratory analyses. These types of reference samples are used, wherever possible, to validate a method. However, they are not available for all types of analyses.

1.3.2 Reference Materials (RMs)

These are reference samples obtained from commercial suppliers or governmental agencies for which the target concentrations have been determined by consensus. They are used in conjunction with CRMs or when CRMs are not available for method validation.

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1.3.3 Internal Reference Materials (IRMs)

These are reference samples in which the analyte concentrations have been determined by repetitive analysis at SGS AXYS or by intercalibration studies. They may be used as "known" samples when a CRM is unavailable. They are either naturally contaminated material or a matrix fortified with target compounds.

1.3.4 Laboratory Control Sample (LCS)

May also be referred to as Spiked Matrix Material (SPM) or On-going Precision and Recovery (OPR) sample. This is a sample of an uncontaminated matrix spiked with a known quantity of authentic target analyte typically at or below the concentration of the mid-level calibration solution. Spiked matrix samples are used most often as reference samples in an analysis batch.

The analytical results for reference samples are compared to the certified or expected values; the acceptance ranges are expressed as percent recovery of the actual concentration. The concentration percent recoveries must meet the method specifications in order for the data to be accepted. Where permissible by contract, marginal LCS exceedances for specified analytes may be accepted for long lists of analytes as documented in standard operating procedure SQA-001 Data Validation Procedures.

Where reference sample results do not meet QC requirements, additional reference results are examined or diagnostic tests are performed, to determine if a systematic error exists. Should a problem be identified, analysis is halted and corrective action is taken. Affected results are identified and depending on the nature of the problem, the samples are re-analyzed or the results are corrected for bias displayed by multiple QC reference samples.

1.4 Spiked Blank (SPB)

A spiked blank is a procedural blank to which a known quantity of authentic target analytes has been added. Spiked blanks are generally used in method validation studies to determine method performance, independent of matrix effects. They may also be analyzed as routine QC reference samples when an appropriate blank matrix is not available.

1.5 Unspiked Matrix (USM)

This is a sample of the uncontaminated matrix used to prepare a spiked matrix sample. It is analyzed to determine the levels of target analytes in the matrix prior to spiking. The concentration of analytes in an unspiked matrix should not normally be significant compared with the spiked amount added. If the contribution is significant, a correction must be applied.

1.6 Matrix Spike (MS) / Matrix Spike Duplicate (MSD)

A matrix spike (MS) sample is a test sample that has been spiked with a known quantity of analytes; the spiked sample may be analyzed in duplicate (MSD). The sample is also

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analyzed unspiked and the recovery of the analyte spike is determined by comparison of the spiked and unspiked sample analysis results. The primary purpose of MS/MSD tests is to establish the applicability of the analytical approach and procedure to the sample matrix of interest, not to evaluate routine laboratory performance. MS/MSD tests are performed as appropriate for method validation purposes and where specified by the analytical method or contract. Usually the client will specify the sample to be analyzed; if not, SGS AXYS chooses a sample from among those with sufficient quantity to allow for multiple sub-samples. If there is insufficient sample to meet MS/MSD requests, duplicate LCS tests may be used to demonstrate precision, with client agreement.

Procedures for the preparation of the above QC samples and for performing the appropriate QA/QC checks on the analytical results are described in the following Standard Operating Procedures.

SLA-016	Preparation of Quality Control Samples
SQA-001	Data Validation Procedures
MLM-001	Determination of Metabolites in Biological Samples (Targeted Metabolomics)

2. INSTRUMENT QUALITY CONTROL CHECKS

The instruments used in the analysis of extracts are required to meet specifications described in each analytical method in order to ensure reliable instrumental data. A number of parameters are monitored on a method-specific basis and sample-specific basis, as a means of ensuring specifications are met. The checks carried out are described below.

2.1 Instrument Linearity

Quantification linearity of the GC/MS, GC/ECD, and LC/MS/MS systems is verified by a multipoint calibration procedure initially as specified by the method and repeated with a minimum frequency of 90 days, or whenever significant instrument adjustment/maintenance is performed, or should a calibration verification test fail. The frequency of multipoint calibration for methods employing ‘continuing calibration’ procedures is documented in the following Standard Operating Procedures.

SIN-028	Frequency of Initial Calibration – GC/MS
SIN-037	Frequency of Initial Calibration – LC/MS/MS
MLM-001	Determination of Metabolites in Biological Samples (Targeted Metabolomics)

The degree of linearity over the working range must meet the specifications established by the analytical method prior to commencing the analysis.

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2.2 Window Standards

Window standards, analyzed for some GC/MS methods, are run when there is a change in GC conditions, column or retention times in calibration solutions, or as stated in the analytical method.

2.3 Resolution Standards

Gas chromatographic resolution is demonstrated prior to analysis.

a) A GC Resolution Standard is analyzed on an established schedule or after changes to the GC system. GC Resolution standards, their test frequencies and acceptance criteria are detailed in each analytical method, where applicable. The GC resolution standard may be a separate solution or it may be combined with calibration solutions.

b) On-going GC Resolution is monitored by monitoring the separation of resolution standard components in the calibration standards and in samples (if present). Peak width of analytes and internal standards is also monitored as an indication of column performance.

2.4 Sensitivity

Instrument sensitivity must be maintained throughout the analysis procedure to ensure detection limit specifications are met. A sensitivity standard is run on a regular basis. The peak areas of surrogate and recovery standards in the calibration solution and samples are monitored on an on-going basis to ensure adequate instrument sensitivity. Acceptance criteria for sensitivity standards are detailed in the analytical method. Sensitivity is also evaluated on an *ad hoc* basis by monitoring the response for particular compounds (normally recovery standards) in calibration solutions and samples.

2.5 Instrumental Response Calibration

Calibration relative response factors (RRF) are determined by analysis of multi-concentration calibration solutions. For linear calibration models a minimum of 5 concentrations are required and for 2nd order calibration models a minimum of 6 concentrations are required. The lower concentration calibration standard and the upper concentration calibration standard define the response range for quantitative analysis. Samples extracts are diluted as required to bring responses with calibration range. Calibration response factors are determined by either a constant RRF model or by regression calculation, in accordance with specific methodology. Calibration is verified at least once every 12 hours by analysis of a calibration verification standard (CV) with target concentrations at or below the calibration mid-point level. Instrumental servicing and/or re-calibration are performed as required to maintain the response factors within specifications. Where agreed by contract, mean RRFs may be determined from a single concentration calibration standard run immediately before and after the samples.

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2.6 Injection Blank (to Monitor Instrumental Injection Carryover)

Solvent blanks are typically injected after a calibration verification or bracketing calibration standard to monitor the rate of instrumental injection carryover. The maximum acceptable level of carryover is 0.3% of the preceding injection, and is determined according to procedures in the Standard Operating Procedure.

SCO-025 Instrumental Data Evaluation Procedures

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X. QUALITY ASSURANCE MEASURES

Quality assurance (QA) measures have been implemented to maintain control of the materials, equipment, conditions and procedures used in the analytical testing procedures. These measures, described below, are conducted on an ongoing, routine basis.

1. PURCHASING OF GOODS AND SERVICES

The SGS AXYS policy for the purchasing of goods and services is as follows:

- Goods and services will be purchased only from reputable and reliable vendors, according to standard operating procedure

  SAD-006 Purchasing of Goods and Services

- Vendors of critical services, equipment and consumables which affect the quality of the tests performed by SGS AXYS must be qualified annually. The qualification consists of reviewing the vendor's current certifications, assessing their ability to deliver reliably and in a timely fashion, and verifying that the vendor's products have consistently passed any applicable QA checks performed by SGS AXYS. Records of the vendor qualifications are maintained.

- All methods specify the quality (specifically grade and manufacturer where applicable) of reagents and materials required.
- Wherever possible, the highest purity reagents will be purchased.
- All chemical standards purchased will be of documented purity and/or concentration.
- No substitutions are allowed without permission of the Technical Director, QA Manager or Director of Operations.

2. LABORATORY QA MEASURES

Reagents and equipment are tested and monitored to verify compliance with established quality and performance specifications. Materials or equipment not meeting the requisite specifications are removed from use or service.

Balances, weights, thermometers and pipettes are regularly calibrated by ISO/IEC 17025 accredited external calibration providers. The requirements are defined in the following Standard Operating Procedure:

SLA-125 Calibration of Equipment

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2.1 Reagent Checks

The quality of all reagents used in the analytical procedures is specified in each written analytical method. Manufacturer's specifications and in-house checks of reagents are used to ensure the quality. Details of reagents are recorded in the LIMS Consumables Inventory List including, where applicable, supplier name, catalogue number, purity or grade, lot number, and expiration date.

Chemical Reagents Where necessary, reagents are subject to cleaning procedures prior to use. Cleaning procedures are described in each written analytical method.

Solvent Checks New batch lots of solvent are checked for impurities prior to use by analyzing the solvent. Records of the analysis are kept on file.

Column Packings Batches of prepared column packings are checked following standard operating procedures. The preparation of packings and cut-point results are documented.

Reagent Water Seastar Low Organic water or equivalent meeting ASTM Type I resistivity and total organic carbon specifications and Canadian Springs bottled water is purchased and used as a reagent in analysis procedures.

Procedural blank data are monitored for the presence of interferences or target analytes that may come from reagents, solvents, column packings and/or reagent water.

If a reagent is shown to be contaminated it is not used.

Procedures for proofing solvents are described in the following Standard Operating Procedure.

SLA-094 Procedure for Proofing Equipment, Sampling Media, Solvent and Sample Containers

2.2 Glassware Checks

Glassware is typically washed thoroughly and baked/oven dried prior to use in the laboratory, to ensure that target background levels meet method requirements. Some analyses performed at SGS AXYS require that glassware proofs be carried out regularly as a part of the analysis. In this case, all the pieces of glassware used in an analysis batch are solvent rinsed or extracted and the rinse/extract analyzed for the presence of target analytes, in order to determine the contribution to the total concentration from the glassware. The contribution must be below method specifications or the analysis is not started.

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Glassware used in the cleaning of 'ultra high' level samples undergoes special cleaning procedures prior to being returned to use. Glassware used with 'ultra' high samples must be proofed prior to return to use for regular level samples.

SGS AXYS, upon request, ships clean sample containers to clients. These containers are purchased with a certificate of cleanliness and are regularly proofed for target analytes. The analysis results from the proofs are kept on file. The containers must meet established acceptance criteria for 'cleanliness' prior to use.

The procedures for cleaning glassware, performing a glassware proof and shipping sample bottles are described in the following Standard Operating Procedures.

SLA-001	Cleaning and Baking Glassware and Disposal of Laboratory Waste Solvent and Materials
SLA-094	Procedure for Proofing Equipment, Sampling Media, Solvents and Sample Containers
SAD-013	Shipping and Receiving Procedures

2.3 Volumetric Measurements

To ensure the accuracy of volumetric measurements is adequate for the application the following practices are followed:

Only Class A volumetric glassware and designated Hamilton syringes are used in the preparation of standard solutions. Some standards, such as LC calibration standards, may be prepared using variable volume pipettes instead of syringes.

Hamilton syringes or calibrated variable volume pipettes are used to dispense standard solutions for daily analysis.

Hamilton syringes are verified for bias and precision prior to use. Variable volume pipettes are calibrated annually and verified quarterly as a minimum; for DoD work variable volume pipettes are verified daily. Records of syringe and pipette accuracy are maintained as described in the following standard operating procedure:

SLA-088 Use and Maintenance of Syringes and Pipettes

2.4 Balance Checks

Balance calibration meeting ISO 17025 requirements are performed annually. The accuracy of any standard weight used in the lab is verified by comparison to certified weights with calibration meeting ISO 17025 requirements.

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The accuracy of the balance calibration is verified daily using reference weights. Records of this verification are maintained in individual balance logbooks kept with the balances.

Logbooks documenting the calibration and repairs of each balance are maintained.

Procedures for accuracy checking, calibration, daily verification of calibration, and maintenance of the balances are described in the following Standard Operating Procedures.

SLA-023 Use of Balances

2.5 Thermometer Checks

All thermometers used for monitoring sample shipments received, sample storage facilities, water baths and the drying oven require calibration to meet ISO17025 standard with a minimum annual frequency. Additionally, thermometer accuracy may be verified internally on-demand following procedures in SLA-046.

SLA-046 Verification of Thermometers

2.6 Controlled Environment Checks

Temperature

The temperatures of the sample storage facilities and instrumental laboratories are monitored to ensure compliance with specifications described in Chapter V, 1.1 and 1.3.

Procedures for monitoring the cooler, freezer and refrigerator temperatures are described in the following Standard Operating Procedure.

SLA-026 Monitoring Temperature of Freezers, Coolers and Refrigerators

Air

Air filters that clean the intake air are changed on an established schedule to ensure a clean air supply. The date last changed is recorded on the unit.

2.7 Equipment Inventory Control

An inventory list of equipment used in analytical testing is maintained in the LIMS. This equipment inventory records the item, the inventory control number, manufacturer, model, serial number, and maintenance and calibration intervals. Each new piece of equipment is assigned an inventory control number and entered onto the list prior to putting the equipment into use. The Laboratory Supervisors are responsible for all laboratory equipment. The Instrumental Analysis Manager is responsible for all instrumental equipment. Items are removed from the list only if they are no longer in SGS AXYS' possession.

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2.8 Equipment Maintenance

Equipment maintenance logs record all maintenance and repairs carried out on balances, laboratory equipment (e.g. rotary evaporators, water baths), sample homogenization equipment, ovens and refrigerators, and instrument logbooks record non-routine maintenance and repairs of GC/MS, GC/ECD, and LC/MS/MS instruments.

Equipment that requires servicing is labelled as “Not in Service”. The repair is documented in the maintenance log (subfolder of G:\Information\Equipment Records\). The Manager/Supervisor is required to sign off on the repaired equipment prior to its return to service.

3. PROFICIENCY TESTING (PT)

PT samples in support of accreditation, obtained from an ISO 17043 accredited vendor or an alternate supplier approved by the accrediting body, are analyzed semi-annually for each analyte-matrix-method combination where available; each successive study is performed within 5 to 7 months of the previous study. Successive PT samples analyzed as corrective action for the purpose of re-establishing a history of successful PT participation must be analyzed at least 15 days apart. PT sample results for initial accreditation must be current within one year, or as required by the accreditation program.

The PT samples are analyzed and evaluated using the same methodology and QC protocol applied to client environmental samples. The results for PT samples, evaluated by the vendor in accordance with ISO 17043 statistical requirements where applicable, are used as a measure of method accuracy and laboratory performance. The laboratory maintains a history documenting at least two successful PT results out of the three most recent sets of PT samples analyzed. PT results are maintained as necessary to meet the requirement of active accreditation scopes.

Where PT samples are not available, certified reference materials, internally developed reference samples or routine laboratory spiked control samples may be used as proficiency demonstrations; comparative evaluation of results from multiple analysts are conducted periodically, with a minimum frequency of one year.

SGS AXYS also participates in relevant interlaboratory comparison studies offered by government agencies, international organizations, and clients.

4. AUDIT PROCEDURES

4.1 Internal Audits

Internal audits covering all aspects of sample receipt, analysis and data reporting to assess compliance with the quality system requirements and effectiveness of policies and procedures are conducted at least annually by the QA department. Internal audits include both technical and quality system areas and include review of raw electronic files. The frequency of

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internal audits is adjusted based on the laboratory's performance. Written records of audit findings and actions taken to correct deficiencies are maintained by the QA Manager and presented to the management team. The QA Manager is responsible for establishing and implementing audit procedures. The following Standard Operating Procedure describes the procedures for conducting an audit and responding to an audit report.

SQA-008 Internal Quality Audit Procedures

A minimum of 5% of reported data packages (10% on a quarterly basis for US DoD work) are reviewed in details for completeness and accuracy by the QA Manager or designees and the findings are provided to managers for the purpose of improvement. For work under DoD accreditation an additional requirement is that if data quality issues are discovered during the review, the client shall be notified within fifteen (15) business days of the discovery of the issue.

4.1.1 Quality System Management Review

An annual management review is conducted by the Vice President to evaluate the effectiveness of the quality program. The management review includes examination of the following:

- results of recent audits, both internal and external;
- results of recent performance evaluation samples;
- quality control activities;
- client feedback/complaints (nature, frequency);
- non-conformances (nature, frequency, root cause);
- corrective and preventive actions;
- quarterly managerial reports;
- staffing levels;
- staff training and effectiveness of training;
- resources;
- suitability of policies and procedures;
- changes in the volume and type of work; and
- management meeting records.

The results of the review are documented in a report and provided to the laboratory management team. Corrective action and improvement findings are entered to the Q-Pulse CA/PA system for resolution. The Vice President is responsible for ensuring that all resultant actions are carried out within an agreed upon timeframe.

4.2 External Audits or Assessments

Agencies that grant accreditation perform on-site assessments on a regular schedule (generally every two years). In addition, SGS AXYS may also be audited as part of a bidding process or as a condition of a specific contact. Corrective action plans to address any deficiencies noted during inspections are developed, submitted to the agency for approval and implemented. Should a change to corrective actions plans be required subsequent to initial agency approval, the

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revised corrective action plan is re-submitted for approval prior to implementation. Records of the assessment/audit findings and any corrective actions are maintained.

4.3 Performance Audits

Performance audits, which quantitatively evaluate the analytical data generated, are conducted by participation in interlaboratory studies and performance evaluation tests. SGS AXYS participates in these studies on an ongoing basis and maintains records of results, findings, and any actions taken based on the results.

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5. PERFORMANCE MONITORING

Analytical data, QC/QA results, and operational practices are monitored for compliance with established Quality Systems standards. Trends or circumstances that indicate potential out of control situations trigger investigation and corrective action where necessary. Any samples analyzed during out of control periods are evaluated for impact and re-analyzed as warranted.

Laboratory and method performance is information is compiled using a LIMS data base query feature (MAGOO). The compliance rate of QC sample results (blank levels, spiked compound recoveries, sample surrogate recoveries) against method specified requirements is documented on a method, matrix and compound specific basis, and formally reviewed with management semi-annually or more frequently if required by accreditation program or indicated by performance. Results falling below acceptable compliance rates for the application, or trends indicating potential method performance problems, trigger corrective action or improvement initiatives. Method laboratory control limits are updated or verified annually, or more frequently if warranted, based on the monitoring results.

Control charts are used to track selected critical or diagnostic performance parameters such as procedural blank concentrations, reference sample recoveries and surrogate recoveries. Control chart procedures are described in the following Standard Operating Procedures:

SQA-007 Control Chart Procedures

6. SUBCONTRACTING

A client may request an analysis that is not carried out at SGS AXYS. In such cases, SGS AXYS arranges, with the client's approval, to subcontract the analysis to another laboratory. The selection of a subcontract laboratory depends upon the subcontracting laboratory's ability and qualifications to perform the required analysis to meet the client's requirements with regard to accreditation, methodology, turn-around time, price, and availability for audit, if requested. SGS AXYS will subcontract analyses to a laboratory specified and approved by the client in writing. Subcontractors for DoD work must meet the requirements of the currently applicable DoD quality standard and be open to review by the DoD client.

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SGS AXYS maintains information on subcontracting laboratories, documenting the specific location of the lab, methods used and laboratory qualification including certification or accreditation status. The QA Manager approves a list of pre-qualified subcontract laboratories. The Project Managers confirm that the data received meet the client's specifications and are acceptable.

Samples are received and logged in at SGS AXYS prior to being sent to the subcontract laboratory. A Release Chain of Custody is generated from LIMS and is sent with the sample(s) to the subcontracting laboratory.

Subcontractor analysis reports are forwarded directly to the customer.

Procedures for the subcontracting of samples are described in the following Standard Operating Procedure.

SAD-002 Subcontracting Procedures

7. CORRECTIVE ACTIONS

Corrective or preventative actions are initiated when non-conformances, weaknesses, or threats are identified. All individuals working at SGS AXYS are responsible for identifying non-conformances to the Manager/Supervisor or QA Manager. Reports of non-conformances and corrective or preventative actions taken are kept on file and reviewed by the QA Manager.

When data quality fails to meet quality objectives, the problem and appropriate corrective measures are documented on the individual sample work-up sheets and also in the LIMS workgroup comments section, which is also used to document any issues that cannot be explained sufficiently on a per sample basis. Corrective actions may include a repeat of the instrumental analysis, additional clean-up of the extract, or a complete re-analysis. The procedures for data validation are described in the following standard operating procedure:

SQA-001 Data Validation Procedures
SLM-002 Metabolomics Data Processing, Checking and Reporting

Non-conformances that require further attention beyond routine remedial actions are documented in a Q-Pulse non-conformance report describing the problem, the person responsible for correcting it, and the date that action is required. Actions include cause analysis, identification and implementation of corrective actions, monitoring the effectiveness of corrective actions, and possible internal audits. Details of corrective and preventive actions performed are completed along with identification of the cause and any contributing factors. The non-conformance reports are reviewed by the QA Manager who closes the reports when remedial actions are judged sufficient. These reports are reviewed as part of the internal audit process.

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The non-conformance reports are available to laboratory staff through the Q-Pulse document management system.

Where method or laboratory performance is identified as non-conforming, the analysis is suspended pending correction. Department Managers have the authority to suspend operations within their areas of responsibility; the Technical Director and the QA Manager have authority to suspend operations within or across departments. QA Manager authorization is required for resumption of suspended analyses. Appropriate remedial action is taken for any analyses that were performed during a period of non-conformance. Should the non-conformance significantly affect results reported to customers, the affected customers are identified and notified in writing within 30 days (within 15 business days for work under DoD accreditation) by the Client Services Manager with oversight of the QA Manager, and results flagged or withdrawn, as appropriate. The corrective actions and client notification details are documented in the Q-Pulse corrective action register system and are reviewed by laboratory management for closure. Where requested, corrective action reports are provided to customers.

The following requirements additionally apply for work under DoD accreditation:

- Upon discovery SGS AXYS notifies affected customers of potential data quality issues resulting from non-conforming work within fifteen (15) business days. Notification shall be performed according to a written procedure.
- Records of corrections taken or proposed corrective actions to resolve the nonconformance shall be submitted to the customer(s) within thirty (30) business days of discovery.
- SGS AXYS must report any instances of inappropriate and prohibited laboratory practices either by laboratory staff or customer stakeholders to their accrediting body within fifteen (15) business days of discovery.
- SGS AXYS must submit records of associated corrections taken or proposed corrective actions to their accrediting body within thirty (30) business days of discovery.

7.1 Client Complaints

Concern or questions expressed by a client, or an agent acting on behalf of the client, regarding a product or service provided by AAS including accuracy of results, reliability of results, report format, completeness, conformance to contractual agreement, fitness for purpose, delivery, confidentiality, turn around time, billing, or staff responsiveness to client needs may constitute client complaints. A judgment call between a client requiring service and a client with a complaint must be made. During the normal course of interactions with clients it is common to receive questions from clients that require explanation (technical service) regarding any of these categories. It is imperative that communication (preferably direct if the situation has any degree of complexity that cannot be readily answered) with the client occur to 1) fully understand and assess the situation, and to 2) provide answers, immediately if available or after consultation with an SGS AXYS resource. If this has been completed and the client is still unsatisfied the issue is deemed a client complaint.

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If questions regarding accuracy of results are raised, SGS AXYS will carry out any reasonable amount of additional work to satisfy the client, be it repeat of the analysis, re-injection of the sample extract or re-examination of the data.

Client complaints are recorded in the Q-Pulse non-conformance register along with findings of investigations, corrective actions and preventative actions. QA Manager approval is required to close non-conformance report following satisfactory resolution.

Detailed procedures for handling a client complaint are described in the following Standard Operating Procedure.

SAD-011 Settlement of Client Complaints

8. CONFIDENTIALITY

Analytical results obtained by SGS AXYS are the property of the client and are confidential, as is the identity of the client. SGS AXYS staff are not permitted to discuss clients' identity, samples or results with the public. The results obtained may often have legal or regulatory implications or be of a sensitive nature. Consequently, it is of utmost importance that SGS AXYS be able to assure client confidentiality and guarantee the security and confidentiality of results. Measures are in place to ensure confidentiality is maintained.

1. Each client is assigned a unique identification code and all data are filed by client identification code number and not by client name.
2. A unique SGS AXYS sample identification code is assigned to each sample and used throughout the analytical process.
3. Access to electronic data is limited and the data are password protected. The computers handling data are located in work areas that are kept locked outside normal working hours.
4. All analytical data and reports are filed in a secure filing system with limited access.
5. Safe transmission practices are in place for the reporting of data.
6. Each staff member at SGS AXYS is required to sign a non-disclosure agreement, thus further safeguarding a client's identity and analytical results.

The procedures for secure computing practices, filing of data, and safe transmission of data are described in the following Standard Operating Procedures.

SAD-005 Transmission of Reports
SAD-022 Record Management
SAD-024 Computer Network Management and Security
SAD-028 Electronic Data - Security Policies and Features

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9. PROPER RECORD KEEPING

The following procedures apply:

1. All hand-written records must be recorded in ink.
2. All corrections must be made with a single line through the item without obscuring the original entry. Use of correction fluid is not allowed. The new entry must be dated and initialled by the person making the corrections.
3. Documentation entries that require a signature or initials must be signed or initialled with a reason (e.g., “approved by”, “entered by”). In the special case of corrections to an existing record, the presence of the correction along with the date and signature or initial is sufficient.
4. Data reports must be authorized with a signature and a title. Only the Project Manager, authorized Instrumental Analysts, the QA Manager, and the Technical Director may authorize the reporting of results to clients.

Record keeping procedures and logbook requirements are described in the following standard operating procedures, respectively:

SQA-019	General Documentation Policies
SLA-027	Completing a Worksheet
SLA-115	Use and Control of Logbooks

10. MONITORING PRACTICES

SGS AXYS has implemented a variety of procedures that monitor the critical steps of the analysis procedures and ensure that documentation practices are adhered to. These procedures include the following:

- A spike witness program for contaminants analysis whereby another analyst, trained in spiking procedures, witnesses the addition of surrogate and native spiking solutions.
- Verification of the records for standard preparation by a second individual.
- Verification of all analyte quantification routines by another individual, trained in data interpretation.
- Review of all sample login information, analysis related information, and calculated results by an Instrumental Analysis Chemist.
- Supervisory review of logbooks and independent review of lab worksheets.
- Random, in-depth data package audits conducted by the QA group.
- Internal audits conducted by the QA group.

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11. PROCESS IMPROVEMENT

SGS AXYS management is committed to the continual improvement of practices and processes. SGS AXYS' quality system incorporates a number of measures to monitor laboratory performance and identify opportunities for improvement. These measures include the following:

1. Internal audits, conducted on a regular basis, to monitor compliance with documented practices and to identify areas of non-conformance or opportunities for improvement.
2. Participation in intercalibration studies and analysis of performance evaluation samples.
3. Monitoring of data trends vs. control parameters to ensure processes are in control.
4. Encouragement of staff to identify areas of improvement and bring these to the attention of management.
5. Procedures for staff members to request corrective or preventative actions.
6. Compliance monitoring to evaluate the effectiveness of actions taken.
7. Annual managerial reviews that consider staff and client feedback, data quality trends, method performance, audit reports, managerial reports, non-conformance records and effectiveness of training programs.
8. Solicitation of feedback from customers (informally and through a scheduled satisfaction survey) regarding data quality and service satisfaction.

The results of management reviews and the above records are used to develop plans for process improvement.

12. ELECTRONIC SIGNATURES

An electronic signature (e-signature) is a paperless method used to authorize or approve electronic documents and records. The e-signature is attached to the electronic document and adopted by a person, the signatory, with the intent to sign the same document. The security and integrity of an e-signature depend on the sophistication of the technical platform used and on applying good signatory practices (for example, maintaining reliable password security).

SGS AXYS policy for e-signatures is to assure:

- Data integrity – Securing the tie between the document and the signatory
- Attribution – Securing the identity of the signatory
- Reliability – Securing the e-signature and document from alterations after the e-signing

SGS AXYS' e-signing policy is satisfied by using the following system of e-signatures:

<u>SGS AXYS LIMS:</u>

E-signatures in LIMS are applied on the records in the LIMS database tables, specifically where analytical data are being entered or revised by a User. The User's username is recorded

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along with a date/time stamp and the reason for making the entry or revision; no edits to data sets are permitted without supplying a reason. Once a data set has been finalized and a User sets the final Approval Status level of QCREV, then that data set is locked against editing from within the LIMS software. Further modifications to that data set cannot be made without rolling back to a step prior to the setting of the QCREV Approval step. Final reports display a programmed translation of that username. **The LIMS e-signature is applied to all LIMS client sample data and records, from sample receiving to the final report.**

Q-Pulse:

E-signatures in Q-Pulse are applied on the records in Q-Pulse's database. **Q-Pulse e-signatures are used to authorize Q-Pulse documents and records**.

Topaz, Excel with password protection:

The Topaz e-signature is a proprietary system used by the Director of Operations and the QA Manager to sign Excel, Word or pdf records of chemists' initial demonstration of competency training records.

Excel without password protection:

This e-signature is used on internal summary records where approval is required. It is used for particular internal records such as method detection limit verifications, syringe/pipette approvals, standard sheet preparation records, etc., where network access restriction procedures are in place as the primary security feature.

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XI. STANDARDS

The analytical methods used at SGS AXYS rely on the use of solutions containing known quantities of surrogate or internal standards, recovery standards, and authentic analytes. These standard solutions are prepared at SGS AXYS using commercially available standards as starting materials. It is the concentrations of these standard solutions that are used to determine analyte concentrations in samples, percent recovery of spiked authentics and percent recovery of surrogate standards. Standard solutions are prepared accurately and reliably and are handled correctly to ensure the most accurate results possible.

The preparation, validation, storage and control of standards are the responsibility of a Technical Service Chemist.

1. CATEGORIES OF STANDARDS

There are four general categories of standards in use at SGS AXYS. They are as follows:

1.1 Certified Reference Materials (CRMs)

Certified Reference Materials are reference materials which are accompanied by a certificate of analysis and are supplied only by recognized agencies or institutions. The concentration of each analyte has been determined by multiple analytical methods. CRMs are usually matrix-specific and are widely used for analytical method validation. Those CRMs that are supplied as solutions in pure solvents can be used directly for standard solution validation.

1.2 Primary Standards

Primary standards are commercially obtained chemical standards. These may be pure compounds or mixtures of compounds in solution. They may be crystals, powders or liquids. The concentration or purity is normally determined by the commercial supplier and certificates of analysis are available. Primary standards are generally not used directly in test methods but are used to prepare stock standard solutions.

1.3 Stock Standards

These are solutions prepared from primary standards. They are generally more concentrated than is required for direct use in test methods and are diluted to prepare working standard solutions.

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1.4 Working Standards

These are solutions prepared at SGS AXYS from stock solutions. These standards are used routinely in test methods. It is the responsibility of each analyst to understand the use of these standards in the analytical process, to handle the solutions correctly, and to accurately add the standards to the sample or sample extract in order to ensure the best possible accuracy of results. Working standards are validated prior to use to verify purity and accuracy. The types of working standards in use at SGS AXYS are described below.

1.4.1 Surrogate Standard

Surrogate standard solutions are composed of, wherever possible, deuterated or ^{13}C-labelled analogues of the target analytes. If these are not available, the surrogates are compounds with a chemical structure and behaviour that mimics closely that of the target analyte. An aliquot of surrogate standard solution is added to every sample, usually prior to the extraction procedure. The surrogate standards serve as internal standards from which the analytical results are calculated. The accurate addition of a known volume of surrogate standard solution is critical to the accuracy of the final concentration.

1.4.2 Recovery Standard

Recovery standards are, whenever possible, deuterated or ^{13}C-labelled analogues of target analytes. If these are not available, compounds with a chemical structure and behaviour that mimic closely that of target analytes are chosen.

A known amount of recovery standard is added to the final extract, just prior to instrumental analysis and is most often used as a quantification standard to determine percent surrogate recoveries. Percent surrogate recoveries are an indication of overall data quality and must fall within specified ranges documented in each analytical method. Recovery standards are also used to monitor instrument response. Recovery standards may also serve as internal standards for quantification of target compounds.

1.4.3 Cleanup Standard

Cleanup standards are, whenever possible, deuterated or ^{13}C-labelled analogues of target analytes. A known amount of cleanup standard is added to the sample extract after extraction, but prior to cleanup. The recovery of the cleanup standard is a measure of the cleanup efficiency and of any losses incurred during sample extract cleanup procedures.

1.4.4 Authentic Standard

Authentic standards contain known quantities of authentic target analytes. Spiked matrices and spiked blanks are prepared by adding an aliquot of authentic standard solution to a matrix known to have low levels of the analytes. The determined concentrations are compared with the expected concentrations, based on the volume of authentic solution added. The degree of agreement between the determined and expected concentrations is an indication of the accuracy.

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1.4.5 Calibration Standards

Calibration standards are a series of solutions used to determine the concentration versus response relationship of the instrument. They are prepared with known amounts of authentic, surrogate and recovery standards; the authentic compound concentrations vary over the working response range of the instrument while the concentrations of surrogate and recovery standard are constant. Each solution is analyzed and the response factors (RFs) or calibration regression relationship are calculated. Instrument linearity of response is demonstrated by this calibration data. The calibration data are used to convert instrumental response to concentrations in samples.

1.4.6 Window Standards

Window standards are mixtures of select target analyte compounds that are used to identify the retention time of the first and last eluting compounds in a suite of target compounds. They are run to ensure that each compound or group of compounds elutes from the GC column within the expected time window.

1.4.7 Sensitivity Standard

This standard is a solution containing authentic target analytes in which each analyte concentration approaches the instrumental detection limit. The signal:noise ratio for this solution must be within method specifications to satisfy instrument detection limit specifications. This solution is usually the least concentrated of the linearity series of solutions.

1.4.8 GC Column Resolution Standard

This standard is a solution that contains closely eluting components of an analysis suite, which must be adequately separated by the gas chromatograph.

1.4.9 Second Source Verification Standards

Second source verification (SSV) standards are solutions used where required to confirm the concentration of the calibration standards. They are prepared with surrogate and recovery standards and an authentic from a different source than the calibration standards. The authentic level is close to CAL-VER level of the calibration standards. The SSV standard solution is analyzed and must be within method specifications for the CAL-VER.

2. NAMING OF STANDARDS

SGS AXYS has developed an in-house system of identifying primary standards, stock solutions, and working solutions. The system used for naming these standards is described in Appendix B.

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3. PREPARATION OF STANDARD SOLUTIONS

Stock and working standard solutions are prepared using primary standards as starting materials. All standards prepared from these materials have concentrations based on the purity and/or concentration of the primary standards. These concentrations are used in the calculations of final analyte concentrations.

Standard solutions are prepared according to established procedures. Standard solutions are prepared in batches, in quantities sufficient to last approximately one year. The solutions are stored in ampoules in quantities sufficient to last no more than a week under normal workloads. Containers of working standard solutions are labelled with the expiry date; where it is a requirement for conformance with an accreditation standard (e.g. US DoD) the containers are also labelled with the preparation date. Procedures for the log-in of primary standards and CRMs, preparation of standard solutions, and documentation of standard preparation are described in the following Standard Operating Procedures.

SAD-006	Purchasing of Goods and Services
SLA-009	Preparation of Standards

4. DOCUMENTATION OF STANDARD PREPARATION

Details and results of standard preparation and validation are recorded in Standard Data Sheet Files. Each standard solution is given a unique identification number. Each solution has an individual Standard Data Sheet File giving the details of preparation, the composition of the solution, the concentration of each component, the solvent type plus the lot number used for dilution, and the date prepared. Standard Data Sheet Files are available electronically to all staff. A Technical Service Chemist is responsible for the maintenance of all Standard Data Sheet Files.

5. VALIDATION OF PREPARED STANDARD SOLUTIONS

New solutions are validated by analyzing the solution and comparing the results against a validated solution or a certified solution.

Once the solutions have been validated, the solutions can be used in the analysis of samples.

Procedures for the validation of standard solutions are described in the following Standard Operating Procedure.

SQA-003	Standard Solution Validation

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6. STORAGE AND CONTROL OF STANDARDS

A Technical Service Chemist is responsible for the security of the standards and access to the standards cupboard is limited to authorized staff.

6.1 Certified Reference Materials

Each Certified Reference Material is logged with a unique Standard Control (SC) number into the LIMS by a Technical Service Chemist. The LIMS record documents the components in the standard, the purity and/or concentration, the lot number, date received, manufacturer, etc. In the event that a problem is identified with a CRM it can be traced back to a particular container.

SGS AXYS maintains a LIMS inventory and a list of certified reference materials in use and keeps on file the certificate of analysis for each CRM. An inventory list of certified reference materials is maintained and kept by the QA Manager.

Unless otherwise specified on the certificate instructions, certified reference materials are stored at ambient temperature, in the dark, in Laboratory 1.5.

6.2 Primary Standards

Each primary standard is logged with a unique Standard Control (SC) number into the LIMS by a Technical Service Chemist. The LIMS record documents the components in the standard, the purity and/or concentration, the lot number, date received, manufacturer, etc. In the event that a problem with a standard solution is identified, it can be traced back to the original starting material.

Primary standards for which ambient temperature storage is appropriate are stored in the dark, in locked, vented storage cupboards in Laboratory 1.5. Primary standard solutions that have been opened and of which an aliquot has been taken are resealed in a glass ampoule prior to storage. Primary standards that require refrigeration or freezing are kept in a locked standards refrigerator or freezer in Laboratory 1.5. The LIMS generates every day a primary standard inventory list, which includes the expiry day of each standard.

Primary standards are used only by those Chemists authorized to prepare standards, under the direction of the Technical Services Coordinator.

6.3 Stock Standard Solutions

Stock standard solutions for which ambient temperature storage is appropriate are stored in clear glass ampoules in the dark, in locked, vented storage cupboards in Laboratory 1.5. Stock standard solutions that require refrigeration or freezing are kept in a locked standards refrigerator

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or freezer in Laboratory 1.5. The LIMS generates every day a stock standard solution inventory list, which includes the expiry day of each solution.

Stock standard solutions are used only by those Chemists authorized to prepare standards, under the direction of the Technical Services Coordinator.

6.4 Working Standards

Working standards are stored in clear glass ampoules at ambient temperature in the storage cupboard in Laboratory 7. The working solutions that are in current use by Lab Chemists may where appropriate be stored in “Reacti-vials” in one of the laboratory refrigerators. The LIMS generates every day a working standard inventory list, which includes the expiry day of each standard.

Calibration standard solutions for which ambient temperature storage is appropriate are stored in Instrument Lab 2. Calibration standard solutions requiring cool or frozen storage are stored in a refrigerator or freezer in the Instrument Lab

All working standard solutions are stored under the controlled premises security measures.

7 STABILITY OF STANDARDS

The following expiry dates are applicable to standards and standard solutions used in the routine analytical testing procedures. They do not apply to special compounds used in customized analysis or research projects.

7.1 Certified Reference Materials

Certified Reference Materials, which are provided with an expiry date from the manufacturer, are replaced when expired. Certified Reference Materials without an expiry date are assigned an expiry date of five years from the date of purchase. Upon expiry, the certified concentrations are checked against a valid CRM. If the results indicate that no change has occurred in the CRM concentrations, the expiry date is extended another five years. Otherwise, the CRM is replaced when next required.

7.2 Primary Standards

Primary standards received without an expiry date are assigned an expiry date based upon the known stability of the compound. An expiry date of five years from date of purchase is given to stable compounds. An expiry date provided by the manufacturer for a primary standard is assessed based on knowledge of the chemistry of the compound, and the expiry date may be extended beyond that of the manufacturer. Upon expiry, primary standards are checked against a

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valid CRM and the expiry date extended if valid. Otherwise the primary standard is replaced when next required.

7.3 Stock Standards

Stock standard solutions stored in ampoules have an expiry date equal to that of the primary standard from which they originate, or of two years from the preparation date, whichever is sooner. Stock standards for PCDD/F, PCB, PBDPE and alkane analyses have an expiry date of 4 years from validation. Solutions that are stored in ampoules may be used after the expiry date upon validation.

7.4 Working Standards

Working standards in ampoules have an expiry date equal to that of the stock or primary standard from which they originate, or of one year from the preparation date, whichever is sooner. Working standards for PCDD/F, PCB, PBDPE, AEH and alkane analyses have an expiry date of 2 years from validation; working standards for other analyses have an expiry date of 1 year from validation unless otherwise specified. Solutions that are stored in ampoules may be re-validated to re-establish an expiry date. Working solutions past the expiry date are removed from use as quantitative standards.

Working standards stored in reacti-vials have an expiry date of one month, one week for working standards made up in volatile solvents. Standards past the expiry date that are stored in reacti-vials are removed from use as quantitative standards.

Working Standards for PFCs are stored in polypropylene test or centrifuge tubes and have expiry dates as outlined in SQA-026 (Routine PFC Standards).

Calibration standards for sterols and tetracyclines have an expiry date of two months. Working authentic standards for tetracyclines have an expiry date of 4 months.

Standards are not stored in volumetric flasks.

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APPENDIX A INTERNAL STANDARD METHOD OF QUANTIFICATION: SAMPLE CALCULATIONS

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Internal Standard Method of Quantification – Constant RRF

The concentration of each compound of interest is routinely calculated by the isotope dilution or internal standard procedure against a known amount of quantification standard added to the sample.

Where the quantification standard is added to the sample at the very beginning of the analysis it is called a 'surrogate standard'. In the special case where the surrogate is the isotopically labelled analogue of the native compound the procedure is called 'isotope dilution' quantification. Where the surrogate is not the labelled analogue of the native compound the procedure is referred to as internal standard quantification. Final concentrations determined against surrogate compounds <u>are recovery corrected</u> for any losses that occurred during the analysis procedure.

Where the quantification standard is added just prior to instrumental analysis it is called a 'recovery standard' and the quantification procedure is also called internal standard quantification. Final concentrations determined against recovery standards <u>are not recovery corrected</u> for any losses that occurred during the analysis procedure. Recovery standards may be used to quantify target compounds or surrogate compounds.

Concentrations are calculated as described in the following equation:

$$Conc_x = \frac{A_x}{A_{si}} \times \frac{W_{si}}{W} \times \frac{1}{RRF_{x,si}}$$

where 'internal standard' is either a surrogate standard or a recovery standard and

A_x = area of the target compound peak from the sample chromatogram;

A_{si} = area of internal standard peak used to quantify x;

W = weight or volume of sample taken for analysis;

W_{si} = weight of internal standard added to sample; and

$RRF_{x,si}$ = relative response factor of x to si as determined by analysis of the calibration standard solution and defined below.

$$RRF_{x,si} = \frac{A_t}{A_s} \times \frac{W_s}{W_t}$$

where A_t = area of target peak in the calibration solution;

A_s = area of internal standard peak in the calibration solution;

W_t = weight of target compound in the calibration solution; and

W_s = weight of internal standard in the calibration solution.

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Detection limits are also calculated using the above equations with the minimum detectable peak area used for A_x. The minimum detectable peak area is calculated as a multiple of the maximum noise (2.5 or 3 times, depending upon the method) in the GC/MS channel of interest (height of noise x area/height ratio of a typical peak x multiple).

Recoveries of surrogate standards are calculated using the following equation:

$$\%\ Recovery = \frac{A_{si}}{A_{rs}} \times \frac{W_{rs}}{W_{si}} \times \frac{1}{RRF_{si,rs}} \times 100$$

where A_{si} and A_{rs} = the areas of the surrogate standard peak and the recovery standard peak from the sample chromatogram;

W_{rs} and W_{si} = the weights of recovery standard and surrogate standard added to the sample, and

$RRF_{si,rs}$ = the response factor of the surrogate standard relative to the response of the recovery standard as determined by analysis of the calibration solution and defined below.

$$RRF_{si,rs} = \frac{A_s}{A_r} \times \frac{W_r}{W_s}$$

where A_s and A_r = the areas of the surrogate standard and recovery standard peaks from the calibration solution chromatogram; and

W_s and W_r = the weights of surrogate standard and recovery standard in the calibration solution.

Concentration, detection limit and internal standard recovery calculations are routinely carried out using commercially available software programs.

In special cases it may be necessary to convert recovery corrected concentrations to non-recovery corrected concentrations to meet specific contract needs. Where recovery corrected concentrations have been determined by quantification against a surrogate compound, non-recovery corrected concentrations can be determined as follows:

$$C_{NRC} = C_{RC} \times (\%R_S/100)$$

Where: C_{NRC} = the non-recovery corrected concentration
C_{RC} = the recovery corrected concentration
$\%R_S$ = the surrogate percent recovery.

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APPENDIX B NAMING CONVENTIONS

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SGS AXYS ANALYTICAL SERVICES LTD
NAMING CONVENTIONS

SGS AXYS' naming conventions rely on the use of code letters to identify analysis type, matrix type, standard solutions, QA/QC samples, and additional procedures carried out on samples. Table 4 summarizes the codes in current use. The applications of these codes to the naming of standard solutions, QA/QC samples, and analytical methods are described in this appendix.

1. STANDARD SOLUTIONS

Standard stock, calibration, surrogate, authentic and recovery solutions are identified by a code of the following form:

'AA ZZZ B - TTT / XX',

where

AA = a 2 letter code indicating the analysis type from LIMS (Reports → Reports to Preview → LIMS → Analysis Codes) ;
ZZZ = the recipe number, a unique combination of components and concentration;
B = the dilution code starting at the letter 'A' and increments with each solution. Each letter represents a solution made by a dilution of the same stock solution. For linearity solutions, 'A' is the most dilute; for all other types of standards, 'A' is the most concentrated.
TTT = the type of standard from Table 4;
XX = sequential batch number, each batch made from a dilution of the same stock solution.

example:	DX001A-STK/01	is a dioxin/furan stock solution, the recipe number is 001 and it is undiluted. This is the first batch.
	DX001B-STK/01	is the first batch of a diluted stock made from the above.
	DX004A-CAL/03	is the third batch of dioxin/furan calibration solution, recipe 004.

Note: When a standard is newly made from original prime standards, it is a new "recipe" and is assigned a new recipe number, even though the components and concentrations are similar to a previously made solution.

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2. TEST SAMPLES

The codes described below are appended to a sample ID under the circumstances described and appear on the sample IDs on final data reports.

1. Sample ID – samples submitted to SGS AXYS Analytical Services for analysis are identified with a unique SGS AXYS ID number consisting of the log-in ID (a letter 'L', followed by a 4-5 digit number) and a number assigned to an individual sample. This number is generated by the LIMS. Samples with the same log-in ID are sequentially numbered.
   example: L1500-1 – first sample in log-in L1500
   L1500-25 – twenty-fifth sample in log-in L1500

2. Repeated Samples - analysis is repeated using another subsample
   - designated by an 'R' to sample ID for first repeat
   - a space between sample ID and suffix
   - add a numeral suffix to 'R' for multiple repeats
   example: L1500-50 R - first repeat
   L1500-50 R2 - second repeat
   The following code letters are appended to a sample ID to indicate extra work carried out on an extract. A space must appear after the sample ID before adding the codes associated with extra work.

3. Repeat of Clean Up/Instrumental Analysis
   In the special case where clean up and injection are repeated using an <u>unused portion of the original extract</u>, append 'RX#' to the original ID where # is a sequential number.
   example: L1500-50 RX - First repeat using an unused portion of sample extract L1500-50
   L1500-50 RX2 - Second repeat using an unused portion of sample extract L1500-50

4. Recolumned Samples - analyzed extract is subject to additional clean-up steps (e.g. chromatography, washing) after initial instrumental analysis has been performed.
   - designated by an 'L' to sample ID
   - add a numeral suffix to 'L' for multiple re-column steps
   example: L1500-50 L - first recolumn
   L1500-50 L2 - second recolumn

5. Reinjected Samples - instrumental analysis is repeated by injecting another aliquot of extract from the same microvial.
   - designated by an 'i' to sample ID
   - add a numeral suffix to 'i' for multiple re-injections
   example: L1500-50 i - first repeat injection
   L1500-50 i2 - second repeat injection

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6. Dilution of Extract - analyzed extract is diluted in the original microvial and re-analyzed.
   - designated by adding suffix 'W' to sample ID
   example: L1500-50 W

7. Transfer of Extract - extract is transferred to another microvial, mainly as a consequence of dilution to improve chromatography or to bring into linear range.
   - designated by adding the suffix 'N#' to the sample ID where # is incremented each time the extract is transferred to a new microvial
   example: L1500-50 N - extract transferred to a new microvial
   L1500-50 N2 - extract again transferred to another new microvial

8. Respiked Samples - **additional** labelled standard added, typically after dilution and transfer to a new microvial. Usually preceded by an 'N'
   - designated by suffix 'K' to sample ID
   example: L1500-50 NK

9. Recolumn to Remove Specific Target Analytes – extract is columned to remove specific target analytes.
   - designated by adding suffix 'P' to sample ID
   example: L1500-50 P

10. Concentration of Extract - extract in microvial is concentrated
    -designated by adding suffix 'M' to sample ID
    example: L1500-50 M

11. Combined Extract - extract in microvial is combined with another extract. Combination of extracts is carried out only under the direction of a Project Manager
    -designated by adding suffix 'C' to sample ID
    example: L1500-50 C

12. Multiple Remedial Procedures – test suffixes are combined and added to sample ID.
    example: L1500-50 Li3 - sample was recolumned, then recolumned extract reinjected three times.

NOTES:

i) The codes R, RX, N, and NK are prefixes to LIMS product names. The other codes are statuses in the LIMS. The codes are appended to the sample IDs as suffixes in the "Extra Work" module of the LIMS.

ii) The only codes appended to the sample ID on the analysis worksheets are R and RX and applicable numerical suffixes (R#, R#X#).

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TABLE 4 NAMING CODES

TTT	STANDARD TYPE	Code	QA/QC SAMPLE TYPE	TEST SAMPLE SUFFIXES	
AUT	Authentic	A	Authentic Spike	C	Extract combined
CAL	Calibration# = A,B,C.*	BLANK	Lab Blank	i	Reinjection
REC	Recovery	CAL	Opening or Closing Cal Std.	L	Extra clean-up of extract
RSN	Resolution	CRM	Certified Reference Material	K	Respike of Quant Std
SEN	Sensitivity	CUBLK	Clean Up Blank	M	Concentration of extract
SSV	Second Source Verification	CUTPT	Cut Point	N	Dil'n, portion in new microvial
STK	Stock	DUP	Duplicate	P	Recolumn to remove selected analytes
SUR	Surrogate	DUP2	Replicate 2	R,#	Repeat Analysis
SUX	Native-like target used as surrogate	DUP3	Replicate 3	RX,#	Repeat clean up of unused extract
WIN	Window	FMSPRF	Proof of the FMS	W	Dilution of extract
		FORMS5	Form5 data	Y	A subsequent portion of an extract from a larger retained back-up portion
		HEXANE	Hexane plug run on instruments		
		INSTBLANK	Instrument Blank with Surrogates		
		IPR	Initial Precision and Recovery		
		IRM	Internal Reference Material		
		LCS	Laboratory Control Spike		
		MDL	MDL study		
		MDLVER	Verification of MDL		
		MS	Matrix Spike		
		MSD	Matrix Spike Duplicate		
		OPR	Ongoing Precision and Recovery		
		PROOF	In-House Proofs		
		R	Recovery Spike		
		RSN	Resolution standard		
		S	Surrogate Spike		
		SA	Surrogate and Authentic Spike		
		SAMP	Client Sample		
		SAR	Surr / Auth / Rec Standard Mixture		
		SAR2	Second Source SAR		
		SEN	Sensitivity Standard		
		SOLVENT	Solvent plug run on instruments		
		SPB	Spiked Blank		
		SPEX	Spiked Extracted Matrix		
		SPIKELOT	Spike lot concentrations		
		SPM	Spiked Matrix		
		SPMDUP	Spiked Matrix (Duplicate)		
		SPMREP	Spiked Matrix (Replicate > 2)		
		SR	Surr / Rec Standard Mixture		
		SRM	Standard Reference Material		
		STK	Stock Solution		
		TEST	Test samples		
		TOLUENE	Toluene plug run on instruments		
		USM	Unspiked Matrix		
		WIN	Window standard		

* Calibration series are named such that "A" is the lowest concentration.

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3. QUALITY CONTROL SAMPLES

Quality control (QC) samples are named by the LIMS, assigning a unique identification number based on the work group number.

The QC samples are named using the following format:

WG #####-1xx

where: ##### is the workgroup number
xx is a number, beginning with 01 and incremented for every QC sample in the work group

For every work group, the numbering of the QC samples starts at 101. There is a field in the LIMS for indicating the QC sample type associated with the QC sample ID.

Typically, the procedural blank is assigned as WG#####-101
and the reference sample as WG#####-102

The codes used to indicate extra work carried out on an extract may also be appended to the name of quality control samples, if applicable.

4. ANALYSIS BATCHES

Each analysis batch (work group) has a unique, sequential number assigned by the LIMS. The number is preceded by the letters WG.

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5. INSTRUMENTATION

Each instrument used in analytical testing procedures has been assigned an instrument code number. These codes are used to identify the instrument used for each sample analyzed.

CODE	INSTRUMENT
GC/MS	
1	Micromass (GC/HRMS)
2	Micromass (GC/HRMS)
3	Micromass (GC/HRMS)
A	Agilent (GC/LRMS)
B	Micromass (GC/HRMS)
C	Micromass (GC/HRMS)
D	Agilent (GC/LRMS)
M	Waters Premier-M (HRMS)
S	Agilent (GC/LRMS)
T	Micromass (GC/HRMS)
U	Agilent (GC/LRMS)
GC/ECD	
E	Agilent (GC/ECD)
F	Agilent (GC/ECD)
LC/MS/MS	
G	Waters (LC/MS/MS)
J	Waters (LC/MS/MS)
P	Waters (LC/MS/MS)
Q	Waters (LC/MS/MS)
R	AB Sciex (LC/MS/MS)
V	Waters (LC/MS/MS)
W	Waters (LC/MS/MS)

6. CHROMATOGRAMS

6.1 Low Resolution GC/MS and GC/ECD Instruments

The data files for samples run on a particular day are stored in a directory named with the date, as follows:

Directory: YY MM DD AA

where YY is the last two digits of the year
MM is the month
DD is the day
AA is the analysis type

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The GC/MS and GC/ECD files for all samples analyzed, including test samples, QC samples, calibration solutions and solvent blanks are assigned a file name in the form 'AA YW XXXX'

where AA is analysis type
Y is the last digit of the current year
W is the last digit of the numerical instrument code, and
XXXX is a sequential chromatogram number.

Example: PB450218 is a PCB chromatogram run on Instrument 05, in 2004.

The sample chromatograms are numbered sequentially irrespective of analysis type. At the beginning of each calendar year, the sequential number 'XXXX' starts again at 0001.

6.2 High Resolution GC/MS and LC/MSMS Instruments

A set of samples queued up for analysis by high resolution GC/MS is designated by a file name. This file name has the same format:

AAYW_XXX

where AA is analysis type
Y is the last digit of the current year
W is the last digit of the instrument code, and
XXX is a sequential file number.

The instruments automatically identify each sample with a sequential sample number (Z) starting with Sample #1 for the first sample in the set.

Each chromatogram is identified as follows:

AAYW_XXX Sample: #Z.

Example:	PB21_013	S:1
	PB21_013	S:2
	PB21_013	S:3
	PB21_013	S:4

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7. ANALYTICAL METHODS

The quality system at SGS AXYS requires that each analytical method be identified by a method number. This number appears on all laboratory work-up sheets and on final data reports. The convention for numbering methods is to use the document number, including the revision number and version number as the method number.

Customized Methods

Upon the request of a client and with the approval of the Product Group and Operations, a method may be modified to suit a client's needs. Such modifications require full documentation and may require a method number. Modifications include changes to the extraction procedure, quantification procedure, instrumental procedure, the use of different surrogates, and/or quantification of non-routine target analytes.

i. For a routine SGS AXYS method, modified for a client, the method number remains the same, and the modifications are documented on the Project Notes and, where necessary, in the case narrative that accompanies the data.

ii. For unusual samples for which new methodology is developed, the QA Chemist develops a method number and documents the methodology.

8. INSTRUMENTAL ANALYSIS METHODS

Detailed instrumental analysis procedures (instrumental operating instructions, data interpretation procedures and calculation of results) may also be documented in separate instrumental methods. The methods are uniquely named, using the document control number, in the following format:

MIN-XXXYY Rev #

Where: - XXX is the same 3 digit code that is used in the document control number of the associated written analytical method (i.e. PCDD/F instrument method is MIN-017 and written analytical method is MLA-017)
YY is an optional clarifying suffix consisting of letter and/or numbers.
- # is the incremental revision number

9. MICROVIAL LABEL CODES

The following analysis codes are used for the specific identification of microvial contents for work-ups producing multiple analysis extracts and to aid in management of instrumental data files. The list of analysis codes is subject to update and is a controlled file in the SGS AXYS LIMS (Reports → Reports to Preview → LIMS → Analysis Codes). Following is an example listing of the codes:

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Code Abbr.	Analysis	Code Abbr.	Analysis
AB	Acid Base Neutral Extractables	MHEX	Metabolomics: Hexoses
AE	inactive: Acid Extractable Non-Cl Phenols	MLIP	Metabolomics: Lipids
AP	Alkyl Phenols	MNRG	Metabolomics: Energy
BB	Polybrominated Biphenyls (PBB)	MP	PAH Metabolites
BC	inactive: Bromochlorodioxins	MR	MultiResidue Pesticides
BD	Polybrominated Dioxins/Furans	MS	inactive: Methyl Sulphones
BE	Brominated Diphenyl Ethers (BDE)	MSTH	Metabolomics: Sterols and Hormones
BF	Brominated Flame Retardants (BFRs)	MU	inactive: Musk
BP	Bisphenol-A	MX	Metabolomics group
CA	inactive: Chloroanisoles	NA	Naphthenic Acids
CE	Chlorinated Diphenyl Ethers	ON	OrganoNitrogen
CG	inactive: Chloroguaicols	OP	OrganoPhosphorus
CL	Chlorinated Pesticides	OT	inactive: Organotins
CM	Carbamates	PA	Parabens
CN	Mono ChloroNaphthalenes	PB	Polychlorinated Biphenyls (PCBs)
CO	inactive: Coplanar PCB Congeners	PE	Phthalate Esters
CP	inactive: Chlorophenolics	PF	Paraffins
CS	Client Standards	PH	PolyAromatic Hydrocarbons
CV	inactive: Chloroveratroles	PM	Phthalate Ester Metabolites
DC	inactive: Chlorinated DX/HCB/ Coplanar PCBs	PP	Pharmaceutical and Personal Care Products group
DW	Dioxins/Furans/WHO PCB/TEQ	PR	DX/F Precursors
DX	Dioxins/Furans	PY	Pyrethroid
EP	Environmental Phenols	QA	PPCP APos List 1
EX	inactive: Exotics	QB	PPCP ACyc List 2
EZ	Enzyme check	QC	inactive: PPCP ANeg (part of QF)
FA	inactive: Fatty Acids	QD	inactive: PPCP BPos (part of QG)
FC	Perfluorinated Compounds	QE	PPCP APos List 5
FK	Perfluoroalkyl Precursors	QF	PPCP ANeg List 3
FO	Fluorinated Phosphonic Acids	QG	PPCP BPos List 4
FP	inactive: Fipronil	QH	PPCP APos List 6
FR	Flame Retardants group	RA	inactive: Resin Acids
FS	FluoroTelomer Sulphonates	RC	OrganoChlorinated and Brominated Flame Retardants
FT	FluoroTelomer Alcohols	RN	Retenoids
GL	Glyphosate	RP	OrganoPhosphate Flame Retardants
GP	Gel Permeation Chromatography	ST	Sterols
HB	Acid Extractable Herbicides (AEH)	TB	Tetrabromo Bisphenol-A
HC	Petroleum Hydrocarbons	TO	Total Oxidizable PFCs
HD	Hexabromocyclododecane (HBCDD)	TP	Toxaphene
HM	Hormones	TR	Triclosan
HP	Hopanes	TY	inactive: 3,5,6-Trichloro-2-Pyridinol
MABA	Metabolomics: Amino Acids and Biogenic Amines	TZ	inactive: Atrazine
MBIA	Metabolomics: Bile Acids	VO	inactive: Volatile Organics
MFAA	Metabolomics: Fatty Acids		

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The microvial labels are coloured to indicate the general analysis type. The labels are coloured as follows:

Colour	Analysis Codes
Orange	CL, CO, DC, MR, ON, OP, PB, PF, TP
Yellow	DX
Blue	CN, HM, PE, PH, ST
Pink	BB, BD, BE, BF
Purple	MU
White	All other

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APPENDIX C DOCUMENT CONTROL SYSTEM

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DOCUMENT CONTROL SYSTEM

1. ORGANIZATION AND NAMING

All documents related to the quality system and testing procedures carried out at SGS AXYS are subject to document control procedures. These procedures ensure that only current documents are available for and used by staff, that appropriate record keeping procedures are in place and that there is the ability to reconstruct all steps of the testing procedures. Document control procedures include the unique identification of all documents and a system for approving, issuing, revising, and maintaining the documentation. The company names SGS AXYS Analytical Services Ltd. and AXYS Analytical Services Ltd. are equivalent for the purposes of quality system documents.

All documents in use at SGS AXYS are uniquely identified by a document number. This number indicates that the document has been authorized for use. The document number consists of a document identifier, revision number and date; for method documents an additional version number may be appended. The document number appears, in the format described below, in the header or footer of all pages in the document.

All documents are created with the company name appearing on the document. Each page is numbered and shows the total number of pages.

Document Control Number for methods:
Identifier Rev. ## (mmmyy) Ver. ## (example MLA-001 Rev. 02 (Jan99) Ver. 05)

Document Control Number for documents other than methods:
Identifier Rev. ##, DD-Mon-YYYY (example SLA-001 Rev. 02, 23-Jan-2011)

Identifier: This is an alphanumeric code that consists of a three letter code indicating the category and sub-category to which the document belongs followed by three numbers indicating a sequential number within the category or sub-category.

Rev. ##: Revision number (##) indicating the revision of the document. ## is a number and is incremented when a new document revision is issued.

Ver. ##: Version number (##) indicating the version of the method document (applicable for method documents only). ## is a number and is incremented when a new method document version is issued.

DD-Mon-YYYY or mmmyy: Date of issue of the revision of the document.

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The table below is a guideline for when a method modification requires a new method number, revision number or version number.

Description of change	**Example**	**Typical validation or justification**
Modifications requiring a new method number		
Development or change of instrumental technology type	Change from LC-MS/MS to GC-MS or from GC-LRMS to GC-HRMS	Sensitivity, specificity, bias, precision in QC and real sample matrix
Systematic change of DL >20 times	Change of ng to pg detection limit targets	Sensitivity, specificity, bias, precision in QC and real sample matrix
Modifications requiring a new revision number (method number remains the same)		
General quantification type	Isotope dilution vs. internal standard, internal standard vs. external standard	Sensitivity, specificity, bias, precision, DL in QC and real sample matrix
Quantification model	Quadratic regression vs. linear	Bias, precision, DL in QC and real sample matrix
Extraction type	Change from Soxhlet to ASE extraction	Recovery, precision, DL in QC and real sample matrix
Extraction solvent	Change from toluene to dichloromethane	Bias, precision, DL in QC and real sample matrix
Clean-up type	Gravity columns to SPE	Bias, precision, DL in QC and real sample matrix
Systematic change of DL 5-20 times	Change of x10 lower DLs due to new instrument of same type with better sensitivity	Sensitivity, specificity, bias, precision, DL in QC and real sample matrix
Addition of new matrix type using novel extraction, clean-up and instrumental techniques	Addition of sludge matrix using SPE extraction where SPE extraction has never been validated by lab for sludge	Bias, precision, DL in QC and real sample matrix
Any loosening of performance criteria affecting recovery or precision of an accredited test parameter	Change of OPR recovery limits from 70-130% to 50-150%	Bias, precision
Modifications requiring a new version number (method and revision numbers remain the same)		
Any document correction or improvement	Correcting information or adding more detailed information to method	As appropriate

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Description of change	**Example**	**Typical validation or justification**
Any refinement of an existing extraction, clean-up of instrumental technique for the purpose of improved, efficiency , ruggedness or defensibility	Adjustment of column packing or elutes, adjustment of extraction technique within a particular type, optimization of instrumental conditions	Demonstration of the improvement
Any improvement in performance specifications	Tightening OPR limit from 50-150% to 70-130%	Sensitivity, specificity, bias, precision, DL in QC and real sample matrix as appropriate to changed aspect
Addition of proven clean-up procedures	Addition of alumina clean-up to PCB analysis	Bias, precision, DL in QC and real sample matrix
Instrumental quantification ions yielding equivalent or better performance	Change of PFHxS ion to xx from xx	Sensitivity, specificity, bias, precision, DL in QC and real sample matrix
Addition of labeled quantification references	Change PFBS quantification from to $^{18}O_2$-PFHxS	Recovery, precision, DL in QC and real sample matrix
Addition of new matrix type using proven extraction, clean-up and instrumental techniques	Addition of water matrix using liquid/liquid extraction, addition of solids using Soxhlet extraction	Bias, precision, DL in QC and real sample matrix as appropriate to changed aspect
Systematic change of DL < 5 times	Change of DL by x3 made possible by lowered background	MDL study as appropriate
Adjustment of method calibration range	Extension of calibration range for lower reporting limit	Multi-level calibration fit, MDL study as appropriate
Adjustment of routine surrogate routine amount or final extract volumes	Increase routine surr spike x2 and increase extract volume to improve chromatography.	Batch OPR, Blank

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Table 5 presents the identifier codes for categories and sub-categories of documents as well as the individual responsible for each category.

TABLE 5 CATEGORIES OF DOCUMENTS

Category	Sub-Categories	Identifier Code	Responsibility
Forms	Work Sheets	FWO-	Laboratory Supervisors
	QA/QC Forms	FQA-	QA Manager
	Standards Forms	FST-	Technical Service Coordinator
	Client Services Forms	FCL-	Client Services Manager
	Sample Control Forms	FSA-	Laboratory Supervisors
	Method Forms	FME-	QA Manager
Analytical Methods	Laboratory Method and	MLA-	Technical Director, Director of Operations and QA Manager
	Metabolomics Methods	MLM-	Manager, Metabolomics Services
	Instrumental Methods	MIN-	Instrumental Analysis Manager
	Summary Methods	MSU-	Client Services Manager and QA Manager
QA/QC Documents	Documents	QDO-	QA Manager
	Specification Charts	QSC-	QA Manager
	Lists	QLI-	QA Manager
Standard Operating Procedures	Administration	SAD-	Client Services Manager, Director of Operations, Laboratory Supervisors or Instrumental Analysis Manager
	Chromatography	SCH-	Laboratory Supervisors or Instrumental Manager
	Coding	SCO-	Instrumental Analysis Manager
	Instrumental	SIN-	Instrumental Analysis Manager
	Laboratory	SLA-	Laboratory Supervisors,
	QA/QC	SQA-	QA Manager
	Metabolomics	SLM-	Manager, Metabolomics Services
IPR Reports (Initial Precision and Recovery)	Sub-Categories according to analysis type	Prefix I (e.g. IDX-)	QA Manager
MDL Studies (Method Detection Limits)	Sub-Categories according to analysis type	Prefix D (e.g. DDX-)	QA Manager

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The QA Chemist assigns document numbers, maintains a master list of all forms and documents in current use and maintains a file of both current and archived documents.

All details of document control procedures are described in the following SOP.

SQA-004 Document Control Procedures

2. DOCUMENTATION FORMAT

SGS AXYS has developed standard formats for the documentation of analytical methods, standard operating procedures and final analysis reports. These formats are described in the following sections as is the system of maintaining and filing these documents.

In order to protect the proprietary information presented in the Quality Manual, the SOPs and analytical methods, each of these documents is printed with the following confidentiality statement, which appears at the top of each page.

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2.1 Analytical Methods

Analytical method documents, for all tests performed, are subject to document control procedures and the document number appears as a footer. The document number is also the method number.

The documentation of the laboratory method is the responsibility of the QA Chemist, who also assigns a document number to the method.

Laboratory analytical methods are prepared with the following minimum elements in the following numbered sections.

Cover Page:	SGS AXYS Method Number, Method Title Method Scope, Authorizing Signatures
References	List of relevant external method descriptions
Changes from Previous Revision or Version	List of changes made to method since last revision
Table of Contents	List of text sections, tables, appendices with page numbers
INTRODUCTION Section	
A. Analytes of Interest	List of routine and optional analytes
B. Contamination or Interferences:	Potential interferences and preventive and/or corrective actions.

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C. Safety:	Precautions to be taken
D. Pollution Prevention and Waste Management:	Controls in place
E. Definitions:	Defines terms, generally references SGS AXYS' glossary
F. Method Performance:	Statement regarding method performance as determined through validation
ANALYIS PROCEDURES Section	
1. Preservation and Storage:	Preservation, storage conditions, recommended hold times
2. Sample Pretreatment and Preparation:	Sample pre-treatment procedures.
3. Materials and Reagents:	Quality and purity of reagent, cleaning procedures, preparation of solutions, column packing materials and standard solutions, storage and shelf life as applicable.
4. Quality Assurance/Quality Control:	Describes QA/QC samples, analysis batch composition, including Method Specification Tables as applicable
5. Extraction Procedures: [1]	Work-up procedures for each type of matrix with identification of default procedure where options exist
6. Clean up Procedures: [1]	Chromatographic clean-up procedures of the extract and preparation for instrumental analysis with identification of default procedure where options exist
7. Instrumental Analysis:	Instrument operating conditions with initial and continuing calibration procedures and identification of default procedure where options exist
8. Qualitative and Quantitative Determination	Criteria for positive identification of analytes and for determination of concentrations
9 Reporting Criteria and Practices:	Date reporting criteria and practices
10. Summary of Modifications to Reference Method (optional	
Adidtional Tables (optional)	supporting information for method
Appendices:(optional as required)	Procedures for optional analyses or supporting information for method including equipment maintenance, computer hardware/software and troubleshooting

Notes:

1 Extraction and clean-up may be combined in Section 5 as appropriate. Section 6 may be noted as intentionally blank, or be titled "Preparation for Instrumental Analysis" as appropriate.

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2.2 Instrument Methods

Methods describing the instrumental analysis of extracts are named and numbered as described in Appendix B. The method number is the document number.

Instrument methods are documented for use according to a standard format. In general, an instrument method includes the following sections, where applicable:

Analysis Type	Class of compounds
Target Compounds	Applicable targets
Instruments	Instrumentation suitable for the method
Instrument Acquisition	Experiment ID, GC program, column, injection volume, carrier gas, injector Temp, mass resolution, tuning protocol, ions acquired, typical retention times
Initial Calibration or Linearity Specifications	Calibration standards and acceptance criteria
Opening Calibration Verification Specifications	Criteria for opening CAL/VER solution
Closing Calibration Verification Specifications	Criteria for closing CAL/VER solution
Window Standard Specifications	Window standard and acceptance criteria
Sensitivity Selectivity	Sensitivity standard and acceptance criteria selectivity standard and acceptance criteria including any secondary confirmation
Other Specifications	Additional criteria specified by method

The instrumental methods are filed in separate three-ring binders and kept in the instrument laboratories.

2.2 Method Summaries

Method summaries are included in data packages or provided to clients if requested. Method summaries are subject to document control procedures; the document number consists of MSU- followed by the same number as applies for the full method.

The documentation of the method summary is the responsibility of the QA Chemist, the final method summaries are approved by the QA Manager and the Client Services Manager.

Method summaries are prepared with the following minimum elements:

"Scope" (general description, information about possible interferences, typical reporting limits, table with target analytes)

1. Extraction and Cleanup Procedures
2. Instrumentation
3. Calibration (including calibration solution table)
4. Quantification Procedures

4.1 Reporting Limits
Table with RTs, quantification references, masses, etc.

5. Quality Acceptance Criteria

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3. STANDARD OPERATING PROCEDURES

The document number for Standard Operating Procedures (SOPs) appears in the header of the SOP. SOPs are identified with a category code defined in Table 5.

Standard operating procedures (SOPs) are generally written according to the following standard format. An example of the SOP format appears on the following page.

The header contains the following information:

Title:	Title of SOP
Area:	Category that SOP belongs to
SOP#:	Document identifier
Rev. No.:	Revision number
Date:	Date of issue
Page:	Page number/total number of pages

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SGS AXYS Analytical Services Ltd
Standard Operating Procedure

Title: **SOP #:**
Area: **Rev. No.:**
Date:
Page:

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Purpose:

Scope:

Requirement and Authority:

Definitions of Terms used:

Equipment and Reagents:

Procedures:

Corrective Actions:

QA/QC Measures:

References and Related Documents:

Approval:

Approved *DD-Mmm-YYYY* (*Name of the Vice President and Senior Technical Director*)
(*Name of the Director of Operations*)
(*Name of the QA Manager*)

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The SOP should contain the following sections, as appropriate.

- Purpose
- Scope
- Requirement and Authority
- Definitions
- Equipment and Reagents
- Procedures
- Corrective Actions
- QA/QC Measures
- References and Related Documents
- Approval Signatures and Date

At a minimum, an SOP should have Purpose, Scope and Procedures sections. When a new SOP is written, it is assigned to an appropriate category and assigned the next sequential number. Each SOP bears the authorizing signatures of the QA Manager, Technical Director and the Director of Operations or the work area Manager/Supervisor responsible for the SOP and date of approval. When an SOP is revised, the revision number is incremented and the date changed to the date of revision.

4. ANALYSIS REPORT FORMAT

All final analytical data generated at SGS AXYS are presented in an analysis report, issued in a standard reporting format, with allowances for customization based on client requests. The reports are checked and approved by Instrumental Analysts trained in secondary data validation procedures.

4.1 SGS AXYS Method Report Format

Data from all samples, including QC samples, the linearity samples, the calibration verification sample and, where applicable, the windowing standard are reported on standardized forms containing the information presented in Table 6, depending on analysis type. Templates for the standardized forms are maintained by the LIMS group. SGS AXYS may report data in a format specified by the client.

Data from each sample, including the procedural blank, are reported on a standardized Form 1A and B and Form 2. Data from the OPR sample are reported on standardized Forms 8A and 8B. Data from the MS/MSD sample are reported on appropriately generated forms. Data from the linearity, calibration verification sample, windowing sample, and CAL/VER relative retention times are reported on Forms 3, 4, 5 and 6 respectively.

Reports for test samples contain the data and information presented in Table 6.

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4.2 Signature

Final analysis reports are signed to authorize release to clients, the name and the function of the person are included with the signature. Signatures may be electronic.

4.3 Footnotes

Footnotes are used on analysis reports to flag data, qualify results, and define terms used in the report.

4.4 Rounding

Rounding is performed by LIMS software used to report final results. Numbers ending in '5' are rounded up.

4.5 Significant Figures

Analytical data are reported with the number of significant figures presented in Table 7, however SGS AXYS will report data with the number of significant figures specified by the client.

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TABLE 6 REQUIREMENTS FOR ANALYSIS REPORTS

HEADER INFORMATION	Analysis Report
Analysis	✓
Lab Name, Address and Contact	✓
Client (Contract) No.	✓
Client Sample ID	✓
Date Sample Received	✓
Date/Time Sample Collection[4]	✓
SGS AXYS Sample ID	✓
Matrix Type	✓
Sample Size	✓
Method No.	✓
Instrument Type	✓
Instrument Column ID	✓
Report Date[1]	✓
Revised Report Date	✓
Extraction Date/Shift	✓
Analysis Date/Time	✓
Initial Calibration Date	✓
Extract Volume	✓
Injection Volume	✓
Dilution Factor	✓
Concentration Units	✓
% Moisture	CR
% Lipid	CR
Sample Data File Name	✓
Blank Data File Name	✓
Cal Ver Data File Name	✓
TEST SAMPLE DATA	
Target Analytes	✓
Surrogates	✓
IUPAC No.[3]	✓
CAS No.[3]	✓
Coelutions (where applicable)	✓
Concentrations	✓
Detection Limits	✓
Flags	✓
Ion Abundance Ratios[2]	✓
Relative Retention Time[2]	✓
% Surrogate Recoveries	✓
Recovery Std Area Response	CR
Toxic Equivalents	CR
Footnotes	✓

[1]Date appears in footer.
[2]Reported when required by analytical method.
[3] Reported for some analyses only.
CR = reported if required by client

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TABLE 7 GUIDELINES FOR REPORTING SIGNIFICANT FIGURES

	DETERMINED VALUE	COMMENTS
% Moisture	<1% 2 sig fig ≥1% 3 sig fig too small to determine	Report < detection limit, 1 sig fig
% Lipid	<1% 2 sig fig ≥1% 3 sig fig too small to determine	Report < detection limit, 1 sig fig
Sample Size	3 sig fig	
% Surrogate Recovery	3 sig fig	
Concentrations	Maximum 3 sig fig	Fewer than 3 sig figs may be reported based on professional judgement of the data evaluator.
Detection Limits	Maximum 3 sig fig	Fewer than 3 sig figs may be reported based on professional judgement of the data evaluator.

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APPENDIX D SGS AXYS GLOSSARY

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1. DEFINITIONS

The following definitions describe the terms used in SGS AXYS' quality documentation and analytical methods**.**

Accreditation	The formal recognition by an accrediting agency of the compliance of a laboratory to predetermined standards.
Accuracy	The degree of agreement between a value and the true value. Determination of analytical method accuracy requires determination of bias and precision.
Analyte	A compound that is extracted from the sample and its concentration determined.
Analyte Table	The calculation routine used to quantify target analytes as carried out by OPUSquan computer software.
Audit	A systematic evaluation to determine quantitative and qualitative specifications of some operational function or activity.
Authentic (Native)	An unlabelled target analyte, present in standard solutions, used for calibration and preparation of reference samples.
AXYS ID	The unique identification number assigned by AXYS to a sample, used to identify the sample throughout the analytical process.
Batch	A set of test samples and associated QC samples analyzed by the same process and for which the analysis is started on the same day. Also referred to as a workgroup.
Bias	The systematic component of error in an analytical result. Results may be referred to as either high or low biased if they show systematic departure from the true value.
Bracket	The set of samples and time period encompassed between the analysis of two consecutive calibration standards.
Bracketing Calibration	A single-point calibration standard analyzed at the beginning and end of a bracket.
CALA	Canadian Association for Laboratory Accreditation, whose main objective is to promote and maintain a high level of assurance in analytical test data. Conducts on-site audits and proficiency testing programs.
Calibration	The determination, by measurement of comparison, of the correct value of each instrumental measurement.
Calibration Standard	A solution used to calibrate an instrument.
Calibration Verification (CAL/VER)	Mid-point linearity calibration standard analyzed to confirm the stability of the instrument calibration.
Chain of Custody (COC)	An unbroken trail of accountability that ensures the physical security of samples.
Clean-up Standard	Standard containing one or more labelled analogues added prior to clean-up procedures to evaluate completeness of extraction and measures losses during cleanup.
Co-elution	The simultaneous elution of two or more compounds from a chromatographic column, making the peak identification ambiguous.
Confirming Ion	An ion monitored in the mass spectrum, which is required to be present to positively identify an analyte.

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Contaminants	Environmental contaminants, determined by analysis
Continuing Calibration	A calibration procedure that evaluates the instrument response over time, at least once every twelve hours, to confirm ongoing compliance with initial multi-level calibration responses.
Control Chart	A graph that plots individual quality control parameters over time and compares them to the established limits for the parameter. A means of detecting non-conformance and observing trends in parameters.
Control Limits	The range of values within which quality control parameters must lie for satisfactory method performance.
Corrective Action	An action taken to correct an existing non-conformity.
Data Reduction	Process by which instrumental data are converted to concentrations.
Daughter ion	An ion resulting from reaction of a particular parent ion in the 2nd stage of a tandem mass spectrometer. Most analytes have at least a few parent-daughter ion transitions that are very specific for that analyte and suitable for quantification.
Detection Limit (DL)	The lowest concentration that can be different from zero with a specified level of confidence.
Document Control	Process by which quality documentation (and revisions) is reviewed, authorized, and distributed to ensure the use of the correct version.
Duplicate	The identical analysis of two sub-samples of the same sample, used to evaluate precision.
Eluate	The solvent that elutes from a chromatography column.
Extraction Standard	A standard containing one or more labelled compound(s) added to the sample prior to extraction to assess losses during extraction.
Holding Time	The maximum allowable storage time prior to analysis of the sample or sample extract under the specific requirements of the analytical method
Information value	Concentration is estimated. Compound identity has been confirmed based on retention time and spectral matching against the compound in a calibration standard but accuracy of quantification has not been established since all requirements to establish accuracy of quantification have not been performed or met. Further quantitative work would be required for confirmation of accuracy.
Initial Calibration	A calibration procedure used to establish the value of RRFs used in the quantification procedures of all subsequent samples.
Initial Precision and Recovery (IPR)	A set of samples analyzed prior to implementing a method, which show that the method can be performed within the required method specifications.
Instrument Linearity	Multipoint calibration procedure used to demonstrate the linear calibrated range of an instrument.
Interlaboratory Study	A study in which several laboratories analyze the same sample(s). The results are compared and are used as a test of accuracy and precision.

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Internal Standard	A compound added to a sample or extract and used for quantification of components present in the sample or extract. If the internal standard is added at the beginning of the analysis it is referred to in SGS AXYS terminology as a 'surrogate' standard; if the internal standard is added to the extract just prior to instrumental analysis it is referred to in SGS AXYS terminology as a 'recovery' standard.
Ion Abundance Ratio	For a specific analyte, the ratio of the responses of the mass spectral ions used to identify the analyte. The theoretical ratio is determined empirically for fragment ions, and is based on natural ion abundance for isotopic cluster ions.
Isotope Dilution	A quantification method that uses isotopically labelled analogues of analytes added prior to extraction for quantification.
ISO17025 standard	International ANS/ISO/IEC Standard 17025, General requirements for the competence of testing and calibration laboratories. All references in this manual refer to the current published version of this standard.
Labelled	A compound that contains an isotopically labelled atom.
LIMS	Laboratory Information Management System, a database and software system used to record and track information relating to samples.
LOGIN	The unique number assigned in LIMS to a set of related samples received at AXYS as a group. The format used is LXXXXX where X is a sequential number generated by the LIMS.
Matrix	The substrate that contains the analytes of interest.
Matrix Spike (MS)	A sample prepared by adding a known amount of target analyte to a specific amount of matrix, for which the target analytes have already been determined independently. Used to measure bias.
Matrix Spike Duplicate (MSD)	A replicate of the matrix spike, used to measure precision.
Metabolomics	Study of endogenous, small molecule, organic compounds in biological samples.
Method Performance	The specifications which QC parameters must satisfy, indicating that the method is carried out satisfactorily
Multiple Ion Detection (MID)	A GC/MS program to acquire data only for the analytes of interest and to disregard other data, also referred to as SIM.
Native	See authentic
Nominal	The designated values based on calculation.
Non-conformance	An indication or judgement that a product has not met established specifications. A departure from documented procedures.
On-going Precision and Recovery (OPR)	A reference sample analyzed to show continuing conformance to method performance specifications.
Organically Clean	Free of organic contaminants, as measured by proof samples for the target analytes of interest.
Parent Ion	An ion from the 1st stage of a tandem mass spectrometer chosen for a particular analyte to be fragmented into daughter ions in the 2nd stage.
Percent Recovery	A method performance parameter used as an indication of analyte losses due to extraction and clean-up procedures.

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Performance Evaluation Sample (PE)	A characterized sample having designated reference values, which is used in the evaluation of laboratory performance.
Precision	The component of accuracy defining random variation. The degree to which a number of observations of measurement obtained under the same conditions conform to themselves.
Primary Standard	A standard of documented purity and authenticity, obtained from commercial sources
Procedural Blank	QC sample type, with no sample matrix or with a clean matrix, analyzed in an identical manner to the test samples. Analyzed to determine the background contribution of analytes to samples from extraction and workup.
Proof	An analysis of lab equipment, lab reagents or sampling media to provide evidence of the level of contamination in these items.
Quality Assurance (QA)	An integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product meets defined standards of quality with a stated level of confidence.
Quality Control (QC)	The overall system of technical activities whose purpose is to measure and control the quality of a product or service so that it meets the needs of users.
Quality Control Samples	Samples designed to show conformance to method performance specifications, i.e., procedural blank, duplicate, reference sample. At least one QC sample is analyzed with every batch,
Quality Manual	A document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability and implementation of a laboratory to ensure the quality of its product.
Quality System	A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability and implementation plan of an organization for ensuring quality in its work processes, products and services. The quality system provides the framework for carrying out the required QA and QC.
Quantification Ion	An ion monitored in the mass spectrum and measured for each analyte. The area is used in the calculations to determine the concentration of that analyte.
Recolumn	Additional chromatographic clean-up of an extract, having determined that routine clean-up procedures were insufficient.
Recovery Standard	A particular type of 'internal standard'. A known amount of standard added to an extract prior to instrumental analysis and used for quantification of components present in the extract.
Reference Samples	A QC sample designed to show accuracy of the method – usually a certified reference material or spiked matrix sample.
Reinjection	A repeat injection of a sample extract.
Resolution	The measure of separation between two closing eluting chromatographic peaks. The larger the separation, the greater the resolution.
Relative Response Factor (RRF)	The ratio of the slope provided by the calibration for the analyte and corresponding standard.

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Retention Time (RT)	The time to elute a specific chemical from a chromatographic column, measured from the time of injection until the time it appears at the detector. The RT is specific to a chromatographic column, carrier gas and flow rate.
Relative Retention Time (RRT)	The ratio of RTs for two chemicals where the denominator represents a reference chemical. The RRT is specific to a chromatographic column, carrier gas and flow rate.
Sample History	The sample collection, chemical preservation, sample container, storage conditions, holding times, and sample pre-treatment requirements for an analytical method.
Sensitivity	A measure of an analytical instrument's ability to detect compounds near the stated instrument detection limit.
Selected Ion Monitoring (SIM)	A GC/MS program to acquire data only for the analytes of interest and to disregard other data, also referred to as MID.
Spike	A known amount of a standard solution added to a sample or QC sample.
SPIKELOT	Sample name (alias) in LIMS used to enter data for standard solutions and reference materials. Typical entries are concentrations and reference values that are required for calculations in LIMS and that must be kept current.
Stock Standard	A standard solution prepared from primary standards and used to prepare working standards.
Subsample	A homogenous portion of a sample, representative of the characteristics of the sample as a whole, used in the analysis.
Surrogate Standard	A substance with properties that mimic the analyte of interest. The surrogate is used to monitor matrix effects and sample processing losses; it may also be used as an internal standard for quantification of analytes.
Target Analyte	The compounds to be determined by the analytical method.
Tentatively Identified Compound (TIC)	Compound identity and concentration are estimated. The compound was not present in the calibration standard, or if present, all qualitative requirements were not performed or met. Identification was based on predicted retention time and approximate spectra matching. Quantification was based on estimated response for the general compound type. Certainty of detection and accuracy of quantification have not been established and further qualitative and quantitative work would be required for confirmation of the result.
Traceability	The property of a result of a measurement whereby it can be related to appropriate accuracy standards through an unbroken chain of comparisons.
Valley Height	A measure of resolution between two closely eluting peaks, as measured by the ratio of the valley height to the height of the shorter peak or as defined by the method.
Window	A viewing window in the chromatogram determined by the scan range of the instrument for a particular ion mass.
Working Standard	A standard solution used in the analysis of a sample.
Workgroup (WG)	A set of test samples and associated QC samples analyzed by the same process and for which the analysis is started on the same day, identified by a unique number. Also referred to as an analysis batch.

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2. DETECTION LIMIT AND REPORTING LIMIT DEFINITIONS

Detection Limit (DL) is a general term. It is the lowest concentration that can be distinguished from zero with a stated degree of confidence. Detection limit statements must include information on how they were derived; specific naming conventions (such as SDL, MDL, IDL) may be used to convey this information.

Method Detection Limit (MDL) - determined as specified by EPA Fed. Reg. 40 CFR Part 136 Appendix B (no iteration option). The 99% confidence level MDL is determined based on analysis of a minimum of 7 replicate matrix spikes fortified at 1-5 times the estimated detection limit. MDL is determined for compliance with accreditation and contract requirements**.**

Limit of Detection (LOD) - LODs are established for every US DoD accredited analyte/matrix combination. The LOD is the lower reporting limit for DoD work. Routinely, the LOD is established at 2-4 times the MDL spiking level. Where methods involve multiple clean-up options, the LOD is determined using the most extensive or demanding clean-up option. For DoD accredited tests LODs are verified quarterly or for each analysis batch on a schedule managed by the laboratory. The LOD verifications must meet all method specified identification criteria.

Sample Specific Detection Limit or Sample Detection Limit (SDL) – determined individually for every sample analysis run by converting the area equivalent of 3.0 times (2.5 times for EPA 1600 series methods) the estimated chromatographic noise height to a concentration in the same manner that target peak responses are converted to final concentrations. The SDL accounts for any effect of matrix on the detection system and for recovery achieved through the analytical work-up.

Equivalent term(s): Estimated Detection Limit (EDL) from EPA method 8290.

Instrument Detection Limit (IDL) – determined by converting the area equivalent of 3.0 times the estimated chromatographic noise height to a solution concentration using the applicable calibration model & data. Determined by analysis of solvent solutions during initial method implementation or method development and verified on established schedule for sample analysis.

Quantification Limit (QL or LOQ) – the lowest concentration that can be quantified with a defined degree of accuracy. SGS AXYS defines **QL** as the sample concentration equivalent to the lowest calibration standard falling above the MDL.

Limit of Quantification (LOQ) - LOQ is the lowest concentration at which the tests compounds can be measured with a stated degree of accuracy, at or above the sample concentration equivalent of the method lowest calibration standard and the LOD. LOQs are established for every US DoD accredited analyte/matrix combination. Routinely, LOQ is established at 2 times the LOD level and is characterized by calculation of bias and precision (mean and standard

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deviation of percent recovery). LOQ bias and precision values are provided to customers and must be acceptable to the customer for specific work. For DoD accredited tests LOQs are verified quarterly or for each analysis batch on a schedule managed by the laboratory. The verification is performed by analysis of four replicates spiked at the LOQ levels. The LOQ verification must meet all method specified identification criteria. Concentration results reported below the LOQ will be flagged to denote increased quantitative uncertainty where required for accreditation compliance (currently NELAP/TNI and US DoD).

The procedures for establishing and verifying MDL, LOD and LOQ are described in the following SOP:

SQA-021 Determination and verification of MDL, LOD, LOQ

Reporting Limit (RL) – the lowest concentration reported. **RL** may be contract specific and can be equal to SDL, MDL, QL, or some other stipulated concentration greater than the SDL. Reporting conventions used with **RLs** may include flagging concentrations below MDL, QL, or some other agreed upon concentration. Where not specified by contract, SGS AXYS defines **RL** as equal to SDL for GC analyses and as the greater of SDL or QL for LC analyses. For LC/MS/MS analyses, SGS AXYS will upon request report concentrations falling below the QL but above the SDL with a flag to denote that the accuracy of quantification is unknown.

Lower Method Calibration Limit (LMCL) – The sample concentration equivalent to the lowest calibration standard. For co-eluting compounds, the sum of the concentrations of the individual compounds that actually are present in the calibration standard are used.

Terms that may be encountered requiring specific definition based on source or application:

Contract Required Quantification Limit (CRQL)
Method Calibration Limit (MCL)
Method Limit (ML)
Practical Quantification Limit (PQL)
Quantification Detection Limit (QDL)

3. ACRONYMS

AEH	SGS AXYS' designation for "acid extractable herbicides"
AFFF	Aqueous film forming foam
BDE	Brominated Diphenyl Ethers (PBDPE)
BHC	USEPA term used for hexachlorocyclohexane
BLK	Procedural Blank
CAEAL (prior to Aug2008)	Canadian Association for Environmental Laboratories
CALA (after Aug2008)	Canadian Association for Laboratory Accreditation
CAL-VER	Calibration Verification solution
CLAM	Continuous low-level aquatic monitoring (used for analytical sampling)

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COC	Chain of custody
CRQL	Contract Requirement Quantification Limit
DBD	Dibenzodioxin
DBF	Dibenzofuran
DCM	Dichloromethane
ECD	Electron Capture Detector
ECNI	Electron Capture Negative Ion
EPA	(United States) Environmental Protection Agency
EPF	Equipment Proof
FID	Flame Ionization Detector
FPD	Flame Photometric Detector
GC	Gas Chromatography
GC-ECD	Gas chromatograph with electron capture detector
GC-ECNI MS	Gas chromatograph with electron capture negative ion mass spectrometer
GC-HRMS	Gas chromatograph with high resolution mass spectrometer
GC-LRMS	Gas chromatograph with low resolution mass spectrometer
GPF	Glassware Proof
HCB	Hexachlorobenzene
HCH	Hexachlorocyclohexane
HR	High Resolution
IHQC	In House Quality Control
IPR	Initial Precision and Accuracy
LC	Liquid chromatography
LC-MS/MS	Liquid chromatograph with tandem mass spectrometer
LIMS	Laboratory Information Management System
LR	Low Resolution
MDL	Method Detection Limits
MID	Multiple Ion Detection
MOS	Mono-Ortho-Substituted
MPT	Method Performance Test
MRES Pest	SGS AXYS' designation for "multi residue pesticides"
MS	Mass Spectrometer
NELAP	National Environmental Laboratory Accreditation Program
NOS	Non-Ortho-Substituted
NP	Nonylphenol (AP)
NYSDoH	New York State Department of Health
OCP	Organochlorine Pesticides
OPR	On-going Precision and Recovery
PAH	Polynuclear Aromatic Hydrocarbons
PBB	Polybrominated Biphenyl(s)
PBDD	Polybrominated Dibenzodioxin(s)
PBDF	Polybrominated Dibenzofuran(s)
PBDE	Polybrominated Diphenylethers (PBDPE)
PCB	Polychlorinated Biphenyl(s)
PCDD	Polychlorinated Dibenzodioxin
PCDF	Polychlorinated Dibenzofuran
PE	Performance Evaluation
PE	Phthalate Esters
PED	Polyethylene strip sampling device (used for analytical sampling)
PFC	Perfluorinated Organic Compounds
POCIS	Polar organic compound integrative sampler (used for analytical sampling)

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PUF	Polyurethane Foam Plug
PUFF	Polyurethane foam filter
QA	Quality Assurance
QC	Quality Control
RRF	Relative Response Factor
RRT	Relative Retention Time
RSD	Relative Standard Deviation
RT	Retention Time
SDL	Sample Detection Limits
SIM	Select Ion Monitoring
SOP	Standard Operating Procedure
SPMD	Semipermeable membrane device (used for analytical sampling)
TEQ	Toxic Equivalents
WG	Work Group
XAD-2	Proprietary name for a styrene-divinylbenzene copolymer adsorbent resin

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APPENDIX E REVISION HISTORY OF QUALITY MANUAL

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Revision History of Quality Manual

The following amendments have been made to the QA/QC Policies and Procedures Manual Revision 27 and have been incorporated into Revision 28. All amendments have been authorized by the QA Manager.

	Page	Amendment
All sections		Changed "AXYS Analytical Services Ltd" to " SGS AXYS Analytical Services Ltd " and "AXYS" to "SGS AXYS".
I, Section 1	9	Entered the data of the company's name change. Deleted outdated reference to Enviro and AXYS Life branding
I, table 1	10-11	Updated the table with new analyses.
I, table 2	12	Updated the instrumentation list.
III, section 1	23-25	Updated/clarified position descriptions for the Vice President and Senior Technical Director, the Delegated Back-up Technical Director, the Director of Operations, The Manager, Metabolomics Services, the Information Technology Manager, the Administration/Accounting Supervisor, the Scientific Director (Technical transfer), the Instrumental Analysis Manager, the Advanced Product Development Scientist, the Laboratory Supervisor, Analyst Group, the Laboratory Supervisor, Technical Group, the Client Services Manager, the Health and Safety Coordinator, the Purchaser, the Facilities Manager, the LIMS Technician and the Data Support Scientist. Removed obsolete Controller position.
IV, section 1.2	28	Added reference to SLA-138
V	31	Changed that waste solvent is removed weekly.
V, section 1.3	33	Clarified how "ultra high level" samples are worked up, removed obsolete designation "high level" samples.
V, section 2	34	Updated safety features to current practice.
V, section 3	34-35	Clarified the name of the Joint Health and Safety Committee. Clarified that all staff must acknowledge that they have read and understood SAF-001
VI, section 1.1	39-40	Added new instructions for contract management. Clarified specific instructions for waiving of DoD QSM requirements. Replaced table with approval limits with a reference to the Product and Service Guide (PSG-001).
VI, section 1.3	41	Updated the participants of the weekly workload management priority meetings.
VI, section 1.4	41-42	Updated responsibilities for work scheduling.
VIII, section 1	50	Clarified approvers of method revisions
VIII, section 1.1	50	Clarified validation scope
VIII, section 2.6	59	Clarified responsibilities for writing Work Group Notes,
VIII, section 2.7	62	Clarified additional report requirements for DoD accredited work.
IX, section 1.1	64	Clarified US DoD criteria for blank contamination.
IX, section 1.6	67	Clarified that duplicate LCS tests may substitute required MS/MSDs when sample amounts are insufficient.
X, section 2.2	73	Updated information about "ultra high" glassware handling
X, section 2.7	74	Clarified that the Laboratory Supervisors are responsible for all inventoried laboratory equipment.
X, section 4.1	75-76	Clarified that internal audits include both technical and quality system areas, and also include review of raw electronic files. Clarified that records of audit findings and CA/PA are written. Clarified dp audit requirements under DoD accreditation. Added specific audit finding reporting required under DoD accreditation.
X, section 6	77	Clarified requirements for subcontractors when used used for DoD accredited work
X, section 7	79	Added specific requirements for corrective actions affecting work under DoD accreditation.
X, section 9	81	Clarified requirements for signing/initialling of corrections of records.
App. B, sect. 5	103	Updated instrument codes
App. B, sect. 7	105	Clarified responsibility for client requested modifications of existing methods.
App. B, sect. 9	106	Updated the list of microvial label codes.
App. C, sect. 1	110	Added information that the equivalent names SGS AXYS Analytical and AXYS Analytical are used on documents.
App. C, table 5	113	Clarified some document responsibilities
App. C, sect. 3	118-119	Clarified SOP signatories.

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App. C, table 6	121	Added "Address and Contact" to the "Lab Name" entry.
App. D, sect. 1	127	Added definition of LOGIN.

The following amendments have been made to the QA/QC Policies and Procedures Manual Revision 26 and have been incorporated into Revision 27. All amendments have been authorized by the QA Manager.

Chapter, Section	Page	Amendment
I, section 1	9	Added information on laboratory ownership change.
I, Table 1	10, 11	Updated table with scope of products, clarified text descriptions
I, Table 2	12	Added Waters TQ-S instrument. Clarified that the Agilent 1100 HPLC with AB API 4000 MS is running on Analyst software
I, section 3	13, 14	Updated the accreditation summary
II, sect. 2.2 & 2.3	17	Updated staff positions that approve methods and SOP.
II, section 3	19	Clarified that the QA Chemist maintains a change request directory and stores supporting information for new and revised method and SOPs.
II, section 3.1	20	Clarified that the QA Chemist is responsible for electronic document distribution.
II, section 4	21	Clarified handling of requests for customized testing.
III, introduction, sections 1, 2, 3, 4 and 6	23-25	Reordered sections, updated and clarified work position names and duties.
III, section 5	25	Added Controller. Replaced LIMS Manager with LIMS Analyst/Programmer.
III, figure 2	25	Removed the condensed organizational chart.
IV, introduction and section 1.1	26-27	Clarified the responsibilities of the new Human Resources Department
IV, section 1.2	27	Clarified responsibilities for training record maintenance.
V, introduction	30	Added server room to the South Building
V, section 1.1	31	Clarified information about freezers and coolers.
V, section 5.1	34	Clarified the current facility access control for the West Building
V, section 6	36	Clarified that separate LIMS databases are used for contaminants and metabolomics analyses.
VI, introduction	38	Changed chapter title to "Contract and Product Management".
VI, section 1.1	38-39	Clarified that the Account Manager is the lead for contract review. Clarified that all quote/ proposal related documentation is saved in the contract file (on AXYS' network.) Clarified requirements for approval of client requests that are outside of methods, or need specialized treatment.
VI, section 1.2	39	Clarified responsibilities
VI, sections 1.3 and 1.4	40	Separated responsibilities for contaminants vs. metabolomics analyses.
VI, section 2	40	Added new section 2 "Product Management"
VII, section 2.1	43	Clarified that the chain-of-custody record is signed at receipt.
VII, section 2.5	45-46	Separated responsibilities for contaminants vs. metabolomics analyses.
VII, section 2.6	46	Updated AXYS' policy for retaining of unused sample portions.
VIII, section 1.1	48	Added reference to SLM-003 "Metabolomics Novel Matrix Validation"
VIII, section 2.2	51	Added reference to SLM-006 "Project Management, Metabolomic Studies"
VIII, sections 2.3, 2.4, 2.6.3 and 2.7	52, 56, 58, 59	Added reference to SLM-002 "Metabolomics Data Processing, Checking and Reporting"
IX, introduction	62	Clarified that chapter IX applies for environmental contaminants; metabolomics are covered by method MLM-001
IX, section 1.1	62	Clarified the purpose of the the procedural blank. Clarified instructions for handling of batches where the procedural blank exceeds the specifications. Added instructions for metabolomics blanks.
IX, sections 1.6 and 2.1	65	Added references to MLM-001.
X, section 4.1.1	77	Clarified that corrective actions and improvement findings from the annual quality system management review are entered into Q-Pulse's CA/PA module.

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X, section 7	76	Added reference to SLM-002.
X, section 9	78	Added reference to SLA-027
X, section 12	80	Added section 12 "Electronic Signatures"
XI, section 1.4.9	83	Added new section 1.4.9 Second Source Verification Standards
XI, section 7.3	87	Clarified that DX, PCB, PBDPE and alkane stock standard solutions have 4 year expiry dates.
App. B, table 4	98	Added SSV for second source verification
App. B, sect. 5	101	Added new Waters instrument (code V)
App. B	102	Deleted obsolete section 6.3 "AB Sciex LC/MSMS Instruments"
App. B, sect. 8	103	Clarified method number format for instrumental analysis methods.
App. B, sect. 9	103	Uppdated list with microvial label codes
App. C, table 5, and sections 2.1, 2.2 and 3	109-113	Updated document responsibilities, added metabolomics information. Adjusted field alignment and added borders to tables to improve readability.
App. C, sect. 4.1	115	Clarified forms used for MS/MSD reporting. Removed obsolete information that reports are printed on AXYS stationery
App. C, sect. 4.4	116	Changed that rounding is performed by LIMS rather than by Excel.
App. D, section 1	122, 125	Added definitions for Contaminants and SPIKELOT
App. D, section 2	126-127	Clarified definitions and schedule for LOD and LOQ verifications.
App. F	155	Removed section "AXYS Analytical Services Floor Plans" instead referring to QDO-034.

The following amendments have been made to the QA/QC Policies and Procedures Manual Revision 25 and have been incorporated into Revision 26. All amendments have been authorized by the QA Manager.

Chapter, Section	**Page**	**Amendment**
I, Section 2	9	Entered information about AXYS Enviro and AXYS Life brands
I, Section 2	9	Updated switchboard hours to be 8:00 am – 4:00 pm.
I, Table 1	10-14	Updated analyses and matrices.
I, Table 2	15	Updated instruments.
I, Section 3	16-17	Added CDPH and PDEP scopes. Added expanded SWADE scope. Updated name of ANAB (previously ACLASS). Added erroneously deleted entries for methods 608 and 8081. Removed CALA accreditation for parabens in urine.
II, Section 1	18, 19	Point 2: Added reference to the US DoD standard for environmental laboratories. Point 10: Clarified that traceability to original data will be maintained through audit trails.
II, Section 2	19	Clarified that quality system documents are in English only.
II, Sections 2.1 and 2.2	20	Clarified who approves the quality manual and method documents.
II, Section 2.5	20	Changed that methods and technical SOPs for DoD work are reviewed annually, rather than every 3 years.
II, Section 3	23	Clarified staff's responsibilities regarding using and acknowledging current documents. Removed obsolete instruction that the QA Chemist maintains a record of externally released documents.
II, Section 4	24	Updated instruction for assessment and reporting of fitness for purpose in cases where method, contract or quality requirements were not met.
III	26	Clarified managers' responsibilities for staff training.
III, Section 2	26	Clarified that the primary accreditation body must be notified if the President is absent for more than 35 days
III, Section 2.1	26	Added position description for Delegated Back-up Technical Directors
III, Section 3.2.2	27	Clarified who acts for the Technical Service Coordinator in the case of absence.
III, Section 3.3.1	28	Clarified who acts for the Operations Coordinator in the case of absence.
III, Section 3.5	28	Added position description for the Manager, Metabolomics Services.
III, Section 4	28	Clarified that the QA Manager has training in laboratory assessment and expertise in evaluating analytical processes and data. Clarified that the QA Manager conducts internal audits, monitors corrective actions and has the authority to suspend or amend operations.
III, Figure 2	29	Updated organizational chart.
IV	30	Added instruction for what job descriptions should cover.

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IV, Section 1.2	31	Removed obsolete reference to documentation of employee participation in AXYS seminars and workshops. Added reference to SQA-016 (Training in Data Integrity, Ethical and Legal Responsibilities)
IV, Section 2	32	Clarified the QA Manager's responsibility to monitor compliance regarding Data Integrity and Ethical and Legal Responsibilities.
V	34	Completed information about the metabolomics lab.
V, Section 1.2	36	Clarified housekeeping requirements.
V, Section 1.3	36	Clarified that special environmental conditions required for custom work will be met.
VI, Section 1.2	43	Added reference to SAD-020 (Project Management)
VII; Section 3	51	Added reference to SAD-034 (Analytical Contracts for Legal Counsel)
VIII, Section 1.1	52	Clarified that methods are revalidated when changes are made to stoichiometry, detection technology, quantification ions or acceptance criteria.
VIII, Section 1.6	53	Clarified that special environmental conditions required for custom work will be met.
VIII; Section 2.1	54	Added reference to SLA-085 (Subsampling Procedures for Solids and Tissues)
VIII; Section 2.4	59	Added that original and manually edited data is retained by an audit trail in LIMS.
VIII, Section 2.7	63	Completed list of minimum information to provide in final data reports. Clarified that customized data reports will be provided after prior arrangement with the client. Clarified that for DoD work the default method format will follow the specifications in Appendix A of the DoD QAM.
VIII, Section 2.8	64	Clarified that test result traceability through the analytical process will include the date and processing times. Clarified that AXYS adheres to applicable regulatory and state legal requirements for records retention.
IX, Section 1	65	Clarified how QC samples are evaluated, with emphasis on DoD requirements.
IX, Section 1.1	65	Added definition of when samples are considered contaminated due to high blank levels.
IX, Section 1.3.4	67	Clarified description of the Laboratory Control Sample
IX, Section 2.1	68	Clarified requirements for running initial (linearity) calibrations.
IX, Section 2.5	69	Clarified the instructions for instrumental response calibration.
X, Section 2	71	Clarified testing and calibration requirements for reagents and equipment. Added reference to SLA-125 (Calibration of Equipment)
X, Section 2.1	72	Added that details of reagents are recorded in the LIMS Consumables Inventory. Added purity specification for Seastar water
X, Section 2.2	73	Updated proofing SOP reference from SLA-002 to SLA-094
X, Section 2.3	73	Clarified verification requirements for syringes and variable volume pipettes.
X, Section 3	75	Completed and clarified handling, use and requirements for PT samples.
X, Section 4.1	75-76	Clarified scope of internal audits. Clarified requirements for data package audits.
X, Section 4.2	76	Clarified handling of corrective actions originating from external audits or assessments.
X, Section 5	77	Clarified how performance monitoring results are communicated to managers, and how method laboratory control limits are updated or verified.
X, Section 6	77-78	Clarified subcontracting instructions.
X, Section 7	78-79	Clarified corrective actions, particularly how clients are notified and how the corrective actions are documented.
X, Section 9	80	Clarified logbook requirements, added reference to SLA-115 (Use and Control of Logbooks)
XI, Section 3	85	Clarified that containers of working standard solutions must be labeled with the expiry date, and, where required for conformance with an accreditation standard (e.g. US DoD), the containers also must be labeled with the preparation date.
XI, section 6.1	86	Updated the storage location of Certified Reference Materials
XI, Section 7.4	88	Clarified that working standards may be revalidated to re-establish an expiry date and that standards past expiry date must be removed from use.
App. B, Sect. 5	101	Added new GC/MS instruments to the table.
App. C, Sect. 2.1	112-113	Added items to include in method sections.
App. C, Sect. 2.2	114	Added items to include in instrument method sections.
App. C, Sect. 2.3	114	Added requirements for method summary documents.
App. C, Sect. 4.1	117	Clarified method report format instructions.
App. D, Sect. 2	128	Added definition of LOD and LOQ
App. F, Fig. F-9	166	Added floor plan for the Metabolomics Laboratory.

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The following amendments have been made to the QA/QC Policies and Procedures Manual Revision 24 and have been incorporated into Revision 25. All amendments have been authorized by the QA Manager.

Chapter, Section	Page	Amendment
I, Table 2	15	Added additional model information to the instruments list
I, Section 3	16	Removed withdrawn accreditation for MLA-007, organochlorine pesticides by GC-ECD. Changed ACLASS to ANAB.
II	19	Clarified that all records (hardcopies and electronic) are retained for a minimum of ten years
III, sections	26-28	Removed "Process and Product Improvement Scientist". Clarified that the President is the Senior Technical Director. Clarified the roles of the Director of Operations. Moved the Client Services Manager from section 2.1 to section 3.1. Removed the Lab Manager as a secondary function for the Director of Operations; the Lab Manager is a separate position.
III, Figure 2	29	Updated organizational chart, added footnote about QDO-005 "AXYS Organizational Chart (with names)"
IV	30	Removed the Safety Manual Acknowledgement Form - this function is maintained through Q-Pulse's electronical document distribution acknowledgements
IV, 1.1	30-31	Added information about the Basic Training
V	34	Added information about the metabolomics lab and -80°C freezers
V, 4	38	Corrected that the IT department is situated in the west building (not the administrative areas)
V, 5.3 (2)	39	Clarified the prescribed syntax of passwords
V, 6	40	Updated server information
VIII, X	63, 78	Deleted reference to obsolete SOP SAD-009 and replaced with SAD-022
IX, 1.2	64-65	Expanded the explanation of the Laboratory Sample Duplicate
X, 11	80	Removed point 9. about the Product Improvement Scientist.
App. C	114	Updated the approval layout to current practice.
App. G	164	Added a comment that instructions for CAS database searches are in the QA Sharepoint Wiki.

The following amendments have been made to the QA/QC Policies and Procedures Manual Revision 23 and have been incorporated into Revision 24. All amendments have been authorized by the QA Manager.

Chapter, Section	Page	Amendment
I, table 2	15	Added new instrument (Agilent 6890N Network Gas Chromatograph with an Agilent 5975 Network Mass Selective Detector)
I, 3	16-17	Updated the accreditation scope with new accreditation acquired, deleted expired California accreditation.
III, sections 2.1, 3, 3.1 and 3.3	27-28	Updated positions.
III, Figure 2	29	Updated the organizational chart
VIII, 1	52	Clarified that only current copies of controlled documents may be used by staff to control processes.
IX, 1.2	64	Exempted aqueous samples from the requirement to run a duplicate with every batch of 7-20 samples.
X, 1	70	Added details on vendor qualification
App. B, 9	104	Updated analysis codes for microvial labels.

The following amendments have been made to the QA/QC Policies and Procedures Manual Revision 22 and have been incorporated into Revision 23. All amendments have been authorized by the QA Manager.

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Chapter, Section	Page	Amendment
I, Table 1	10	Updated Table 1 "Scope of Products"
I, section 3	16	Added metabolomics to the accreditation scope.
II, section 2.5	19	New section about document reviews.
III, Figure 2	28	Updated organizational chart
VIII, section 2.6	60	Added policy for quantification of native compounds using alternate ions.
X, sections 2.7 and 2.8	72	Removed the QA chemist as responsible for the equipment record. Clarified that the equipment record is in the LIMS. Clarified the location of the maintenance log.
X, section 7	76	Added positions with the authority to suspend and resume non-conforming operations
Appendix B	100	Added AB Sciex instrumental file naming format
App. D, sect. 3	127-128	Updated abbreviations/acronyms.
Appendix F	153-160	Updated and added floor plans.

The following amendments have been made to the QA/QC Policies and Procedures Manual Revision 21 and have been incorporated into Revision 22. All amendments have been authorized by the QA Manager.

	Chapter, Section	Page	Amendment
	I, Table 1	10-13	Updated "Scope of Products" to current status
	I, Table 2	14	Added new Agilent HPLC and AB Sciex MS.
	I, section 3	15	NYSDH: Updated accreditation summary with DX/F in solid matrix and indicated which analyses are primary or secondary accreditations. Deleted "pending" for CALA PAH in water.
	II, section 1	17	Point 2: Changed "Technical Director" to "Technical Directors". Point 6: Added clarification that methods must be "fit for purpose".
	III, Section 1	25-26	Updated the responsibilities of the Director of Sales, Marketing and Service and of the Client Services Manager
	III, Section 1.1 and 3	26	Updated the responsibilities of the Client Services manager and the Director of Operations. Deleted the Reporting Supervisor position.
	III, Section 3.3	27	Updated the responsibility of the Product Development Scientist
	III, Figure 2	28	Updated organizational chart
	V	33	Updated facilities description, deleted warehouse.
	V, section 1.1	34-35	Added that metabolomics samples are stored in a freezer at -80ºC. Clarified who is responsible for temperature monitoring of freezers and refrigerators.
	VI, sections 1.1 and 1.2, table 3	41-42	Updated contract management procedures to reflect current practice.
	VII, section 1	45	Added that HDPE sample containers are used for a number of LC analyses.
	VII, section 2.3	48	Clarified that the LIMS CoC must be approved by the Project Manager only before samples are released internally for analysis.
	VIII, section 2.2	54	Added SPE to the extraction procedures list.
	VIII, section 2.4	58	Clarified that the note about additional work that is entered into LIMS' Work Group Notes must be verified and signed off by the Project Manager.
	VIII, section 2.5	58	Added AB Sciex Analyst to the list of analysis calculation software..
	X, section2.1	70	Changed "de-ionized water" to "Seastar ultrapure water or Canadian Springs bottled water"
	X, section 6	75	Clarified that for samples submitted to subcontracting laboratories a Release Chain of Custody document is generated from LIMS and sent together with the samples.
	XI, section 1.4.3	80	Added description of cleanup standard

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	Appendix B, section 5	98	Added new instrument R (AB Sciex). Added missing instrument names
	Appendix C, table 5	108	Updated document responsibilities.
	Appendix D, section 1	120-121	Added definitions for Parent Ion and Daughter Ion
	Appendix G	159	Expanded the description of CAS # policy to include more detail

The following amendments have been made to the QA/QC Policies and Procedures Manual Revision 20 and have been incorporated into Revision 21. All amendments have been authorized by the QA Manager.

Date	Chapter, Section	Page	Amendment
	I, sect. 3	15-16	Added Virginia state accreditation. Added PBDPE in NP water for the SWADE scope. Added water as ”pending” matrix for CALA accreditation.
	I, sect. 1, point 9	18	Added pipettors to the list of instruments that need to undergo traceable calibration.
	III, sect. 1 and 3	26	Corrected title of the Client Services Manager. Updated Director of Operations description
	III, sect. 3.1	26	Corrected title of the Lab Manager
	III, sect. 3.4	27	Added section 3.4 “Process and Product Improvement Scientist”
	iii, Figure 2	29	Updated organizational chart
	V, Sect. 1.3	36	Deleted obsolete instruction to cover lab bench on the north wall of lab 1 with Al foil. The bench has been replaced by stainless steel counters.
	V, sect. 2	37	Updated location of the first aid room.
	VI, Sect 1.4	44	Clarified Work Scheduling tasks and responsibilities.
	VIII, sect. 2.3	57	Updated list of current SIN documents for instrument QA/QC checks and mass calibration
	VIII, sect. 2.4	59	Added SIN-026 to list of documents for instrument data evaluation
	iX, sect. 2.1	67	Added SIN-037 to list of documents for instrument linearity determination
	X, sect. 2.5	72	Deleted reference to use of IR or digital thermometers for drinking water applications
	X, sect. 3	73-74	Updated PT sample description
	X, sect. 5	75	Updated performance monitoring description
	XI, sect. 6.2/3	85	Updated location of prime and stock standards
	App D, Sect 2	125	Added definition of LMCl (Lower Method Calibration Limit) including policy for coeluting compounds

The following amendments have been made to the QA/QC Policies and Procedures Manual Revision 19 and have been incorporated into Revision 20. All amendments have been authorized by the QA Manager.

Date	Chapter, Section	Page	Amendment
	I	10-13	Expanded description of product classes. Replaced Table 1 column of method class status with a reference to the current Product and Service Guidelines.
	I, 3	15-16	Added new accreditation
	II	18	Added the requirement for NIST traceability of thermometer calibrations meeting ISO 17025 standards
	III	28	Updated organizational chart
	VII	45	Changed “Teflon” to “fluoropolymer”.
	VII, . 2.7	49	Provided reference to SAD-014 for details about sample and extract retention policies.

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	VIII	62	Clarified record retention times. Deleted reference to obsolete SAD-022.
	IX, 1.6	65	Expanded description of MS/MSD test applicability
	X 2.5	71-72	Revised thermometer calibration/verification requirements
	X 3.	73	Added information on the frequency of accreditation PE studies
	Appendix C	105	Clarified method numbering system
	Appendix C	109-110	Clarified instructions for formatting of method documents
	Appendix H	161	Added definitions for report flags H, TIC and MAX

The following amendments have been made to the QA/QC Policies and Procedures Manual Rev.18 and have been incorporated into Revision 19. All amendments have been authorized by the QA Manager.

Date	Chapter	Page	Amendment
20 May 2011	I, Appendix .B	5, 89	Updated instrument lists to include one new LC/MS/MS
20 May 2011	I Section 3 (table)	6	Added EPA 8270D and 8081B method codes. Replaced reference to Appendix D with reference to document ACC-101 Accreditation Scope. Updated several accreditation entries.
20 May 2011	II 1.2	7	Text clarified that current versions of CALA and NELAP standards apply
20 May 2011	II, section 3	11-12	Minor corrections of document distribution procedures.
20 May 2011	II, section 4	13	Expanded the explanation of authorization for departure from documented procedures.
20 May 2011	III	15	Changed title Scientific Director (Opportunities) to Senior Scientific Specialist
20 May 2011	III, Figure 2	18	Updated organizational chart.
20 May 2011	IV	19	Corrected reference to the Safety Manual (now SAF-001)
20 May 2011	VI	31	Replaced verbal agreement with authorized quotation process
20 May 2011	VII	35	Updated the reference to the Safety Manual
20 May 2011	VII 2.1	36	AXYS Sample Acceptance Criteria: Added requirements for soil samples (pertaining to Agricultural Hazards)
20 May 2011	VII	40	Updated reference to SLA-003 for Chain-of-Custody instructions.
20 May 2011	X	66	Expanded description of client complaint resolution process
20 May 2011	Appendix B	90, 91	Deleted reference to an outdated system of analysis level codes. Updated the list with analysis codes.
20 May 2011	Appendix C, section 1	95-97	Added a few definition clarifications. Added guideline for when method changes trigger a new method number, method revision number or method version number.
20 May 2011	Appendix C, sections 2.1 and 3	99, 101	Clarified document distribution procedures.
20 May 2011	Appendix D	106 (formerly)	Deleted Appendix D (separate document ACC-101 now applies). All subsequent appendices renumbered as a consequence of the deleted Appendix D.

The following amendments have been made to the QA/QC Policies and Procedures Manual Rev. 17 and have been incorporated into Revision 18. All amendments have been authorized by the QA Manager.

Date	Section	Page	Amendment
June 2010	I	5	Added Water 2795 HPLC
June 2010	III	15	Corrected that the LIMS Manager reports to the Controller.
March 2010	III, 3.1.1	16-17	Deleted the position “Sample Preparation Coordinator”. Updated that the Lab Schedule coordinator now also schedules sample preparation work. Deleted the title of “senior” Chemist. Changed Product Development Manager to be Product Development Scientist. Corrected that in case of absence the Director of Operations acts for the Instrumental Analysis Manager and the Product Development Scientist.
March 2010	III	19	Figure 2: Updated the org. chart.

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June 2010	IV	20	Clarified that Managers record performance evaluations and job descriptions in personnel files.
June 2010	V	23	Updated volume of walk-in coolers to a total of ~3000 cubic feet
June 2010	V, sect. 3	27-28	Updated information pertaining to the new Safety Manual SAF-001. Added closed toe shoes as item under lab safety policies.
June 2010	V, sect. 5.3	29	Clarified that LIMS passwords are changed every 180 days.
March 2010	V-6	30	Deleted central server "Dell PowerEdge 2900". Replaced "Unix-based firewall" with "SonicWall Gateway Appliance". Replaced "Optiplex" LIMS server with "R510". Reference to SAD-031 added.
June 2010	VI, sect. 1.3	34	Added that the President also attends the weekly work priority meetings.
June 2010	VII, sect. 2.2 and 2.5	39-40	Clarified that Sample Receiving Chemists are responsible for sample preservation (instead of Sample Preparation).
June 2010	VII, sect. 2.7	41	Changed that sample extracts are kept for 90 days after invoicing (instead of one year).
June 2010	VIII, sect. 2.1	43	Added list of sample preparation SOPs
June 2010	VIII, sect. 2.1	45	Added references to sample preparation SOPs.
June 2010	VIII, sect. 2.4	49	Renamed section to "Primary Data Validation Procedures".
June 2010	VIII, sect. 2.7	50	Clarified Data Reporting routines.
June 2010	VIII, sect. 2.7	51	Replaced SAD-001 "Analysis Report Preparation" by SAD-030 "Preparation of Final Reports using LIMS".
June 2010	VIII, sect. 2.8	54	Deleted "data coding forms' from the list of the records.
June 2010	IX, sect. 2.1	58	Corrected linearity calibration frequency to be at least 90 days (instead of 60).
June 2010	X, sect. 2.5	61	Clarified requirement to calibrate and validate thermometers.
June 2010	X, sect 7	67	Deleted reference to archived SOP SIN-025
June 2010	X, sect. 7.1	68	Corrected Sales and Marketing department to be Client Services.
June 2010	XI, sect. 1.3 and 1.4	69-70	Clarified that working standards are direclty validated (not stock standards)
June 2010	Spp. B, sect. 5	91	Corrected instrument code for one LC/MS/MS to be P (instead of L)
March 2010	App. C, sect. 2.1	100	Added that method references should be included in AXYS' methods.
June 2010	App. C, sect 4.2	102	Clarified report signing responsibilities
March 2010	I-6	6	Added PPCP accreditation details
March 2010	Appendix D	119 ff	Deleted CALA accreditation for endrin aldehyde in tissue. Added CALA accreditation for PPCP in aqueous and solid samples.
March 2010	Appendix E	128	Added a definition for ISO17025 standard and a statement that the term ISO17025 refers to the current version of the standard.
June 2010	App. E, sect. 3	134	Added IHQC to Acronym list
May 2010	Appendix G	154-157	Updated floor plans: North Building (both floors) and South Building (both floors).
	Appendix I		Added flag H "information only value"

The following amendments have been made to the QA/QC Policies and Procedures Manual Rev. 16 and have been incorporated into Revision 17. All amendments have been authorized by the QA Manager.

Date	Section	Page	Amendment
Oct 2009		1-165	Fixed pagination by adding bookmark to the last page (must not be deleted)
Oct 2009	All		Reference to ISO 17025 as current version.
Sep 2009	Chapter I	1	Revised section 1 about affiliated companies.
Sep 2009	Chapter I	5	Updated detector for Water HPLC 2690 (deleted diode array detector, changed to be MS/MS detector)
Sep 2009	Chapter I	6	Updated section 3. Accreditation Summary
Sep 2009	Chapter II	12	Added description of the requirement to notify accrediting organizations of SOP changes
Sep 2009	Chapter III	15-17	Corrected position names (Product Improvement Scientist, Technical Service Chemists, Technical Service Coordinator)
Sep 2009	Chapter III	19	Updated org. chart
Sep 2009	Chapter IV	21-22	Added that an IT Policies form is signed by new employees

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Sep 2009	Chapter V	28	Safety Features: Deleted reference to Halon fire extinguishers (not used anymore).
Sep 2009	Chapter V	29	Updated paragraph about AXYS Analytical Safety Committee. Corrected unlocked door in w building to be Mon-Fri 7 am – 5 pm
Sep 2009	Chapter V	30-31	Updated section 5.3 Security of Data and Section 6 Computing Capabilities to reflect current SAD-028
Sep 2009	Chapter VI	33	Added the LIMS group to the RFP reviewers
Sep 2009	Chapter VI	34-35	Section 1.3 Workload Management and section 1.4 Work Scheduling: Corrected positions and responsibilities.
Sep 2009	Chapter VII	38	Corrected sample documentation requirements
Sep 2009	Chapter VIII	46	Corrected that worksheets now are generic for the whole batch, not individual for each sample
Sep 2009	Chapter VIII	47	Corrected Flow Diagram of Testing Procedures by adding EDD preparation into the Report box
Sep 2009	Chapter VIII	50	Corrected how a request for additional work is done and recorded.
Sep 2009	Chapter IX	55-56	Deleted evaluation instructions in section 1.2 Sample Duplicate, instead referring to method specs and SOPs
Sep 2009	Chapter X	63	Section 2.3 Volumetric Measurement: Added pipette pertaining clarification
Sep 2009	Chapter X	67	Section 4.2 External Audits: Added SWADE and MDH as bienniel auditors
Sep 2009	Chapter XI	72, 75-78	Chapter XI Standards: Corrected position names (to be Technical Service Chemist and Technical Service Coordinator), updated documentation of standard solutions to be stored on the network only, updated that documentation of CRT, primary standards, stock standards and working standards is done in LIMS, updated storage conditions and locations, added detail for expiry dates of working standards
Sep 2009	Appendix B	86, 87, 89, 94-95	Updated the definition of the term “AA” in the standard solution, corrected the definition of test sample code N, updated Table 4 Naming Codes, updated Instrument table in section 5 (Instrumentation), updated analysis code table and microvial label colour codes in section 9 (Microvial Label Codes),
Sep 2009	Appendix B	91	Updated instrument list
Sep 2009	Appendix C	100	Added IPRs and MDLs to table 5 (Categories of Documents)
Sep 2009	Appendix D	118	Added PFC accredited analytes for MDH
Sep 2009	Appendix G	149, 151	Updated floor plans for the lower floors of the North and the South Buildings.

The following amendments have been made to the QA/QC Policies and Procedures Manual Rev. 15 and have been incorporated into Revision 16. All amendments have been authorized by the QA Manager.

Date	Section	Page	Amendment
Dec 2008	Introduction Table 1	2	Updated ‘Scope of Fully Commercialized Products’
Dec 2008	Introduction Table 2	4	Added 1 new HRMS instrument to ‘Instruments’
Dec 2008	Chapter III	15- 17	Updated job titles for summary job descriptions
Dec 2008	Chapter III, 3.5	17	Name ‘R&D’ changed to ‘Product Development’
Dec 2008	Chapter III, figure 2	19	Updated organizational chart
Dec 2008	Chapter IV	21	Added reference to staff minimum qualifications requirement
Dec 2008	Chapter IV	23	Added reference to SOP SQA-024 Data Integrity Procedures
Dec 2008	Chapter IV	23	Added reference to annual management review of data integrity plan
Dec 2008	Chapter VIII	54	Added reference to transfer of records to client if business ceases
Dec 2008	Appendix B Table 4	88	Deleted columns named ‘Analysis Type’
Dec 2008	Appendix B	90	Added Premier instrument code
Dec 2008	Appendix B, 6.2	91	Added LC/MS/MS to naming conventions covered
Dec 2008	Appendix E	126	Changed CAEAL to CALA and changed all document references to CALA
Dec 2008	Appendix H	155	Added Appendix for CAS number usage policy
Dec 2008	Appendix I	159	Added Appendix for data flagging conventions

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The following amendments have been made to the QA/QC Policies and Procedures Manual Rev. 14 and have been incorporated into Revision 15. All amendments have been authorized by the QA Manager.

Date	Section	Page	Amendment
Aug 2007	Table 1, Table 2	2	Table 1 content updated, Table 2 deleted
Aug 2007	Table 3	4	Deleted Finnigan Incos 50 GC/MS and HP5890 GC/ECD instruments
Aug 2007	3. Accreditation	5	Added PCDD/F to accreditation by CDPH . Added accreditation by FLDH and by NJDEP. Added accreditation for pesticides in water by SWADE
Aug 2007	Chapter III, figure 2	19	Updated organizational chart
Aug 2007	4.4.1	64	Added “Quality control activities” to the list for management review
Aug 2007	Appendix B, Table 5	87	Added “SPEX” as the code for “Spiked Extract”
Aug 2007	Appendix D	108-117	Addition of new analytes (PCDD/F) accredited in California. Addition of analytes accredited by NJDEP (PCDD/F and PFC) Addition of pesticides to analytes accredited by SWAPE
Aug 2007	Appendix E	126	Added policy for reporting concentrations below QL for LC/MS/MS

The following amendments have been made to the QA/QC Policies and Procedures Manual Rev. 13 and have been incorporated into Revision 14. All amendments have been authorized by the QA Manager.

Date	Section	Page	Amendment
March 2007	Table 3	4	Deleted instruments VG-70 SE (x2), HP 5890 GC (x1) and Tekmar headspace.autosampler. Changed Autospec Ultima autosamplers to read CTC A200 S rather than 200 SE.
March 2007	Headers Document Control Procedures Documentation Format	All, except first 13 and 110	Modified copyright statement
March 2007	Table –WASDE accreditation	5	Corrected PCB method from 1614 to 1668
March 2007	Table –WASDE accreditation	21, 22	Changed the Quality Manual acknowledgement to be done only electronically.
March 2007	Several locations		Changed “Quality Manager” to “QA Manager”
March 2007	Appendix D: Scope of accreditation	109	Added analytes for FlDOH accreditation 1-Jan-2007 (total tetra-, penta-, hexa- and heptadioxins and -furans in solids and tissue)
March 2007	Figure 2; Organiza-tional Chart	19	Updated
March 2007	Table 1, Table 2	2-3	Moved a number of analyses from Table 2 (Scope of Specialty Analyses) to Table 1 (Scope of Routine Analyses).

The following amendments have been made to the QA/QC Policies and Procedures Manual Rev. 12 and have been incorporated into Revision 13. All amendments have been authorized by the QA Manager.

Date	Section	Page	Amendment
Nov 2006	Global Changes		Entire text revised to include revised job titles and supervisory responsibilities. Deleted references to GC/FID. Update SOP references and titles.
Nov 2006	Responsibility, Dist. & Control	i	Deleted President as signatory to QA Manual. Added statement about management support and procedures being binding on employees. Deleted Quality Policy Statement; policies are included in Ch. II.

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Nov 2006	Ch I, 2.	1	Revised business hours and number of employees.
		3	Table 2 Scope of Analyses updated.
Dec 2006	Ch 1, 3	5	Added tables to list accredited method for each accrediting agency. Included pending Florida accreditation. Reference to Appendix D added.
Nov 2006	Ch II, 1	7	Deleted Quality Objectives, included them in Quality Policies. Added AXYS' objective statement. Revised some quality policies added some new policies.
	CH II, 2	8	Deleted Reference to Method and SOP Manuals, reference just to Methods or SOP
	Ch II, 2.1	8	Added reference to electronic QA Manual
	Ch II, 2.2	9	Moved information about source of methods, method format, and method control from Ch VIII to this section.
	Ch II, 2.3	9	Moved information about SOP format and SOP control from Ch VIII to this section.
Dec 2006	Ch II, 2.4	9	Added this section to list quality documents kept on file.
Nov 2006	Ch III	15-19	Chapter rewritten and Figure 2 revised to describe changes in organizational structure. Deleted section on 'Assigned Responsibilities'
Dec 2006	Ch IV, 1.1	21	Used "data integrity" to replace legal and "ethical responsibilities".
	Ch IV, 1.2	22	Added Evaluation of effectiveness of training to what is monitored.
	Ch IV, 2	23	Added Data Integrity as part on Legal and Ethical Training. Revised point #7. Added criminal/civil prosecution to consequences on not adhering to policies.
Nov 2006	Ch V, Section 1.1	26	Revised responsibility for monitoring sample storage temperatures to 'staff'. Changed frequency of monitoring from daily to every business day.
	Section 1.3	27	Changed responsibility for approving cleaning products to Lab Manager.
	Section 4, 5.1	29	Revised description of building security to describe changed system for locked doors. Revised hours of operation
Nov 2006	Ch VI	33-35	New chapter - Moved Contract Management from Ch III to its own chapter. Revisions made to procedures for reviewing proposals and contracts.
Nov 2006	Ch VIII, Section 1.1	43	Added Section 1.1.1 about detection limits.
Nov 2006	Ch VIII, Sect. 2.2, 2,4	45,49	Included extra work being documented in the LIMS.
	Section 2.6.2	52	Revised section on Detection Limit. Deleted reference to procedures in EPA Federal Register 40.
Dec 2006	Ch VIII, 2.7	52	Added requirement to include a statement on reports that data applies only to sample.
Dec 2006	Ch VIII, 2.8	54	Added related QC records to records that are maintained.
Nov 2006	Ch IX, Section 1.1	55	Revised requirement for BLK, deleting option of no matrix.
Dec 2006	Ch X, 4.1.1	65	Added effectiveness of training to items considered in management review.
	Ch X, 7	67	Added point that all staff may identify non-conformances. Added actions taken for non-conformances. Added statement that clients are notified if non-conformance affects data.
	Ch X, 11	70	Added this section on Process Improvement.
Nov 2006	Ch XI	71-77	Replaced Standards Chemist with Technical Specialist
Nov 2006	Ch XI, Section 1.4.2	72	Expanded definition of Recovery standard.
	Section 1.4.4	73	Added information on linearity solutions to this section. Deleted stand-alone section.
Nov 2006	Ch XI, Section 7	76	Included expiry date of 2 years for alkane working standards.
Nov 2006	Appendix B	83	Table 4 revised to update Analysis Types, delete obsolete codes
Nov 2006	Appendix C	95	Table 5 updated responsibilities for documents
Dec 2006	Appendix D	107	Added tables of accredited analytes.
Nov 2006	Appendix E, Sect. 1	123	Deleted 'Labsyst' and detection limit definitions from glossary.
	Sect. 2	127	Added this section with Detection Limit Definitions.
Nov 2006	Appendix G	150	Updated some floor plans.

The following amendments have been made to the QA/QC Policies and Procedures Manual Rev. 11 and have been incorporated into Revision 12. All amendments have been authorized by the QA Manager.

Date	Section	Page	Amendment

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Aug 2006	Global Changes		Entire text revised to include revised job titles and supervisory responsibilities
			Project Mangers, Reporters and Sample Receiving moved to Client Services
Mar-2006	Global changes		Client Services changed to Sales, Marketing and Service.
			Project Manager changed to Senior Project Manager.
			Project QC Chemist 3 changed to Project Manager.
			VP Production assigned responsibility for Instrument group.
			Entire text revised to include revised job titles and supervisory responsibilities.
Mar-2006	Ch. I, 3	3 5	Updated Tables 1 and 2, to include Superfund Methods, acid extractable herbicides, multi-pesticide residues and PE metabolites. Revised CALA accredited test to included PFCs.
Mar-2006	Ch. III, Section 1.2	15-22 17	Rewrote section to describe a revised organizational structure that includes renaming several positions, restructuring supervision of Extraction Lab, VP Production supervision of Instrument group and Project Management group. Deleted Reference to use of form FLC-012.
Mar-2006	Ch. V	26	Revised description of west and south buildings to include new location of coding, accounting and IT groups.
Mar-2006	Ch. VII, 2.7	52	Revised to include the use of LIMS reporting.
Mar-2006	Ch. IX, 2.8 Section 6.0	64 67	Revised reference to equipment maintenance logbooks to equipment maintenance log for lab and sample prep equipment. Deleted reference to managerial review of logbook. Revised description of subcontracting, there Is no longer a single Project QC chemist supervising the area.
Mar-2006	Ch. X, 6.2,6.3	75	Revised so that Standards Chemist is responsible for standards.
Mar-2006	Appendix C, 4	104	Revised to allow for customization of reports. Deleted reference to AXYS 2nd page stationary for reporting data.
Mar-2006	Appendix G	117	Updated floor plans for south building.

The following amendments have been made to the QA/QC Policies and Procedures Manual Rev. 10 and have been incorporated into Revision 11. All amendments have been authorized by the QA Manager.

Date	Section	Page	Amendment
Oct. 2005	General		Corrections made to grammar and spelling.
Oct 2005	I, 3	5	Deleted reference to BC EDQA program. Put CALA accredited tests in a table.
Oct 2005	VII, 2.3	47	Modified section on mass calibration for HR MS.
Oct 2005	X, 7	77	Included 2 year expiry date for PCB 1668A working stds.
Oct 2005	IX,	67	Replaced incorrectly printed page with correct page.

The following amendments have been made to the QA/QC Policies and Procedures Manual Rev. 9 and have been incorporated into Revision 10. All amendments have been authorized by the QA Manager.

Date	Section	Page	Amendment
August 2005	Quality Policy Statement	ii	Included ensuring security of “data”.
August 2005	II, 3 2)	9	Revised approval of methods to include appropriate Managers
August 2005	V, 1.3 2)	29	Added exception of PFC analysis, which uses polypropylene labware.
August 2005	VI, 2.7	39	Revised retention of samples and extracts to “1 year from invoicing”
August 2005	VII, 1.1 VII, 2 VII, 2.3.2	41 43 47	Revised signing of methods to include appropriate Managers Added Lab Coordinator composed analysis batches. Added specification for calibration and instrument performance check for LC/MS/MS.

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August 2005	IX, 6.0	66	Revised requirement for subcontract labs to be ISO 17025 accredited where possible
August 2005	Appendix A	81	Added "Constant RRF' to title, Internal Standard Method of Quantification
July 2005	Global change		Lab Services changed to Sample Preparation Group. Technical Specialist changed to Standards Chemist. Replaced "Method Specification Table" with analytical method. Replaced Senior Analyst with Manager SR&D
July 2005	Table 1, Table 2	2	Updated Scope of Analysis.
July 2005	Table 3	3	Updated Instrumentation.
July 2005	I, 3	5	Added PBDE to CALA accredited analyses. Revised table of NYSDOH/California State accredited analyses.
July 2005	II, 1 6)	7	Included ensuring security of "data".
July 2005	III	15-22	Revised Org. chart and text to describe recent organizational changes, including creation of Support Research and Development Group and Scientific Director positions, and new Technical Director, VP Production supervision of Project Management Group.
July 2005	V V, 1.1	27 29	Included offsite warehouse facilities in description of AXYS facilities. Added Instrument Chemist responsible for monitoring Instrument refrigerator.
July 2005	IX, 2.3	63	Added variable pipettor as acceptable volumetric glassware.
July 2005	X, 7	77	PCDD/F working standard have 2-year expiry date.
July 2005	Appendix B	88	Updated Table 4 to include additional Analysis Type codes.
July 2005	Appendix B, 5	90	Updated Instrument Codes.
July 2005	Appendix C	98	Revised document responsibilities.
May 2005	IX, 10	69	Added this section to describe monitoring practices.
April 2005	II, 2, pt 2	7	Added requirement for training in data security procedures.
April 2005	V, 5.1	31	Added requirement for visitor to wear visitor badge.
April 2005	V, 5.3	32	Added policies for security of data and reference to SAD028.
February 2005	Global Change		"VP Client Services" replaced with "VP Market Development and Client Services".
February 2005	Global Change		"Technical Group" replaced by Support Research and Development (SR&D) Group. Manager of the group revised from Technical Director to Manager of SR&D.
February 2005	Various		Removed all references to Standards Council of Canada as an accrediting agency for AXYS.
December 2004	IV IV, 2	23 26	Included that Technical Director certifies staff have appropriate qualifications. Added requirement for annual training in legal and ethical responsibilities.
February 2005	VI, 1	35	Added paragraph to refer to special handling procedures for agricultural and biohazardous samples.

The following amendments have been made to the QA/QC Policies and Procedures Manual Rev. 8 and have been incorporated into Revision 9. All amendments have been authorized by the QA Manager.

Date	Section	Page	Amendment
July 2004	Global Change		"Chief Technical Officer" replaced with "Technical Director".
July 2004	Global Change		"QC Chemist" replaced with "Project QC Chemist". Responsibilities of QC Chemist become responsibilities of Project QC Chemist.
July 2004	Global Change		"batch sheet" replaced with "Batch List".
July 2004	Global Change		"project sheet" replaced with "Project Notes".
July 2004	Responsibility, Distribution and Control	i	Included statement that QA manual is available electronically.
July 2004	Amendments	iii	Frequency of Quality Manual revision changed to 'reviewed annually and revised as warranted'.
July 2004	I	2,3,4	Tables 1, 2, and 3 updated.
July 2004	I	5	Added EPA 1668A to NELAP accredited methods and solids to Washington State accreditation. Added '(modified)' to some accredited methods.

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Aug 2004	II, 2, pt 10	8	Included exception for precursor data, retained 1 year
Aug 2004	II, 5	13	Authorization has changed to include Project QC Chemist 3 for customized procedures, Lab Manager for SOPs and methods. Deleted requirement to document departures in client file.
July 2004	III	15-23	Revised section to reflect changes in organizational structure and staff responsibilities, including elimination of position of Chief Operating Officer, appointment of Lab Manager and of Director of Business Development, amalgamation of QC Chemists with Project Management, LIMS reporting to President. Data Packaging moved to Project Management.
June 2004	III, Figure 2	16	Organizational Chart revised.
July 2004	III, 1.2.1	17	Added procedures for documenting contract and proposal review.
July 2004	IV	25	Responsibility for training records changed to QA Department.
July 2004	V	29,30, 31	Frozen storage changed to <-10°C.
July 2004	V, 3	33	Safety manuals available to all staff, not issued to all staff.
June 2004	V, 6	35	Updated information re Server and computer network.
Aug 2004	VI, 2.7	41	Changed retention time for samples and extracts to 1 year from final reporting. Exception is precursor samples that are held for 3 months from date of receipt.
July 2004	VII, 2.3.2	50	Included recording HRGC//MS routine instrument maintenance on run list.
July 2004	VII, 2.5	51	Revised responsibility for Standards Use List and quantification methods to Coder 3.
July 2004	IX, 2.1	64	Deleted specific reference to Seastar Water as reagent water.
July 2004	IX, 2.2	64	Added requirement for proofing glassware.
July 2004	IX, 2.4	65	Balance is traceable to ISO 17025 standards.
July 2004	IX, 2.7	66	Responsibility for Equipment List revised to Lab Manager.
June 2004	X, 6	77	Removed reference to Lab 7 being air-conditioned. Removed reference to "during work hours" for accessibility to standards.
June 2004	X, 6.1	77	Removed "The container of CRM currently in use is kept in the laboratory."
June 2004	X, 6.1, 6.2	77	Replaced "the Purchaser" with "a chemist in the Technical Group".
Aug 2004	Appendix B, 2 Pt 8	89	Revised definition of K, to included addition of a labelled standard, after dilution, usually accompanied by 'N' Deleted Reference to 'Y' code, no longer used by technical group.
July 2004	Appendix B, Table 4	90	Deleted column with matrix codes, as they are no longer used in naming. Deleted several analysis codes, CA, CG, CJ, CV, MR, PN, TZ, VO and added some new codes, ST, FP, BCDX. Deleted LIN code from STD codes. Revised some QC sample codes.
Aug 2004	Appendix B, 5	92	Updated Instrument codes
July 2004	Appendix B, 8	94	Revised naming of Instrument methods to current system, deleted outdated system.
Aug 2004	Appendix B, 9	95	Updated table with colour codes for labels
June 2004	Appendix C, Table 5	100	Added MLC (Lab Contract) category. Updated responsibility for documents
Aug 2004	Appendix C, 2.2	102	Deleted Table 6 with outdated format for instrument methods. Revised the section to describe new format.
Aug 2004	Appendix C, 4.2	105	Included Project Manager as signatory on methods
Aug 2004	Appendix D	109	Minor corrections to definitions, including valley height, where taller was revised to shorter.
Aug 2004	Appendix G	131	Updated floor plans.

The following amendments have been made to the QA/QC Policies and Procedures Manual Rev. 7. The QA Manager has authorized all amendments.

Date	Section	Page	Amendment
Oct-2002	Cover Page		"Approved By" and "Date" added to cover page.
Oct-2002	Title Page		Page removed - information now incorporated on Cover.

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Apr-2003 Jun-2003	Preliminary Statements	Pg i Pg iii	Included President and Technical Director as signers of manual. Deleted mission statement.
Oct 2002	Preliminary Statements	Pg ii	C. Hamilton's title change to "Technical Director".
May-2003	Preliminary Statements	Pg iv	Revised amendment procedures, manual issued semi-annually. Deleted table with amendments.
Apr-2003	Global		Revised QA Checker to Project QC Chemist
May-2003	Global		Responsibilities of VP Extraction Lab assumed by Technical Director Position of Chief Analyst introduced
Apr-2003	I, 2	Pg 2	Revised hours of operation
May-2003	I, 2	Pg 3,4	Revised Scopes, moving MDT, non 2,3,7,8 PCDD/F to Specialty Analyses
Apr-2003	I,3	Pg 6	Deleted Pesticides as part of Wash. accreditation
Apr-2003 May-2003	II, 2	Pg 2 Pg 3	Point 5, included uncertainty estimates Point 9, included Hamilton syringes Changed length of time paper records kept to 5 years
Apr-2003 July- 2003	II, 3	Pg 4	Revised individuals signing methods, SOPs, Quality Manual Deleted names of those issued manuals. Included reference to distribution lists.
Oct-2002	II, 4	Pg 7	Only copies issued internally are controlled by recording number, date of issue, name of department and contact person. Copies issued externally are not controlled and not updated, but a record is kept of contact name, company name and date of issue.
Nov-2002	II, 4.1	Pg 8	Title of SQA-005 changed to read "Creation of New Documents".
July-2003 April 2003 July-2003	III	Pg 1	President changed to John Cosgrove. Deleted Purchaser reporting to President. Changed substitute for Client Services Manager
Apr-2003	III Figure 2	Pg 2	Revised Org. Chart to reflect organizational changes.
May-2003	III, 1.2.2	Pg 3	Revised Project Management section to include both Managers and PCs
May-2003	III, 1.2.3	Pg 4	Tracking meetings held with Technical Director
May-2003	III, 2	Pg 5	Revised supervision of Ext'n Lab to Technical Director. Revised substitutes in case of absence.
Nov-2002	III, 2.4	Pg 6	Revised to include Chief Analyst as supervisor Added "The Chief Analyst is assisted by the Technical Specialist and Lab Chemists".
May-2003	III, 3 III, 3.2	Pg 7	Substitute for VP Prod'n changed to Instrument Supervisor Deleted Data Interpretation Manager.
Apr-2003	III, 3.4	Pg 8	Changed title of QA Checker to QA/Project QC Chemist
Apr-2003	III, 4	Pg 9	Moved Purchasing/Shipping to be under supervision of COO
Apr-2003	III, 6	Pg 10	Revised Assigned Responsibilities
Apr-2003	IV	Pg 1	Described more fully the training records kept by QA. Included reference to both safety manuals.
Apr-2003	IV, 1.2	Pg 3	Specified which analysts prove competency
Oct-2002	V	Pg 1	Deleted reference to distilling apparatus Change capacity of walk-in coolers to 1,500 cubic feet. Change capacity of walk-in freezers to 5,000 cubic feet.
Apr-2003	V, 1.1	Pg 2	Person monitoring cold storage revised to Lab Technician

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			Under section Walk-in Freezers and Coolers, added "The freezer and cooler temperatures are also monitored daily by the Lab Technician."
July-2003	V,	Pg 3	Added Facilities Maintenance section
July-2003	V, I.3, Pt 6	Pg 4	Revised to allow pesticides or herbicides with permission
May-2003	V, 1.2	Pg 5	Revised requirement for electrical breakers for instruments
May-2003	V, 3	Pg 6	Specified distribution of safety manuals and included references.
Apr-2003 May-2003	V, 5,2	Pg 7	Pt #2 Added Accounting Dept maintains list of key holders. Pt #3 Sample Receiving Chemist responsible for sample storage/retrieval Pt #4 Revised to include storage of extract in Instrument lab
Oct-2002	VI 2.2	Pg 3	Delete Shipper/Receiver as collecting the shipping and chain-of-custody documents, etc.
Apr-2003	VI, 2.5	Pg 4	Added sample preservation to this section. Changed responsibility for storage of samples to Sample Receiving Chemist
May-2003	VII, 1	Pg 1	Added Chief Analyst to those issued methods.
Nov-2002	VII, 1.1	Pg 1	Change title of SQA-005 to "Creation of New Documents". Change title of SQA-006 to "Revision of Documents".
Apr-2003	VII, 1.1	Pg 1	Added VP Ext'n Lab and VP Prod'n as signatories to methods
Apr-2003	VII, 1.3	Pg 2	Added this section on Measurement Uncertainty
Oct-2002	VII, 1.4	Pg 2	"Technical Director" added for permission to reproduce methods.
Apr-2003	VII, 2.2	Pg 4	Deleted surrogate for sol'ns that are verified, all sol'ns are verified
May-2003	VII, 2.3.2	Pg 8	Added routine maintenance for ECDs, FIDs, and LC/MS
Apr-2003	VII, 2.4	Pg 9	Deleted Mass resolution as item checked by coders Added requirement for additional work documented in LIMS
Apr-2003	VII, 2.5	Pg 10	Added cal'n routine made and checked by 2nd person
Oct-2002	VII, 2.6	Pg 11	Delete "samples" from "every batch consists of…." Added non-conformances documented in narrative
Oct-2002	VII, 2.8	Pg 15	Added "Records falling under NELAP requirements are retained for a minimum of five years. Client records are retained indefinitely. In the event of a Transfer of ownership or if the company ceases business, AXYS would contact clients regarding their records."
Apr-2003	VIII, 1.1, 1.2, 1.3	Pg1-2	Added frequency of analysis of Blanks, Duplicates and Ref Samples
Apr-2003	VIII, 1.2	Pg 1	Deleted reference to correcting for blank conc., added flagging data
Apr-2003	VIII, 2	Pg 5	Changed bi-monthly to 60 days, added LC/MS/MS
Apr-2003	IX,1	Pg 1	Deleted reference to VP's list of approved suppliers Added QA Manager as allowing substitutions of goods and services
Apr-2003	IX, 2.1	Pg 2	Deleted Distilled water and reference to extracted water
Apr-2003	IX, 2.2	Pg 3	Included reference to bottles with cleanliness certificate
July-2003	IX, 2.3 IX, 2.4	Pg 3	Deleted use of Class B glassware for use in analyses Revised Balance checks section
May-2003	IX,	Pg 4	Added Thermometer Checks as Section 2.5
Apr-2003	IX,	Pg 5	Added this section (2.8) to describe procedures for equipment Not in Service
May-2003	IX,4.1	Pg 7	Revised, deleted section 4.1.2
May-2003	X,1.4.2	Pg 2	Included Rec. Std. Used to monitor instrument response

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May-2003	X	Pg 1	Added Chief Analyst as supervisor of Standards Prep.
May-2003	X, 4	Pg 4	Added Data Sheets available electronically.
Oct-2002	Appendix A	Pg 2,3	First three paragraphs revised extensively. Deleted "daily runs" replace with "analysis" Revised minimum detectable area to include multiple of 2.5 or 3.
May-2003	Appendix B, A	Pg 2	Added more specific details to naming of standard sol'ns
Nov-2002 Apr-2003	Appendix B, Table 4	Pg 4	Added "PFOS Polyfluorooctylsurfactants" Added C, P, M, and Y codes
July-2003	Appendix B	Pg 10	Added section I. Microvial Label Codes
May-2003	Appendix C, Table 5	Pg 3	Replaced VP Lab with Technical Director
Oct-2002	Appendix C, 2.1	Pg 4, 5	Added Optional Analyses, Interferences, Method Performance, Pollution and Waste Management, Appendices to
May-2003	Appendix C, 3	Pg 6	Added additional sections to be included in SOP
May –2003	Appendix C, Table 6	Pg 7	Revised format of instrumental methods
May-2003	Appendix C, 4	Pg 10 Pg 11	Revised this section, eliminating description of Axys style report, this is now specified by client. EPA style report section becomes standard report format. Table 7, deleted Axys Style report column, updated items included in reports.
May-2003	Appendix C, 4.3	Pg 11	Deleted initialling of EPA style report by QA/Project QC Chemist
May-2003	Appendix C, 4.6	Pg 12	Increased by 1 the # of. sig figs on % moisture, % lipid Deleted req'ment to round surr. Rec.>100% to nearest 10% Sig Figs is max 3 for conc. and SDL – may be less if deemed by checker
May-2003	Appendix E, 2,1	Pg 1 Pg 3 Pg 4 Pg 6	Analyte table, specified for QPUSquan only Continuing Cal, specified "at least" very 12 hrs. Holding time, revised to include sample and sample extract. Matrix Spike, added used for measurement of bias. Valley height, added height of "taller" peak
Nov-2002 May-2003	Appendix E, 2.	Pg 6 Pg 7	Add "LR Low Resolution" Added PFOS

The following amendments have been made to the QA/QC Policies and Procedures Manual Rev. 6. All amendments have been authorized by the QA Manager.

Date	Section	Amendment
Sep-2002	Global Changes made throughout the manual.	VP Sales changed to VP Client Services/Technical Director. Technical Director replaced by Technical Director. VP QA/QC changed to VP Quality Assurance. Project QC Chemist changed to Project Manager. Assistant Project QC Chemist changed to Sample Receiving Chemist. Environmental Analytical Chemist changed to Lab Chemist. Instrumental Analytical Chemist changed to Instrument Chemist. Data Interpretation Chemist changed to Coder. Project QC Chemist changed to QA Checker. Data Reporter changed to Reporter. Purchasing and Receiving Clerk replaced with Purchaser and

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		Shipper/Receiver. Supervisor changed to Manager. SOP numbers replaced with Q-Pulse numbers. AXYS Analytical Methods Manual changed to AXYS Methods Manual.
Sep-2002	I, 2 Pg 2	Number of employees changed to 125.
Sep-2002	I ,2 Table 1 Pg 3	Deleted EPA Methods 8270C and 8082A.
Sep-2002	I, 2 Table 2 Pg 4	Added EPA Methods 8270C and 8082A.
Sep-2002	I, 2 Table 3 Pg 5	Revised to included new instrumentation.
Sep-2002	I, 3 Pg 6	Deleted CALA accreditation for DBD, DBF. Added accreditation with Washington State Dept of Ecology.
Sep-2002	II, 2 8) Pg 2 10)	Changed to "Accuracy of balance is verified". Replaced NIST Class S weights with "weights traceable to nationally recognized standards". Added that electronic records kept 10 years.
Sep-2002	II, 3 2) Pg 3 3)	Replaced authorized with "approved by QA Manager, Chief Operations Manager, Technical Director, VP Extraction Lab and VP Production". Replace authorized with "approved and signed by QA Manager, COO or VP of the work area". Deleted designate for signing SOPs, methods. Added that additional copies of manuals available to staff.
Sep-2002	II, 4 Pg 5	Added description of Q-Pulse for managing documentation. Changed responsibility distribution and collection of documentation to Documentation Chemist.
Sep-2002	II, 4.1 Pg 6	Deleted QA Manager responsible for quality documentation; added responsibility for ensuring an effective overall system.
Sep-2002	II, 5 Pg 7	Deleted point about modifications to methods and incorporated departures from methods in with departures from SOPs. Added Project Manager as approver of non-conforming data Deleted reference to documenting non-conformance on Batch List. Added requirement for date on approval of all departures.
Sep-2002	III Pg 1-9 Pg 2	Section revised to describe changes in organizational structure including new position and responsibilities of COO and Technical Specialist. Revised organizational chart.
Sep-2002	IV Pg 1	Deleted reference to responsibility for job descriptions.
Sep-2002	IV Pg 2	Changed "Ethical Conduct" to "Ethical and Legal. Responsibilities".
Sep-2002	IV, 4 Pg 3	Deleted reference to QA testing by QA Manager.
Sep-2002	V Pg 1-2	Section revised to describe new use of physical space.
Sep-2002	V, 1.1 Pg22 Pg 4	Added air sampling media to samples stored frozen. Combined freezer and cooler sections. Deleted chest freezers as sample storage.
Sep-2002	V, 1.2 Pg 5	Added the exclusion of foam-padded chairs from labs.
Sep-2002	V, 5 Pg78	Identified West building as having an unlocked door during office hours.

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Sep-2002	VI, 1	Pg 1	Revised person responsible for instructions to client to Client Services group under direction of Project Manager.
Sep-2002	VI, 2.2	Pg 3	Included Shipper/Receiver as one who signs for samples.
Sep-2002	VI, 2.3	Pg 4	Added use of backup label where necessary.
Sep-2002	VII, 1	Pg 1	Revised AXYS Methods Manual to have only current methods. Deleted reference to 5 sections of manual.
Sep-2002	VII, 1.1	Pg 2	Added QA Manager as method approver and signer.
Sep-2002	VII, 1.2	Pg 2	Deleted reference to validation of custom methods.
Sep-2002	VII, 1.3	Pg 3	Revised responsibility for ensuring current document in use to Manager and individual analysts.
Sep-2002	VII, 1.4	Pg 3	Deleted reference to matrix specific method number and included document number as the method number.
Sep-2002	VII, 2	Pg 5	Added section 2.1 Sample Preparation.
Sep-2002	VII, 2.1	Pg 6 Pg 7	Figure 3 Deleted HPLC, GC/FID from Inst. Analysis Deleted Lab Supervisor as having authority to approve method deviations. Added verification of addition of surrogate std. Deleted reference to notebooks maintained by analysts.
Sep-2002	VII, 2.2.1	Pg 8	Added EPA requirement for tuning, calibration every 12 hours.
Sep-2002	VII, 2.5	Pg 12	Added QA Checkers responsible for documenting method and QA specification deviations in LIMS and on data report.
Sep-2002	VII, 2.7	Pg 16	Added sample receipt records to list of records kept.
Sep-2002	VIII, 1.3	Pg 2	Specified use of CRMs for method validation.
Sep-2002	VIII, 2	Pg 4	Revised Inst. Linearity verification to bimonthly.
Sep-2002	IX, 2.4	Pg 3	Revised to describe use of weights traceable to national standards to verify accuracy of balances.
Sep-2002	IX, 4	Pg 5	Deleted section on control charts.
Sep-2002	IX, 7.1	Pg 8-9	Deleted use of Client Complaint form and added use of Q-Pulse Complaint module.
Sep-2002	X	Pg 1-8	Responsibility for standards changed to Technical Specialist.
Sep-2002	X, 7	Pg 8	Revised expiry date policy for standard solutions.
Sep-2002	Appendix B, B(a)	Pg B-2	Deleted description of AXYS ID prior to 1998.
Sep-2002	Appendix B, Table 4	Pg B-4	Revised Table 4- deleted additional worksheet odes, revised codes for sample storage.
Sep-2002	Appendix B, E	Pg B-6	Revised instrument codes to include new instruments.
Sep-2002	Appendix B, G	Pg B-7-9	Described revised system for numbering methods and naming custom methods.
Sep-2002	Appendix C, 1	Pg C-2-5	Revised document naming system to conform to Q-Pulse naming.
Sep-2002	Appendix C, 2	Pg C-5-6	Revised to deleted matrix specific method numbers. Revised format of methods.
Sep-2002	Appendix C, 3	Pg C-7-8	Revised to describe Q-Pulse numbers for SOPs.
Sep-2002	Appendix E	Pg D-2 Pg D-3	Added “Bias” to glossary. Added “CRQL” to glossary. Added “Internal Standard” to glossary.

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Sep-2002	Appendix F	Revised to include distinction between surrogate and recovery standards.
Sep-2002	Appendix G F-1-5	Replaced floor plans with up-to-date plans.

The following amendments were made to the QA/QC Policies and Procedures Manual Rev. 5. All amendments were authorized by the QA Manager.

Date	Section	Amendment
Aug 12/99	II, 2 pg 8	QA Manager changed to QA Manager.
"	II, 3. 2) pg 10	Methods Approval Chemist changed to Senior Chemist or designate.
"	II, 3. 3) pg 10	Added "or designate".
"	II, 4 pg 13	QA/QC Document Control Chemist changed to QA/Project QC Chemist.
"	III pg 16	Organizational Chart revised to reflect current job titles.
"	III pg 15-19, 23	Job titles changed to be consistent with those in Organizational Chart.
"	IV pg 24, 30, 33	Job titles changed to be consistent with those in Organizational Chart.
"	V pg 35-37	Job titles changed to be consistent with those in Organizational Chart.
"	V, 3. pg 39	Updated Chain-of-Custody Procedures.
"	VI pg 40, 42, 43, 45, 46, 49, 50	Job titles changed to be consistent with Organizational Chart.
"	VI, 2.6 pg 51	Clarified policy of preliminary data requiring authorization.
"	VIII, 6 pg 64	Updated Subcontracting Procedures.
"	VIII pg 54, 63	Job titles changed to be consistent with Organizational Chart.
"	IX pg 67, 71-73	Job titles changed to be consistent with Organizational Chart.
"	Appendix B, B, 4 B-3	"X" becomes "RX".
"	Appendix B, H, 3(ii) B-9	Job titles changed to be consistent with Organizational Chart.
"	Appendix C, C-2, C-5, C-6	Job titles changed to be consistent with Organizational Chart.
Sept 23/99	III pg 16	Organizational Chart revised to add new Group Leaders
"	III pg 17	Added new Group Leaders
"	III pg 23	Assigned Responsibilities revised to add new Group Leaders
May 15/00	III pg 16	Revised Organization Chart
May 15/00	IV pg 23	Revised Assigned Responsibilities
May 15/00	I pg 5	Updated Instrumentation Table
May 15/00	Appendix B pg B-6	Updated Instrument Codes
Sep 26/00	I. 3. pg 6/6a	Added table of NYSDOH accredited methods and statement that policies and procedures are in accordance with NELAC standards.
Sep 26/00	II. 2. 2) pg. 8	Added training in methods and ethical and legal responsibilities. Added training records are maintained.
	pg. 6a	Deleted IAETL membership added CCIL membership
Sep 26/00	VI. 2.6 pg. 51	Reference to Transmission of Data SOP.

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Date	Section	Amendment
		Added title to person signing data. Added requirement for NYSDOH certificate number on NYSDOH reports
Sep 26/00	VIII. 7. pg. 65	Added "Corrective Actions" section.
Sep 26/00	VIII 9. (new) pg. 66	Added "Proper Record Keeping" section.
Oct 30/00	Appendix C. 4.1 C-10	Added Receipt, Analysis data, date of sample receipt.
Oct 30/00	Appendix C 4.3 C-10	Added requirement for title with signature.
Nov 6/00	III. 6.1 pg. 21	Added personnel are trained in ethical and legal responsibilities.
Nov 6/00	III. 6.4 (new) pg. 22/22a	Added Ethical and Legal Responsibilities section.
Nov 6/00	V. 1. pg. 35	Added Receiving Clerk informed of shipment of samples.
Nov 6/00	V. 2.1 (new) pg. 36	Added Sample Acceptance Policy.
Nov 6/00	V. 2.2. pg. 36a	Deleted reference to log-in sheet. Added verifying sample acceptance criteria.
Nov 6/00	V. 2.3. pg. 36b	Deleted reference to log-in sheet.
Dec 29/00	III. 6.1 pg. 21	Deleted reference to conflict of interest. Added Ethical Conduct Statement. Added reference to QA-QC-16.
09-Apr-01	Appendix E	Added Appendix E with Glossary of Definitions.
09-Apr-01	III pg. 15-20	Revised to describe new organizational structure.
09-Apr-01	III pg 23	Revised Assigned Responsibilities.
09-Apr-01	III pg. 16	Revised Organization Chart.
11-Apr-01	I pg. 1	Revised reference to AXYS Group.
11-Apr-01	II pg. 2	Deleted organizational chart of AXYS Group.
02-May-01	II. 5. pg. 14	Revised authority for approval.
03-May-01	III pg 16	Revised Organization Chart
07-May-01	III. 2.3 III, 9.4 pg 18	Deleted word Laboratory. Amended Ethical & Legal Responsibilities in accordance with QA/38 Rev 03.
23-May-01	II. 5 pg 14	Deleted Vice President
Sep-01	Global changes	QA/QC Manager changed to QA Manager. Senior Chemist changed to Technical Director. Sample and Laboratory Preparation Chemist changed to Environmental Analytical Chemist. Laboratory Supervisor changed to VP Extraction Lab.
Sep-01	Management Endorsement pg i	Replaced with Quality Policy Statement.
Sep-01	Responsibility, Distribution and Control pg ii	Deleted numbered copy of QA manual issued to staff – replaced by QA manual available to all staff.
Sep-01	Amendment pages iii-iv	All amendments of QA manual, Rev 5 moved to Appendix F.
Sep-01	I pg 2-4	Revised Scope of Analyses. Revised Table 2 – Instrumentation.
Sep-01	I, 3 pg 6	Revised to include accreditation by State of California, Dept. of Health Services. Deleted reference to CCIL membership.
Sep-01	II, 2, 1) pg 8	Revised distribution of QA manual.

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Date	Section		Amendment
Sep-01	II, 2, 2)	pg 8	Deleted testing of staff.
Sep-01	II, 3	pg 10	Revised distribution of QA manual.
Sep-01	II, 3.1	pg 12	Moved to Section 4.
Sep-01	II, 4	pg 13	Deleted reference to forms, replaced with documents. Deleted reference to distribution of numbered copies of QA manual to staff.
Sep-01	III	pg 15-19	Rewritten to reflect new organizational structure, including revising organizational chart.
Sep-01	III	pg 20	VPs Products/Extraction Lab responsible for tracking.
Sep-01	III	pg 20-22a	Put into new chapter.
Sep-01	IV	pg 24-27	Revised to include new lab, revised floor plans moved to Appendix G.
Sep-01	IV, 1.1	pg 29	Responsibility for monitoring temp. of sample storage changed to Lab Services Group. Specifications for sample storage revised.
Sep-01	IV, 3	pg 32	Revised Safety Committee meetings to monthly – only Analytical staff on committee.
Sep-01	IV, 5.1	pg 33	Deleted point 4. Expanded Point 1. Point 3, deleted whenever staff member is not present.
Sep-01	IV, 6	pg 34	Revised description of computing facilities.
Sep-01	IV, 7	pg 34	Deleted this section.
Sep-01	V, 1	pg 35	Changed responsibility for sample receipt to Assistant Project QC Chemist.
Sep-01	V, 3	pg 39	Changed responsibility for sample receipt to Assistant Project QC Chemist.
Sep-01	VI, 1.1	pg 41	Added Method revisions approved by Technical Director and QA Manager.
Sep-01	VI, 1.6	pg 43	Revised method inventory available to all staff.
Sep-01	VI, 2	pg 43	Changed responsibility for sample receipt to Assistant Project QC Chemist Deleted Group Leader.
Sep-01	VI, Fig 7	pg 44	Added Report Preparation.
Sep-01	VI, 2.1	pg 45	Deviations permitted by Project QC Chemist.
Sep-01	VI, 2.3	pg 47	Deleted “instructions in AXYS Analytical Methods Manual”.
Sep-01	VI, 2.3, 2.4	pg 48, 49	Deleted reference to hand-coded data.
Sep-01	VI, 2.4	pg 49	Responsibility of calculation routines changed to VP Production.
Sep-01	VI, 2.5	pg 50	Changed number of samples in batch to 20.
Sep-01	VI, 2.6	pg 51	Responsibility for reporting changed to Data Management. Deleted Vice President as authorized to sign data reports, added President.
Sep-01	VI, 2.7	pg 52	Added sample prep records, LIMS COC as records that are kept. Deleted QA/QC summary form.
Sep-01	VII, 1	pg 53	Deleted “2 QC samples with every batch”.
Sep-01	VIII, 2.1	pg 59	Added reagent water.

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Date	Section		Amendment
Sep-01	VIII, 2.6	pg 61	Changed responsibility for equipment inventory to Documentation Chemist.
Sep-01	VIII, 5.1	pg 62	Revised management review.
Sep-01	VIII, 5.2	pg 63	Revised Quality System Review.
Sep-01	VIII, 5.3	pg 63	Deleted this section.
Sep-01	VIII, External Audits	pg 63	Deleted external audit as annual audit.
Sep-01	VIII, Performance Audits	pg 63	Deleted reference to blind replicates.
Sep-01	VIII, 6	pg 64	Deleted Purchasing and Receiving Clerk log-in of samples.
Sep-01	VIII, 9.4	pg 66	Deleted Vice-President as authorizing data, replaced with President.
Sep-01	IX, 4	pg 91	Deleted location of Standard Preparation Data Sheets.
Sep-01	Appendix A	p A-3	Deleted in-house software, replaced with commercially available software.
Sep-01	Appendix B	p.B-2	Deleted B.2, duplicates.
Sep-01	Appendix B	p B-3	Revised Table 3.
Sep-01	Appendix B, E	p B-6	Revised Table.
Sep-01	Appendix B. F	pg B-7	Revised naming system.
Sep-01	Appendix B, G	pg B-8	Deleted this section.
Sep-01	Appendix B, H	pg B-8	Deleted this section
Sep-01	Appendix B, H, 2	pg B-9	Deleted this section.
Sep-01	Appendix B, H, 3	pg B-9	Deleted point iii.
Sep-01	Appendix B, I	pg B-10	Deleted HPLC.
Sep-01	Appendix C	pg C-10 – 12	Revised to include EPA report format

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APPENDIX F SGS AXYS ANALYTICAL SERVICES FLOOR PLANS

Refer to QDO-034 "SGS AXYS Analytical Services Floor Plans" for current floor plans.

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APPENDIX G CHEMICAL ABSTRACT (CAS) NUMBER USAGE POLICY

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Chemical Abstract (CAS) Number Usage Policy

1. All CAS numbers used and reported will be supported by a CAS database search. A copy of the database search will be initialed by QA staff to indicate approval and a scanned copy will be maintained on file.
2. Approved CAS numbers will be entered to the LIMS database by Reporting, QA or LIMS staff. The 'approved' field in LIMS will be completed by QA or LIMS staff.

The SGS AXYS LIMS database will be the standard source of CAS numbers for SGS AXYS reports. Use of any other CAS numbers on reports will require the written approval and justification of both the QA Manager and the Project Chemist. Correspondence with the client including the original request, the SGS AXYS reply to the client granting the exception, and a record of the SGS AXYS approval with a description of justification are maintained in the CLIENT File and also recorded or referenced in each applicable Project Note.

Instructions for performing database searches for CAS numbers are in the QA Wiki (in Sharepoint.)

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APPENDIX H DATA FLAGGING CONVENTIONS

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Data Flagging Conventions

SGS AXYS FORMAT FLAGS

C	=	co-eluting congener
ND	=	not detected
NDR	=	peak detected, but did not meet quantification criteria, result reported represents the estimated maximum possible concentration
D	=	dilution data
J	=	concentration less than LMCL
B	=	analyte found in sample and the associated blank
N	=	authentic recovery is not within method/contract control limits
V	=	surrogate recovery is not within method/contract control limits
G	=	lock mass interference present
N/A	=	not available OR not applicable
NQ	=	data not quantifiable
OLR	=	exceeds calibrated linear range, see dilution data
Z	=	compound not requested
X	=	results reported separately (original report and separate reports)
P	=	deletes target or surrogate off report (Excel reports only)
T	=	analyte recalculated against alternate labelled compound(s) or internal standard
H		concentration is estimated (information only value)
TIC		compound identity and concentration are estimated
MAX		concentration is an estimated maximum value

EPA FORMAT FLAGS

C	=	co-eluting congener
U	=	not detected
R/K	=	peak detected, but did not meet quantification criteria, result reported represents the estimated maximum possible concentration
D	=	dilution data
J	=	concentration less than LMCL
B	=	analyte found in sample and the associated blank
N	=	authentic recovery is not within method/contract control limits
V	=	surrogate recovery is not within method/contract control limits
G	=	lock mass interference present
N/A	=	not available OR not applicable

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NQ	=	data not quantifiable
E	=	exceeds calibrated linear range, see dilution data
X	=	results reported separately (original report)
X	=	results from recolumn/reinjection/repeat data (separate report)
P	=	deletes target or surrogate off report (Excel reports only)
T	=	analyte recalculated against alternate labelled compound(s) or internal standard

EPA 8290 FORMAT FLAGS

U	=	not detected
J	=	concentration less than LMCL
B	=	analyte found in sample and the associated blank
EMPC	=	estimated maximum possible amount
E	=	exceeds calibrated linear range, see dilution data
C	=	co-eluting congener
D	=	dilution data
X	=	results reported separately (original report)
X	=	results from recolumn/reinjection/repeat data (separate report)

X only used when required, the rest of the flags will always be present

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Quality Assurance Manual Cover Page (updated 02/20/2018)

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Title Page:

Quality Assurance Manual
Approval Signatures

Laboratory Director – Don Dawicki	3-5-2018 Date
Quality Assurance Manager - Luke Orchard	2-20-2018 Date
Technical Manager – Kristine Dusablon	3-5-2018 Date
Operations Manager – Matthew Kirk	3-19-2018 Date

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REFERENCED CORPORATE SOPs AND POLICIES

SOP / Policy Reference	Title
CA-I-P-002	Electronic Reporting and Signature Policy
CA-L-P-002	Contract Compliance Policy
CA-Q-M-002	Corporate Quality Management Plan
CA-Q-S-001	Solvent and Acid Lot Testing and Approval
CA-Q-S-002	Acceptable Manual Integration Practices
CA-Q-S-006	Detection Limits
CA-Q-S-009	Root Cause Analysis
CA-T-P-001	Qualified Products List
CW-E-M-001	Corporate Environmental Health & Safety Manual
CW-F-P-002	Company-Wide Authorization Matrix
CW-F-P-004	Procurement and Contracts Policy
CW-F-S-007	Capital Expenditure, Controlled Purchase Requests and Fixed Asset Capitalization
CW-L-P-004	Ethics Policy
CW-L-S-002	Internal Investigation
CW-L-S-004	Subcontracting Procedures
CW-Q-S-001	Corporate Document Control and Archiving
CW-Q-S-002	Writing a Standard Operating Procedure (SOPs)
CW-Q-S-003	Internal Auditing
CW-Q-S-004	Management Systems Review
CW-Q-S-005	Data Recall Process
CA-C-S-001	Work Sharing Process

REFERENCED LABORATORY SOPs

SOP Reference	Title
BR-QA-003	Document Control
BR-QA-004	Complaint Resolution
BR-QA-011	Lab Training & DOC
BR-QA-005	Detection Limits
BR-QA-020	Subsampling and Homogenization
BR-SM-001	Sample Receipt / Login

SECTION 3. INTRODUCTION, SCOPE AND APPLICABILITY

3.1 Introduction and Compliance References

TestAmerica Burlington's Quality Assurance Manual (QAM) is a document prepared to define the overall policies, organization objectives and functional responsibilities for achieving TestAmerica's data quality goals. The laboratory maintains a local perspective in its scope of services and client relations and maintains a national perspective in terms of quality.

The QAM has been prepared to assure compliance with The NELAC Institute (TNI) Standard, dated 2009, Volume 1 Modules 2 and 4, and ISO/IEC Guide 17025:2005(E). In addition, the policies and procedures outlined in this manual are compliant with TestAmerica's Corporate Quality Management Plan (CQMP) and the various accreditation and certification programs listed in Appendix 3. The CQMP provides a summary of TestAmerica's quality and data integrity system. It contains requirements and general guidelines under which all TestAmerica facilities shall conduct their operations.

The QAM has been prepared to be consistent with the requirements of the following documents:

- ANSI/ASQC, E4-1994, "Specifications and Guidelines for Quality Management Systems for Environmental Data Collection and Environmental Technology Programs" (American National Standard, January 5, 1995, or most recent version)
- "EPA Requirements for Quality Management Programs" (QA/R-2) (EPA/240/B-01/002, May 31, 2006).
- EPA 600/4-88/039, *Methods for the Determination of Organic Compounds in Drinking Water,* EPA, Revised July 1991.
- EPA 600/R-95/131, *Methods for the Determination of Organic Compounds in Drinking Water,* Supplement III, EPA, August 1995.
- EPA 600/4-79-019, *Handbook for Analytical Quality Control in Water and Wastewater Laboratories,* EPA, March 1979.
- *Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846), Third Edition, September 1986, Final Update I, July 1992, Final Update IIA, August 1993, Final Update II, September 1994; Final Update IIB, January 1995; Final Update III, December 1996; Final Update IV, January 2008; Final Update V, August 2015.*
- *U.S. Department of Defense (DoD)/Department of Energy (DOE) Consolidated Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1.1, 2018.*
- Federal Register, 40 CFR Parts 136, 141, 172, 173, 178, 179 and 261.
- *Manual for the Certification of Laboratories Analyzing Drinking Water (EPA 815-R-05-004, January 2005) (DW labs only)*
- *Statement of Work for Inorganics & Organics Analysis, SOM and ISM, current versions, USEPA Contract Laboratory Program Multi-media, Multi-concentration.*
- APHA, *Standard Methods for* the Examination of Water and Wastewater, 18th Edition, 19th, 20th, 21st, and on-line Editions.
- Marine Protection, Research, and Sanctuaries Act (MPRSA).
- Toxic Substances Control Act (TSCA).

3.2 Terms and Definitions

A Quality Assurance Program is a company-wide system designed to ensure that data produced by the laboratory conforms to the standards set by state and/or federal regulations. The program functions at the management level through company goals and management policies, and at the analytical level through Standard Operating Procedures (SOPs) and quality control. The TestAmerica program is designed to minimize systematic error, encourage constructive, documented problem solving, and provide a framework for continuous improvement within the organization.

Refer to Appendix 2 for the Glossary/Acronyms.

3.3 Scope / Fields of Testing

The laboratory analyzes a broad range of environmental and industrial samples every month. Sample matrices vary among air, drinking water, effluent water, groundwater, hazardous waste, sludge, soils, sediment, tissue and other biological matrices. The Quality Assurance Program contains specific procedures and methods to test samples of differing matrices for chemical and physical parameters. The Program also contains guidelines on maintaining documentation of analytical processes, reviewing results, servicing clients and tracking samples through the laboratory. The technical and service requirements of all analytical requests are thoroughly evaluated before commitments are made to accept the work. Measurements are made using published reference methods or methods developed and validated by the laboratory.

The methods covered by this manual include the most frequently requested methodologies needed to provide analytical services in the United States and its territories. The specific list of test methods used by the laboratory can be found in the Laboratory Information Management System (TALS). The approach of this manual is to define the minimum level of quality assurance and quality control necessary to meet these requirements. All methods performed by the laboratory shall meet these criteria as appropriate. In some instances, quality assurance project plans (QAPPs), project specific data quality objectives (DQOs) or local regulations may require criteria other than those contained in this manual. In these cases, the laboratory will abide by the requested criteria following review and acceptance of the requirements by the Laboratory Director and the Quality Assurance (QA) Manager. In some cases, QAPPs and DQOs may specify less stringent requirements. The Laboratory Director and the QA Manager must determine if it is in the lab's best interest to follow the less stringent requirements.

3.4 Management of the Manual

3.4.1 Review Process

The template on which this manual is based is reviewed annually by Corporate Quality Management Personnel to assure that it remains in compliance with Section 3.1. This manual itself is reviewed annually by senior laboratory management to assure that it reflects current practices and meets the requirements of the laboratory's clients and regulators as well as the CQMP. Occasionally, the manual may need changes in order to meet new or changing regulations and operations. The QA Manager will review the changes in the normal course of business and incorporate changes into revised sections of the document. All updates will be reviewed by the senior laboratory management staff. The laboratory updates and approves

such changes according to our Document Control & Updating procedures SOP No. BR-QA-003, Document Control.

SECTION 4. MANAGEMENT REQUIREMENTS

4.1 Overview

TestAmerica Burlington is a local operating unit of TestAmerica Laboratories, Inc.. The organizational structure, responsibilities and authorities of the corporate staff of TestAmerica Laboratories, Inc. are presented in the CQMP. The laboratory has day-to-day independent operational authority overseen by corporate officers (e.g., President and Chief Executive Officer (CEO), Chief Operating Officer (COO), Executive Vice President (VP) Operations, Corporate Quality, etc.). The laboratory operational and support staff work under the direction of the Laboratory Director. The organizational structure for both Corporate & TestAmerica Burlington is presented in Figure 4-1.

4.2 Roles and Responsibilities

In order for the Quality Assurance Program to function properly, all members of the staff must clearly understand and meet their individual responsibilities as they relate to the quality program. The following descriptions briefly define each role in its relationship to the Quality Assurance Program.

4.2.1 Additional Requirements for Laboratories

The responsibility for quality resides with every employee of the laboratory. All employees have access to the QAM, are trained to this manual, and are responsible for upholding the standards therein. Each person carries out his/her daily tasks in a manner consistent with the goals and in accordance with the procedures in this manual and the laboratory's SOPs. Role descriptions for Corporate personnel are defined in the CQMP (CA-Q-M-002). This manual is specific to the operations of TestAmerica's Burlington laboratory.

4.2.2 Vice President of Operations

Each VP of Operations reports directly to the Executive VP of Operations and is a part of the Executive Committee. Each VP of Operations is responsible for the overall administrative and operational management of their respective laboratories. The VP's responsibilities include allocation of personnel and resources, long-term planning, goal setting, and achieving the financial, business, and quality objectives of TestAmerica. The VP's ensure timely compliance with Corporate Management directives, policies, and management systems reviews. The VP's are also responsible for restricting any laboratory from performing analyses that cannot be consistently and successfully performed to meet the standards set forth in this manual.

4.2.3 Laboratory Director

TestAmerica Burlington's Laboratory Director is responsible for the overall quality, safety, financial, technical, human resource and service performance of the whole laboratory and reports to their respective VPO. The Laboratory Director provides the resources necessary to implement and maintain an effective and comprehensive Quality Assurance and Data Integrity Program.

Specific responsibilities include, but are not limited to:

- Provides one or more technical managers for the appropriate fields of testing. If the Technical Manager is absent for a period of time exceeding 15 consecutive calendar days, the Laboratory Director must designate another full time staff member meeting the qualifications of the Technical Manager to temporarily perform this function. If the absence exceeds 65 consecutive calendar days, the primary accrediting authority must be notified in writing.
- Ensures that all analysts and supervisors have the appropriate education and training to properly carry out the duties assigned to them and ensures that this training has been documented.
- Ensures that personnel are free from any commercial, financial and other undue pressures which might adversely affect the quality of their work.
- Ensures TestAmerica's human resource policies are adhered to and maintained.
- Ensures that sufficient numbers of qualified personnel are employed to supervise and perform the work of the laboratory.
- Ensures that appropriate corrective actions are taken to address analyses identified as requiring such actions by internal and external performance or procedural audits. Procedures that do not meet the standards set forth in the QAM or laboratory SOPs may be temporarily suspended by the Laboratory Director.
- Reviews and approves all SOPs prior to their implementation and ensures all approved SOPs are implemented and adhered to.
- Pursues and maintains appropriate laboratory certification and contract approvals. Supports ISO 17025 requirements.
- Ensures client specific reporting and quality control requirements are met.
- Captains the management team, consisting of the QA Manager, the Technical Manager(s), and the Department Manager(s)/Supervisor(s) as direct reports.

4.2.4 Technical Director

The Technical Manager reports directly to the Laboratory Director. He/she is accountable for all analyses and analysts under their experienced supervision and for compliance with the ISO 17025 Standard. The scope of responsibility ranges from the new-hire process and existing technology through the ongoing training and development programs for existing analysts and new instrumentation. Specific responsibilities include, but are not limited to:

- Exercises day-to-day supervision of laboratory operations for the appropriate field of accreditation and reporting of results. Coordinating, writing, and reviewing preparation of all test methods, i.e., SOPs, with regard to quality, integrity, regulatory and optimum and efficient production techniques, and subsequent analyst training and interpretation of the SOPs for implementation and unusual project samples. He/she insures that the SOPs are properly managed and adhered to at the bench. He/she develops standard costing of SOPs to include supplies, labor, overhead, and capacity (design vs. demonstrated versus first-run yield) utilization.

- Reviewing and approving, with input from the QA Manager, proposals from marketing, in accordance with an established procedure for the review of requests and contracts. This procedure addresses the adequate definition of methods to be used for analysis and any limitations, the laboratory's capability and resources and the client's expectations. Differences are resolved before the contract is signed and work begins. A system documenting any significant changes is maintained, as well as pertinent discussions with the client regarding their requirements or the results of the analyses during the performance of the contract. All work subcontracted by the laboratory must be approved by the client. Any deviations from the contract must be disclosed to the client. Once the work has begun, any amendments to the contract must be discussed with the client and so documented.

- Monitoring the validity of the analyses performed and data generated in the laboratory. This activity begins with reviewing and supporting all new business contracts, insuring data quality, analyzing internal and external non-conformances to identify root cause issues and implementing the resulting corrective and preventive actions, facilitating the data review process (training, development, and accountability at the bench), and providing technical and troubleshooting expertise on routine and unusual or complex problems.

- Providing training and development programs to applicable laboratory staff as new hires and, subsequently, on a scheduled basis. Training includes instruction on calculations, instrumentation management to include troubleshooting and preventive maintenance.

- Enhancing efficiency and improving quality through technical advances and improved LIMS utilization. Capital forecasting and instrument life cycle planning for second generation methods and instruments as well as asset inventory management.

- Coordinating sample management from "cradle to grave," insuring that no time is lost in locating samples.

- Scheduling all QA/QC-related requirements for compliance, e.g., MDLs, etc.

- Captains department personnel to communicate quality, technical, personnel, and instrumental issues for a consistent team approach.

- Coordinates audit responses with the QA Manager.

- Compliance with ISO 17025.

- Compliance with DoD ELAP.

4.2.5 Quality Assurance (QA) Manager or Designee

The QA Manager has responsibility and authority to ensure the continuous implementation of the quality system.

The QA Manager reports directly to the Laboratory Director and their Corporate Quality Director. This position is able to evaluate data objectively and perform assessments without outside (e.g., managerial) influence. Corporate QA may be used as a resource in dealing with regulatory

requirements, certifications and other quality assurance related items. The QA Manager directs the activities of the QA officers to accomplish specific responsibilities, which include, but are not limited to:

- Serves as the focal point for QA/QC in the laboratory.
- Having functions independent from laboratory operations for which he/she has quality assurance oversight.
- Maintaining and updating the QAM.
- Monitoring and evaluating laboratory certifications; scheduling proficiency testing samples.
- Monitoring and communicating regulatory changes that may affect the laboratory to management.
- Training and advising the laboratory staff on quality assurance/quality control procedures that are pertinent to their daily activities.
- Have documented training and/or experience in QA/QC procedures and the laboratory's Quality System.
- Having a general knowledge of the analytical test methods for which data audit/review is performed (and/or having the means of getting this information when needed).
- Arranging for or conducting internal audits on quality systems and the technical operation.
- The laboratory QA Manager will maintain records of all ethics-related training, including the type and proof of attendance.
- Maintain, improve, and evaluate the corrective action database and the corrective and preventive action systems.
- Notifying laboratory management of deficiencies in the quality system and ensuring corrective action is taken. Procedures that do not meet the standards set forth in the QAM or laboratory SOPs shall be investigated following procedures outlined in Section 12 and if deemed necessary may be temporarily suspended during the investigation.
- Objectively monitor standards of performance in quality control and quality assurance without outside (e.g., managerial) influence.
- Coordinating of document control of SOPs, MDLs, control limits, and miscellaneous forms and information.
- Review a percentage of all final data reports for internal consistency. Review of Chain of Custody (COC), correspondence with the analytical request, batch QC status, completeness of any corrective action statements, evaluate manual calculations, format, holding time, sensibility and completeness of the project file contents.
- Review of external audit reports and data validation requests.
- Follow-up with audits to ensure client QAPP requirements are met.
- Establishment of reporting schedule and preparation of various quality reports for the Laboratory Director, clients and/or Corporate QA.
- Development of suggestions and recommendations to improve quality systems.
- Research of current state and federal requirements and guidelines.

- Captains the QA team to enable communication and to distribute duties and responsibilities.
- Ensuring Communication & monitoring standards of performance to ensure that systems are in place to produce the level of quality as defined in this document.
- Notifying laboratory management of deficiencies in the quality system and ensuring corrective action is taken. Procedures that do not meet the standards set forth in the QAM or laboratory SOPs are temporarily suspended following the procedures outlined in Section 12.
- Evaluation of the thoroughness and effectiveness of training.
- Compliance with ISO 17025.
- Compliance with the DoD/DOE QSM.

4.2.6 Operations Manager

The Operations Manager manages and directs the analytical production sections of the laboratory. He/She reports directly to the Laboratory Director. He/She assists the Technical Director in determining the most efficient instrument utilization. More specifically, he/she:

- Evaluates the level of internal/external non-conformances for all departments.
- Continuously evaluates production capacity and improves capacity utilization.
- Continuously evaluates turnaround time and addresses any problems that may hinder meeting the required and committed turnaround time from the various departments.
- Develops and improves the training of all analysts in cooperation with the Technical Manager and QA Manager and in compliance with regulatory requirements.
- Is responsible for efficient utilization of supplies.
- Constantly monitors and modifies the processing of samples through the departments.
- Fully supports the quality system and, if called upon in the absence of the QA Manager, serves as his substitute in the interim.

4.2.7 Supervisors

Supervisors report to the Operations Manager. Each one is responsible to:

- Ensure that analysts in their department adhere to applicable SOPs and the QA Manual. They perform frequent SOP and QA Manual review to determine if analysts are in compliance and if new, modified, and optimized measures are feasible and should be added to these documents.
- Provide guidance to analysts in resolving problems encountered daily during sample prep/analysis in conjunction with the Technical Manager, Operations Manager, and/or QA Manager. Each is responsible for 100% of the data review and documentation, non-conformance and CPAR issues, the timely and accurate completion of performance evaluation samples and MDLs, for his department.
- Ensure all logbooks are maintained, current, and properly labeled or archived.
- Report all non-conformance conditions to the QA Manager, Technical Manager, Operations Manager, and/or Laboratory Director.

- Ensure that preventive maintenance is performed on instrumentation as detailed in the QA Manual or SOPs. He is responsible for developing and implementing a system for preventive maintenance, troubleshooting, and repairing or arranging for repair of instruments.
- Maintain adequate and valid inventory of reagents, standards, spare parts, and other relevant resources required to perform daily analysis.
- Achieve optimum turnaround time on analyses and compliance with holding times.
- Conduct efficiency and cost control evaluations on an ongoing basis to determine optimization of labor, supplies, overtime, first-run yield, capacity (designed vs. demonstrated), second- and third-generation production techniques/instruments, and long-term needs for budgetary planning.
- Develop, implement, and enhance calibration programs.
- Provide written responses to external and internal audit issues.

4.2.8 Laboratory Analysts

Laboratory analysts are responsible for conducting analysis and performing all tasks assigned to them by the group manager or supervisor. The responsibilities of the analysts are listed below:

- Perform analyses by adhering to analytical and quality control protocols prescribed by current SOPs, this QA Manual, and project-specific plans honestly, accurately, timely, safely, and in the most cost-effective manner.
- Document standard and sample preparation, instrument calibration and maintenance, data calculations, sample matrix effects, and any observed non-conformance on worklists, benchsheets, lab notebooks and/or the Non-Conformance Database.
- Report all non-conformance situations, instrument problems, matrix problems and QC failures, which might affect the reliability of the data, to their supervisor, the Technical Manager, and/or the QA Manager or member of QA staff.
- Perform 100% review of the data generated prior to entering and submitting for secondary level review.
- Suggest method improvements to their supervisor, the Operations Manager, and the QA Manager. These improvements, if approved, will be incorporated. Ideas for the optimum performance of their assigned area, for example, through the proper cleaning and maintenance of the assigned instruments and equipment, are encouraged.
- Work cohesively as a team in their department to achieve the goals of accurate results, optimum turnaround time, cost effectiveness, cleanliness, complete documentation, and personal knowledge of environmental analysis.

4.2.9 Project Manager (PM)

The PM reports to the Manager of Project Management (MPM) and serves as the interface between the laboratory's technical departments and the laboratory's clients. There is an entire staff of Project Managers that makes up the Project Management team. With the overall goal of total client satisfaction, the functions of this position are outlined below:

- Technical training and growth of the Project Management team.
- Technical liaison for the Project Management team.
- Responsible to ensure that clients receive the proper sampling supplies.
- Accountable for response to client inquiries concerning sample status.
- Responsible for assistance to clients regarding the resolution of problems concerning COC.
- Ensuring that client specifications, when known, are met by communicating project and quality assurance requirements to the laboratory.
- Notifying the laboratory of incoming projects and sample delivery schedules.
- Accountable to clients for communicating sample progress in daily status meeting with agreed-upon due dates.
- Responsible for discussing with client any project-related problems, resolving service issues, and coordinating technical details with the laboratory staff.
- Responsible for staff familiarization with specific quotes, sample log-in review, and final report completeness.
- Monitor the status of all data package projects in-house to ensure timely and accurate delivery of reports.
- Inform clients of data package-related problems and resolve service issues.
- Coordinate requests for sample containers and other services (data packages).

4.2.10 Environmental Health and Safety Manager

At TestAmerica's Burlington Laboratory the regional EHS Manager is responsible for the development and implementation of the TestAmerica Environmental, Health and Safety program. The EHS Manager reports directly to Laboratory Director and the VP-QA/EHS. Responsibilities include:

- Consolidation and tracking all safety and health-related information and reports for the company, and managing compliance activities for TestAmerica locations.
- Coordination/preparation of the corporate Environmental, Health and Safety Manual Template that is used by each laboratory to prepare its own laboratory-specific Safety Manual/ CHP.
- Prepare and provide EHS information and training materials to the laboratory.
- Assistance in the internal and external coordination of employee exposure and medical monitoring programs to insure compliance with applicable safety and health regulations.
- Serving as Department of Transportation (D.O.T.) focal point and providing technical assistance to location management.
- Serving as Hazardous Waste Management main contact and providing technical assistance to location management.
- Reviewing and updating annually the Hazardous Waste Contingency Plan in the Environmental Health & Safety Manual.

- Auditing the staff with regard to compliance with the Hazardous Waste Contingency Plan.
- Monitors all areas for unsafe conditions, acts, and potential hazards.
- Enforces environmental, health, and safety policies and procedures.
- Maintains regulatory compliance with local, state, and federal laws.
- Makes safety and health recommendations to laboratory management in conjunction with the facility safety committee.

4.2.11 Environmental Health and Safety Coordinator

The Environmental Health and Safety Coordinator (EHSC) reports to the Laboratory Director and the Region Environmental Health and Safety Manager and ensures that systems are maintained for the safe operation of the laboratory. The EHSC is responsible to:

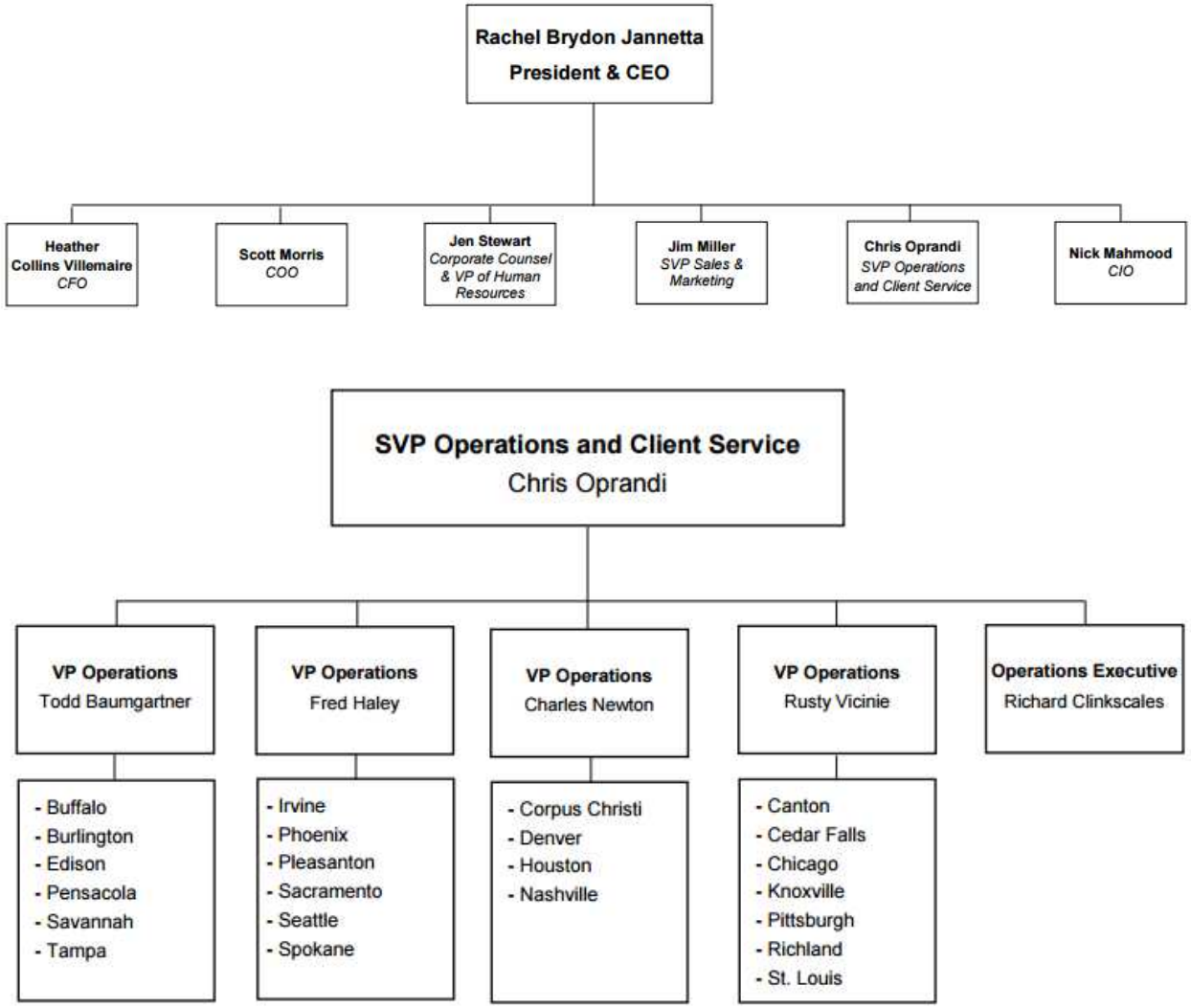
- Conduct ongoing, necessary safety training and conduct new employee safety orientation.
- Assist in developing and maintaining the Chemical Hygiene/Safety Manual.
- Administer dispersal of all Material Safety Data Sheet (MSDS) information.
- Perform regular chemical hygiene and housekeeping instruction.
- Give instruction on proper labeling and practice.
- Serve as chairman of the laboratory safety committee.
- Provide and train personnel on protective equipment.
- Oversee the inspection and maintenance of general safety equipment – fire extinguishers, safety showers, eyewash fountains, etc. and ensure prompt repairs as needed.
- Supervise and schedule fire drills and emergency evacuation drills.
- Determine what initial and subsequent exposure monitoring, if necessary to determine potential employee exposure to chemicals used in the laboratory.
- When determined necessary, conduct exposure monitoring assessments.
- Determine when a complaint of possible over-exposure is “reasonable” and should be referred for medical consultation.
- Assist in the internal and external coordination of the medical consultation/monitoring program conducted by TestAmerica’s medical consultants.

4.3 Deputies

The following table defines who assumes the responsibilities of key personnel in their absence:

Key Personnel	Deputy
Don Dawicki Laboratory Director	Operations Manager
Luke Orchard Quality Manager	Laboratory Director Technical Director Quality Specialist
Kristine Dusablon Technical Director	Laboratory Director Quality Manager
Matthew Kirk Operations Manager	Laboratory Director Technical Director
Matthew D. Kirk Inorganics Supervisor	Operations Manager Technical Director
William R. Desjardins Specialty Organics Supervisor	Operations Manager Technical Director
Benjamin H.O. Kirchner CLP Organics Supervisor	Operations Manager Technical Director
Scott Lavigne Sample Management Supervisor	Operations Manager Technical Director
Thomas Deaton Organic Extractions Supervisor	Operations Manager Technical Director
Dan W. Helfrich EHS Manager	Laboratory Director Environmental Health and Safety Coordinator
Benjamin H.O. Kirchner EHS Coordinator	EHS Manager Laboratory Director

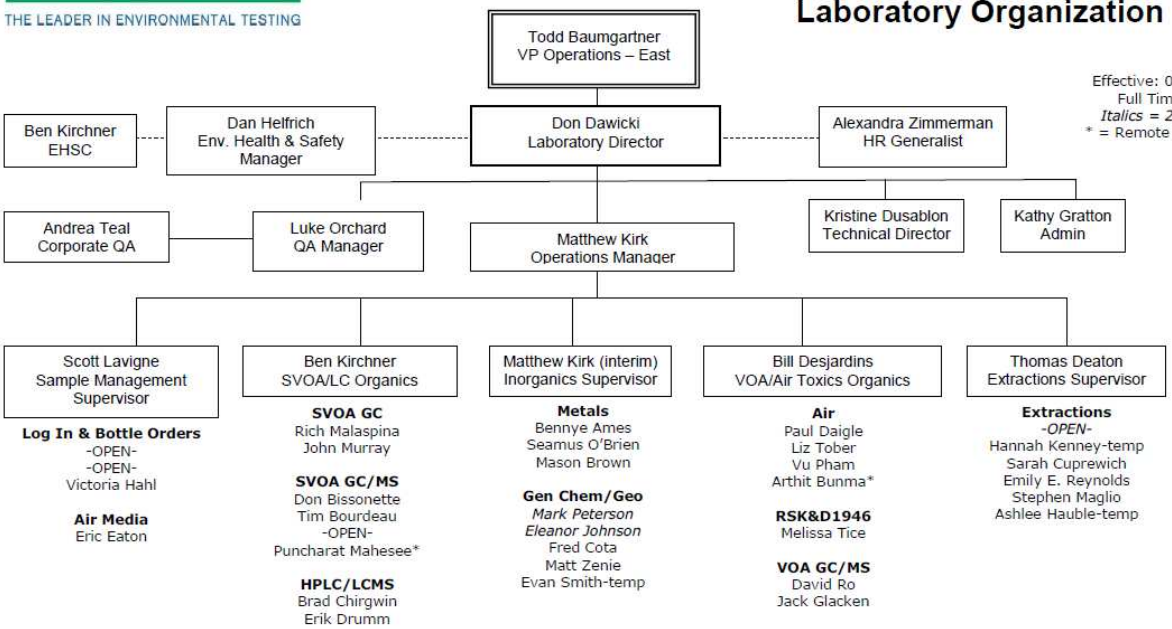
Figure 4-1. Corporate and Laboratory Organization Charts

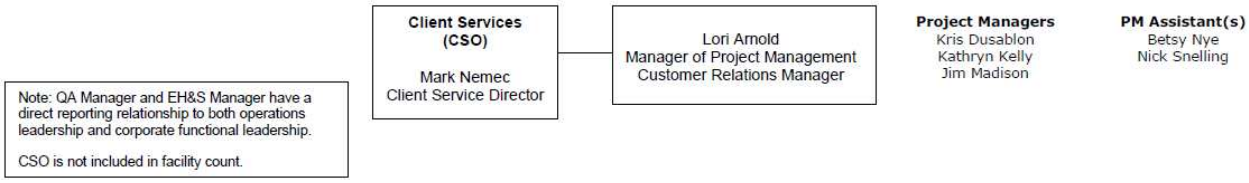


TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Burlington Laboratory Organization

Effective: 03/05/18
Full Time: 34
Italics = 2nd Shift
* = Remote Reviewer





Note: QA Manager and EH&S Manager have a direct reporting relationship to both operations leadership and corporate functional leadership.

CSO is not included in facility count.

SECTION 5. QUALITY SYSTEM

5.1 Quality Policy Statement

It is TestAmerica's Policy to:

- Provide data of known quality to its clients by adhering to approved methodologies, regulatory requirements and the QA/QC protocols.
- Effectively manage all aspects of the laboratory and business operations by the highest ethical standards.
- Continually improve systems and provide support to quality improvement efforts in laboratory, administrative and managerial activities. TestAmerica recognizes that the implementation of a quality assurance program requires management's commitment and support as well as the involvement of the entire staff.
- Provide clients with the highest level of professionalism and the best service practices in the industry.
- To comply with the ISO/IEC 17025:2005(E) International Standard, the 2009 TNI Standard and to continually improve the effectiveness of the management system.

Every staff member at the laboratory plays an integral part in quality assurance and is held responsible and accountable for the quality of their work. It is, therefore, required that all laboratory personnel are trained and agree to comply with applicable procedures and requirements established by this document.

5.2 Ethics and Data Integrity

TestAmerica is committed to ensuring the integrity of its data and meeting the quality needs of its clients. The elements of TestAmerica's Ethics and Data Integrity Program include:

- An Ethics Policy (Corporate Policy No. CW-L-P-004) and Employee Ethics Statements.
- Ethics and Compliance Officers (ECOs).
- A Training Program.
- Self-governance through disciplinary action for violations.
- A Confidential mechanism for anonymously reporting alleged misconduct and a means for conducting internal investigations of all alleged misconduct. (Corporate SOP No. CW-L-S-002).
- Procedures and guidance for recalling data if necessary (Corporate SOP No. CA-Q-S-005).
- Effective external and internal monitoring system that includes procedures for internal audits (Section 15).
- Produce results, which are accurate and include QA/QC information that meets client pre-defined Data Quality Objectives (DQOs).
- Present services in a confidential, honest and forthright manner.

- Provide employees with guidelines and an understanding of the Ethical and Quality Standards of our Industry.
- Operate our facilities in a manner that protects the environment and the health and safety of employees and the public.
- Obey all pertinent federal, state and local laws and regulations and encourage other members of our industry to do the same.
- Educate clients as to the extent and kinds of services available.
- Assert competency only for work for which adequate personnel and equipment are available and for which adequate preparation has been made.
- Promote the status of environmental laboratories, their employees, and the value of services rendered by them.

5.3 Quality System Documentation

The laboratory's Quality System is communicated through a variety of documents.

- Quality Assurance Manual – Each laboratory has a lab-specific quality assurance manual.
- Corporate SOPs and Policies – Corporate SOPs and Policies are developed for use by all relevant laboratories. They are incorporated into the laboratory's normal SOP distribution, training and tracking system. Corporate SOPs may be general or technical.
- Work Instructions – A subset of procedural steps, tasks or forms associated with an operation of a management system (e.g., checklists, preformatted bench sheets, forms).
- Laboratory SOPs – General and Technical
- Laboratory QA/QC Policy Memorandums

5.3.1 Order of Precedence

In the event of a conflict or discrepancy between policies, the order of precedence is as follows:

- Corporate Quality Management Plan (CQMP)
- Corporate SOPs and Policies
- Laboratory QA/QC Policy Memorandum
- Laboratory Quality Assurance Manual (QAM)
- Laboratory SOPs and Policies
- Other (Work Instructions (WI), memos, flow charts, etc.)

NOTE: The laboratory has the responsibility and authority to operate in compliance with regulatory requirements of the jurisdiction in which the work is performed. Where the CQMP conflicts with those regulatory requirements, the regulatory requirements of the jurisdiction shall hold primacy. The laboratory's QAM shall take precedence over the CQMP in those cases.

5.4 QA/QC Objectives for the Measurement of Data

Quality Assurance (QA) and Quality Control (QC) are activities undertaken to achieve the goal of producing data that accurately characterize the sites or materials that have been sampled. Quality Assurance is generally understood to be more comprehensive than Quality Control. Quality Assurance can be defined as the integrated system of activities that ensures that a product or service meets defined standards.

Quality Control is generally understood to be limited to the analyses of samples and to be synonymous with the term *"analytical quality control"*. QC refers to the routine application of statistically based procedures to evaluate and control the accuracy of results from analytical measurements. The QC program includes procedures for estimating and controlling precision and bias and for determining reporting limits.

Request for Proposals (RFPs) and Quality Assurance Project Plans (QAPP) provide a mechanism for the client and the laboratory to discuss the data quality objectives in order to ensure that analytical services closely correspond to client needs. The client is responsible for developing the QAPP. In order to ensure the ability of the laboratory to meet the Data Quality Objectives (DQOs) specified in the QAPP, clients are advised to allow time for the laboratory to review the QAPP before being finalized. Additionally, the laboratory will provide support to the client for developing the sections of the QAPP that concern laboratory activities.

Historically, laboratories have described their QC objectives in terms of precision, accuracy, representativeness, comparability, completeness, selectivity and sensitivity (PARCCSS).

5.4.1 Precision

The laboratory objective for precision is to meet the performance for precision demonstrated for the methods on similar samples and to meet data quality objectives of the EPA and/or other regulatory programs. Precision is defined as the degree of reproducibility of measurements under a given set of analytical conditions (exclusive of field sampling variability). Precision is documented on the basis of replicate analysis, usually duplicate or matrix spike (MS) duplicate samples.

5.4.2 Accuracy

The laboratory objective for accuracy is to meet the performance for accuracy demonstrated for the methods on similar samples and to meet data quality objectives of the EPA and/or other regulatory programs. Accuracy is defined as the degree of bias in a measurement system. Accuracy may be documented through the use of laboratory control samples (LCS) and/or MS. A statement of accuracy is expressed as an interval of acceptance recovery about the mean recovery.

5.4.3 Representativeness

The laboratory objective for representativeness is to provide data which is representative of the sampled medium. Representativeness is defined as the degree to which data represent a characteristic of a population or set of samples and is a measurement of both analytical and field sampling precision. The representativeness of the analytical data is a function of the procedures used in procuring and processing the samples. The representativeness can be

documented by the relative percent difference between separately procured, but otherwise identical samples or sample aliquots.

The representativeness of the data from the sampling sites depends on both the sampling procedures and the analytical procedures. The laboratory may provide guidance to the client regarding proper sampling and handling methods in order to assure the integrity of the samples.

5.4.4 Comparability

The comparability objective is to provide analytical data for which the accuracy, precision, representativeness and reporting limit statistics are similar to these quality indicators generated by other laboratories for similar samples, and data generated by the laboratory over time.

The comparability objective is documented by inter-laboratory studies carried out by regulatory agencies or carried out for specific projects or contracts, by comparison of periodically generated statements of accuracy, precision and reporting limits with those of other laboratories.

5.4.5 Completeness

The completeness objective for data is 90% (or as specified by a particular project), expressed as the ratio of the valid data to the total data over the course of the project. Data will be considered valid if they are adequate for their intended use. Data usability will be defined in a QAPP, project scope or regulatory requirement. Data validation is the process for reviewing data to determine its usability and completeness. If the completeness objective is not met, actions will be taken internally and with the data user to improve performance. This may take the form of an audit to evaluate the methodology and procedures as possible sources for the difficulty or may result in a recommendation to use a different method.

5.4.6 Selectivity

Selectivity is defined as: The capability of a test method or instrument to respond to a target substance or constituent in the presence of non-target substances. Target analytes are separated from non-target constituents and subsequently identified/detected through one or more of the following, depending on the analytical method: extractions (separation), digestions (separation), inter-element corrections (separation), use of matrix modifiers (separation), specific retention times (separation and identification), confirmations with different columns or detectors (separation and identification), specific wavelengths (identification), specific mass spectra (identification), specific electrodes (separation and identification), etc..

5.4.7 Sensitivity

Sensitivity refers to the amount of analyte necessary to produce a detector response that can be reliably detected (Method Detection Limit) or quantified (Reporting Limit).

5.5 Criteria for Quality Indicators

The laboratory maintains a Quality Control Limit Summary in the Laboratory Information Management System (LIMS). These tables summarize the precision and accuracy acceptability

limits for performed analyses. This summary includes an effective date, is updated each time new limits are generated and are managed by the laboratory's QA department. Unless otherwise noted, limits within these tables are laboratory generated. Some acceptability limits are derived from US EPA methods when they are required. Where US EPA method limits are not required, the laboratory has developed limits from evaluation of data from similar matrices. Criteria for development of control limits is contained in BR-QA-013, Control Charts, Trend Analysis and In-House Limits.

5.6 Statistical Quality Control

Statistically-derived precision and accuracy limits are required by selected methods (such as SW-846). The laboratory routinely utilizes statistically-derived limits to evaluate method performance and determine when corrective action is appropriate. The analysts are instructed to use the current limits in the Laboratory Information Management System (LIMS). Limits are entered into the Method Limit Groups according to the effective date. Historical limits can be obtained using the "Historical" feature in the LIMS. If a method defines the QC limits, the method limits are used.

If a method requires the generation of historical limits, the lab develops such limits from recent data in the QC database of the LIMS following the guidelines described in Section 24. All calculations and limits are documented and dated when approved and effective. On occasion, a client requests contract-specified limits for a specific project.

Current QC limits are entered and maintained in the LIMS analyte database. As sample results and the related QC are entered into LIMS, the sample QC values are compared with the limits in LIMS to determine if they are within the acceptable range. The analyst then evaluates if the sample needs to be rerun or re-extracted/rerun or if a comment should be added to the report explaining the reason for the QC outlier.

5.6.1 QC Charts

The laboratory's procedures for the creation of control charts are described in the laboratory SOP BR-QA-013, Control Charts, Trend Analysis and In-House Limits. Control charts are created from data stored in the LIMS. The charts are evaluated by QA or technical staff to determine if limits need to be updated or to assess the need for corrective actions to improve method performance.

5.7 Quality System Metrics

In addition to the QC parameters discussed above, the entire Quality System is evaluated on a monthly basis through the use of specific metrics (refer to Section 16). These metrics are used to drive continuous improvement in the laboratory's Quality System.

SECTION 6. DOCUMENT CONTROL

6.1 Overview

The QA Department is responsible for the control of documents used in the laboratory to ensure that approved, up-to-date documents are in circulation and out-of-date (obsolete) documents are archived or destroyed. The following documents, at a minimum, must be controlled:

- Laboratory Quality Assurance Manual
- Laboratory Standard Operating Procedures (SOP)
- Laboratory Policies
- Work Instructions and Forms
- Corporate Policies and Procedures distributed outside the intranet

Corporate Quality posts Corporate Manuals, SOPs, Policies, Work Instructions, White Papers and Training Materials on the company intranet site. These Corporate documents are only considered controlled when they are read on the intranet site. Printed copies are considered uncontrolled unless the laboratory physically distributes them as controlled documents. A detailed description of the procedure for issuing, authorizing, controlling, distributing, and archiving Corporate documents is found in Corporate SOP No. CW-Q-S-001, Corporate Document Control and Archiving. The laboratory's internal document control procedure is defined in BR-QA-003, Document Control.

The laboratory QA Department also maintains access to various references and document sources integral to the operation of the laboratory. This includes reference methods and regulations. Instrument manuals (hard or electronic copies) are also maintained by the laboratory.

The laboratory maintains control of records for raw analytical data and supporting records such as audit reports and responses, logbooks, standard logs, training files, MDL studies, Proficiency Testing (PT) studies, certifications and related correspondence, and corrective action reports. Raw analytical data consists of bound logbooks, instrument printouts, any other notes, magnetic media, electronic data and final reports.

6.2 Document Approval and Issue

The pertinent elements of a document control system for each document include a unique document title and number, pagination, the total number of pages of the item or an 'end of document' page, the effective date, revision number and the laboratory's name. The QA personnel are responsible for the maintenance of this system.

Controlled documents are authorized by the QA Department. In order to develop a new document, the Operations Manger or Supervisor submits an electronic draft to the QA Department for suggestions and approval before use. Upon approval, QA personnel add the identifying version information to the document and retains that document as the official document on file. That document is then provided to all applicable operational units (may include electronic access). Controlled documents are identified as such and records of their

distribution are kept by the QA Department. Document control may be achieved by either electronic or hardcopy distribution.

The QA Department maintains a list of the official versions of controlled documents.

Quality System Policies and Procedures will be reviewed at a minimum of every annually and revised as appropriate. Changes to documents occur when a procedural change warrants.

6.3 Procedures for Document Control Policy

For changes to the QA Manual, refer to SOP No. BR-QA-003, *Document Control*. Uncontrolled copies must not be used within the laboratory. Previous revisions are stored by the QA department. Electronic copy of the most current version is stored on the Public server in the QA_Public folder (\\tafs\Lab\Burlington\Public\QA_Public\SOPs_Controlled_Distribution\Quality Manual). The SOP identified above also defines the process for changes to SOPs.

Forms, worksheets, work instructions and information are organized by department in the QA office. Electronic versions are kept on a hard drive in the QA department. The procedure for the care of these documents is in SOP No. BR-QA-003, *Document Control*.

6.4 Obsolete Documents

All invalid or obsolete documents are removed, or otherwise prevented from unintended use. The laboratory has specific procedures as described above to accomplish this. In general, obsolete documents are collected from employees according to distribution lists and are marked obsolete on the cover or destroyed. At least one copy of the obsolete document is archived according to SOP No. BR-QA-003, *Document Control*.

SECTION 7. SERVICE TO THE CLIENT

7.1 Overview

The laboratory has established procedures for the review of work requests and contracts, oral or written. The procedures include evaluation of the laboratory's capability and resources to meet the contract's requirements within the requested time period. All requirements, including the methods to be used, must be adequately defined, documented and understood. For many environmental sampling and analysis programs, testing design is site or program specific and does not necessarily "fit" into a standard laboratory service or product. It is the laboratory's intent to provide both standard and customized environmental laboratory services to our clients.

A thorough review of technical and QC requirements contained in contracts is performed to ensure project success. The appropriateness of requested methods, and the lab's capability to perform them must be established. Projects, proposals and contracts are reviewed for adequately defined requirements and the laboratory's capability to meet those requirements. Alternate test methods that are capable of meeting the clients' requirements may be proposed by the lab. A review of the lab's capability to analyze non-routine analytes is also part of this review process.

All projects, proposals and contracts are reviewed for the client's requirements in terms of compound lists, test methodology requested, sensitivity (detection and reporting levels), accuracy, and precision requirements (% Recovery and RPD). The reviewer ensures that the laboratory's test methods are suitable to achieve these requirements and that the laboratory holds the appropriate certifications and approvals to perform the work. The laboratory and any potential subcontract laboratories must be certified, as required, for all proposed tests.

The laboratory must determine if it has the necessary physical, personnel and information resources to meet the contract, and if the personnel have the expertise needed to perform the testing requested. Each proposal is checked for its impact on the capacity of the laboratory's equipment and personnel. As part of the review, the proposed turnaround time will be checked for feasibility.

Electronic or hard copy deliverable requirements are evaluated against the laboratory's capacity for production of the documentation.

If the laboratory cannot provide all services but intends to subcontract such services, whether to another TestAmerica facility or to an outside firm, this will be documented and discussed with the client prior to contract approval. (Refer to Section 8 for Subcontracting Procedures.)

The laboratory informs the client of the results of the review if it indicates any potential conflict, deficiency, lack of accreditation, or inability of the lab to complete the work satisfactorily. Any discrepancy between the client's requirements and the laboratory's capability to meet those requirements is resolved in writing before acceptance of the contract. It is necessary that the contract be acceptable to both the laboratory and the client. Amendments initiated by the client and/or TestAmerica, are documented in writing.

All contracts, QAPPs, Sampling and Analysis Plans (SAPs), contract amendments, and documented communications become part of the project record.

The same contract review process used for the initial review is repeated when there are amendments to the original contract by the client, and the participating personnel are informed of the changes.

7.2 Review Sequence and Key Personnel

Appropriate personnel will review the work request at each stage of evaluation.

For routine projects and other simple tasks, a review by the Project Manager (PM) is considered adequate. The PM confirms that the laboratory has any required certifications, that it can meet the clients' data quality and reporting requirements and that the lab has the capacity to meet the clients turn around needs. It is recommended that, where there is a sales person assigned to the account, an attempt should be made to contact that sales person to inform them of the incoming samples.

For new, complex or large projects, the proposed contract is given to the Client Relations Manager or Proposal Team, who will decide which lab will receive the work based on the scope of work and other requirements, including certification, testing methodology, and available

capacity to perform the work. The contract review process is outlined in TestAmerica's Corporate SOP No. CA-L-P-002**,** Contract Compliance Policy.

This review encompasses all facets of the operation. The scope of work is distributed to the appropriate personnel, as needed based on scope of contract, to evaluate all of the requirements shown above (not necessarily in the order below):

- Contract Administrator
- VP of Operations
- Customer Relations Manager
- Laboratory Project Manager
- Laboratory and/or Corporate Technical Managers / Directors
- Laboratory and/or Corporate Information Technology Managers/Directors
- Account Executives
- Laboratory and/or Corporate Quality
- Laboratory and/or Corporate Environmental Health and Safety Managers/Directors
- The Laboratory Director reviews the formal laboratory quote and makes final acceptance for their facility.

The Sales Director, Contract Administrator, Account Executive or Proposal Coordinator then submits the final proposal to the client. In the event that one of the above personnel is not available to review the contract, his or her back-up will fulfill the review requirements.

The Contracts Department maintains copies of all signed contracts**.** A copy is also retained at the facility by the Customer Relations Manager/Manager of Project Management, or Project Manager.

7.3 Documentation

Appropriate records are maintained for every contract or work request. All stages of the contract review process are documented and include records of any significant changes.

The contract will be distributed to and maintained by the appropriate sales/marketing personnel and the Account Executive. A copy of the contract and formal quote will be filed with the laboratory PM.

Records are maintained of pertinent discussions with a client relating to the client's requirements or the results of the work during the period of execution of the contract. The PM keeps a phone log of conversations with the client.

7.3.1 Project-Specific Quality Planning

Communication of contract specific technical and QC criteria is an essential activity in ensuring the success of site specific testing programs. To achieve this goal, a PM is assigned to each client. It is the PM's responsibility to ensure that project-specific technical and QC requirements are effectively evaluated and communicated to the laboratory personnel before and during the

project. QA department involvement may be needed to assist in the evaluation of custom QC requirements.

PM's are the primary client contact and they ensure resources are available to meet project requirements. Although PM's do not have direct reports or staff in production, they coordinate opportunities and work with laboratory management and supervisory staff to ensure available resources are sufficient to perform work for the client's project. Project management is positioned between the client and laboratory resources.

Prior to work on a new project, the dissemination of project information and/or project opening meetings may occur to discuss schedules and unique aspects of the project. Items to be discussed may include the project technical profile, turnaround times, holding times, methods, analyte lists, reporting limits, deliverables, sample hazards, or other special requirements. The PM introduces new projects to the laboratory staff through project kick-off meetings or to the supervisory staff during production meetings. These meetings provide direction to the laboratory staff in order to maximize production and client satisfaction, while maintaining quality. In addition, project notes may be associated with each sample batch as a reminder upon sample receipt and analytical processing.

During the project, any change that may occur within an active project is agreed upon between the client/regulatory agency and the PM/laboratory. These changes (e.g., use of a non-standard method or modification of a method) and approvals must be documented prior to implementation. Documentation pertains to any document, e.g., letter, e-mail, variance, contract addendum, which has been signed by both parties.

Such changes are also communicated to the laboratory during production meetings. Such changes are also updated in the project notes and are introduced to the managers at these meetings. The laboratory staff is then introduced to the modified requirements via the PM, laboratory Operations Manager and or department Supervisors. After the modification is implemented into the laboratory process, documentation of the modification is made in the case narrative of the data report(s).

The laboratory strongly encourages client visits to the laboratory and for formal/informal information sharing session with employees in order to effectively communicate ongoing client needs as well as project specific details for customized testing programs.

7.4 Special Services

The laboratory cooperates with clients and their representatives to monitor the laboratory's performance in relation to work performed for the client. It is the laboratory's goal to meet all client requirements in addition to statutory and regulatory requirements. The laboratory has procedures to ensure confidentiality to clients (Section 15 and 25).

The laboratory's standard procedures for reporting data are described in Section 25. Special services are also available and provided upon request. These services include:

- Reasonable access for our clients or their representatives to the relevant areas of the laboratory for the witnessing of tests performed for the client.
- Assist client-specified third party data validators as specified in the client's contract.

- Supplemental information pertaining to the analysis of their samples. Note: An additional charge may apply for additional data/information that was not requested prior to the time of sample analysis or previously agreed upon.

7.5 Client Communication

Project managers are the primary communication link to the clients. They shall inform their clients of any delays in project completion as well as any non-conformances in either sample receipt or sample analysis. Project management will maintain ongoing client communication throughout the entire client project.

The Technical Director is available to discuss any technical questions or concerns that the client may have.

7.6 Reporting

The laboratory works with our clients to produce any special communication reports required by the contract.

7.7 Client Surveys

The laboratory assesses both positive and negative client feedback. The results are used to improve overall laboratory quality and client service. TestAmerica's Sales and Marketing teams periodically develops lab and client specific surveys to assess client satisfaction.

SECTION 8. SUBCONTRACTING OF TESTS

8.1 Overview

For the purpose of this quality manual, the phrase subcontract laboratory refers to a laboratory external to the TestAmerica laboratories. The phrase "work sharing" refers to internal transfers of samples between the TestAmerica laboratories. The term outsourcing refers to the act of subcontracting tests.

When contracting with our clients, the laboratory makes commitments regarding the services to be performed and the data quality for the results to be generated. When the need arises to outsource testing for our clients because project scope, changes in laboratory capabilities, capacity or unforeseen circumstances, we must be assured that the subcontractors or work sharing laboratories understand the requirements and will meet the same commitments we have made to the client. Refer to TestAmerica Corporate SOPs on Subcontracting Procedures (CW-L-S-004) and the Work Sharing Process (CA-C-S-001).

When outsourcing analytical services, the laboratory will assure, to the extent necessary, that the subcontract or work sharing laboratory maintains a program consistent with the requirements of this document, the requirements specified in TNI/ISO 17025 and/or the client's Quality Assurance Project Plan (QAPP). All QC guidelines specific to the client's analytical program are transmitted to the subcontractor and agreed upon before sending the samples to the subcontract facility. Additionally, work requiring accreditation will be placed with an

appropriately accredited laboratory. The laboratory performing the subcontracted work will be identified in the final report, as will non-TNI accredited work where required.

Project Managers (PMs), Client Relations Managers (CRM) or Account Executives (AE) for the Export Lab (TestAmerica laboratory that transfers samples to another laboratory) are responsible for obtaining client approval prior to subcontracting any samples. The laboratory will advise the client of a subcontract arrangement in writing and when possible approval from the client shall be retained in the project folder. Standard TestAmerica Terms & Conditions include the flexibility to subcontract samples within the TestAmerica laboratories. Therefore, additional advance notification to clients for intra-laboratory subcontracting is not necessary unless specifically required by a client contract.

Note: In addition to the client, some regulating agencies (e.g., USDA) or contracts (e.g., DoD and DOE projects) require notification prior to placing such work.

8.2 Qualifying and Monitoring Subcontractors

Whenever a PM, AE or CRM become aware of a client requirement or laboratory need where samples must be outsourced to another laboratory, the other laboratory(s) shall be selected based on the following:

- The first priority is to attempt to place the work in a qualified TestAmerica laboratory;
- Firms specified by the client for the task (Documentation that a subcontractor was designated by the client must be maintained with the project file. This documentation can be as simple as placing a copy of an e-mail from the client in the project folder);
- Firms listed as pre-qualified and currently under a subcontract with TestAmerica: A listing of all approved subcontracting laboratories is available on the TestAmerica intranet site. Supporting documentation is maintained by corporate offices and by the TestAmerica laboratory originally requesting approval of the subcontract lab. Verify necessary accreditation, where applicable, (e.g., on the subcontractors TNI, A2LA accreditation or State Certification).
- Firms identified in accordance with the company's Small Business Subcontracting program as small, women-owned, veteran-owned and/or minority-owned businesses;
- TNI or A2LA accredited laboratories.
- In addition, the firm must hold the appropriate certification to perform the work required.

All TestAmerica laboratories are pre-qualified for work sharing provided they hold the appropriate accreditations, can adhere to the project/program requirements, and the client approved sending samples to that laboratory. The client must provide acknowledgement that the samples can be sent to that facility (an e-mail is sufficient documentation or if acknowledgement is verbal, the date, time, and name of person providing acknowledgement must be documented). The originating laboratory is responsible for communicating all technical, quality, and deliverable requirements as well as other contract needs. (Corporate SOP No. CA-C-S-001, Work Sharing Process).

When the potential sub-contract laboratory has not been previously approved, Account Executives or PMs may nominate a laboratory as a subcontractor based on need. The decision

to nominate a laboratory must be approved by the Laboratory Director. The Laboratory Director requests that the QA Manager or PM begin the process of approving the subcontract laboratory as outlined in Corporate SOP No. CA-L-S-002, Subcontracting Procedures.

8.2.1 Once the appropriate accreditation and legal information is received by the laboratory, it is evaluated for acceptability (where applicable) and forwarded to the Corporate Quality Information Manager (QIM) for review. Once all documents are reviewed for completeness, the Corporate QIM will forward the documents to the Purchasing Manager for formal signature and contracting with the laboratory. The approved vendor will be added to the approved subcontractor list on the intranet site and the finance group is concurrently notified for JD Edwards.

8.2.2 The client will assume responsibility for the quality of the data generated from the use of a subcontractor they have requested the lab to use. The qualified subcontractors on the intranet site are known to meet minimal standards. TestAmerica does not certify laboratories. The subcontractor is on our approved list and can only be recommended to the extent that we would use them.

8.2.3 The status and performance of qualified subcontractors will be monitored periodically by the Corporate Contracts and/or Corporate Quality Departments. Any problems identified will be brought to the attention of TestAmerica's Corporate Finance or Corporate Quality personnel.

- Complaints shall be investigated. Documentation of the complaint, investigation and corrective action will be maintained in the subcontractor's file on the intranet site. Complaints are posted using the Vendor Performance Report.
- Information shall be updated on the intranet when new information is received from the subcontracted laboratories.
- Subcontractors in good standing will be retained on the intranet listing. CSO will notify all TestAmerica laboratories, Corporate Quality and Corporate Contracts if any laboratory requires removal from the intranet site. This notification will be posted on the intranet site and e-mailed to all CSO Personnel, Laboratory Directors, QA Managers and Sales Personnel.

8.3 Oversight and Reporting

The PM or CRM must request that the selected subcontractor be presented with a subcontract, if one is not already executed between the laboratory and the subcontractor. The subcontract must include terms which flow down the requirements of our clients, either in the subcontract itself or through the mechanism of work orders relating to individual projects. A standard subcontract and the Lab Subcontractor Vendor Package (posted on the intranet) can be used to accomplish this, and Corporate Counsel can tailor the document or assist with negotiations, if needed. The PM (or EDS, AEs or CSM, etc.) responsible for the project must advise and obtain client consent to the subcontract as appropriate, and provide the scope of work to ensure that the proper requirements are made a part of the subcontract and are made known to the subcontractor.

Prior to sending samples to the subcontracted laboratory, the PM confirms their certification status to determine if it's current and scope-inclusive. The information is documented within the

project records. For TestAmerica laboratories, certifications can be viewed on the company's TotalAccess Database.

The Sample Control department is responsible for ensuring compliance with QA requirements and applicable shipping regulations when shipping samples to a subcontracted laboratory.

All subcontracted samples must be accompanied by a TestAmerica Chain of Custody (COC). A copy of the original COC sent by the client must be available in TALS for all samples workshared within TestAmerica. Client CoCs are only forwarded to external subcontractors when samples are shipped directly from the project site to the subcontractor lab. Under routine circumstances, client CoCs are not provided to external subcontractors.

Through communication with the subcontracted laboratory, the PM monitors the status of the subcontracted analyses, facilitates successful execution of the work, and ensures the timeliness and completeness of the analytical report.

Non-TNI accredited work must be identified in the subcontractor's report as appropriate. If TNI accreditation is not required, the report does not need to include this information.

Reports submitted from subcontractor laboratories are not altered and are included in their original form in the final project report. This clearly identifies the data as being produced by a subcontractor facility. If subcontract laboratory data is incorporated into the laboratories EDD (i.e., imported), the report must explicitly indicate which lab produced the data for which methods and samples.

Note: The results submitted by a TestAmerica work sharing laboratory may be transferred electronically and the results reported by the TestAmerica work sharing lab are identified on the final report. The report must explicitly indicate which lab produced the data for which methods and samples. The final report must include a copy of the completed COC for all work sharing reports.

8.4 Contingency Planning

The Laboratory Director may waive the full qualification of a subcontractor process temporarily to meet emergency needs; however, this decision & justification must be documented in the project files, and the 'Purchase Order Terms And Conditions For Subcontracted Laboratory Services' must be sent with the samples and Chain-of-Custody. In the event this provision is utilized, the laboratory (e.g., PM) will be required to verify and document the applicable accreditations of the subcontractor. All other quality and accreditation requirements will still be applicable, but the subcontractor need not have signed a subcontract with TestAmerica at this time. The comprehensive approval process must then be initiated within 30 calendar days of subcontracting.

SECTION 9. PURCHASING SERVICES AND SUPPLIES

9.1 Overview

Evaluation and selection of suppliers and vendors is performed, in part, on the basis of the quality of their products, their ability to meet the demand for their products on a continuous and

short term basis, the overall quality of their services, their past history, and competitive pricing. This is achieved through evaluation of objective evidence of quality furnished by the supplier, which can include certificates of analysis, recommendations, and proof of historical compliance with similar programs for other clients. To ensure that quality critical consumables and equipment conform to specified requirements, which may affect quality, all purchases from specific vendors are approved by a member of the supervisory or management staff. Capital expenditures are made in accordance with TestAmerica's Capital Expenditure, Controlled Purchase Requests and Fixed Asset Capitalization, SOP No. CW-F-S-007.

Contracts will be signed in accordance with TestAmerica's Company-Wide Authorization Matrix Policy, Policy No. CW-F-P-002. Request for Proposals (RFP's) will be issued where more information is required from the potential vendors than just price. Process details are available in TestAmerica's Corporate Procurement and Contracts Policy (Policy No. CW-F-P-004). RFP's allow TestAmerica to determine if a vendor is capable of meeting requirements such as supplying all of the TestAmerica facilities, meeting required quality standards and adhering to necessary ethical and environmental standards. The RFP process also allows potential vendors to outline any additional capabilities they may offer.

9.2 Glassware

Glassware used for volumetric measurements must be Class A or verified for accuracy according to laboratory procedure. Pyrex (or equivalent) glass should be used where possible. For safety purposes, thick-wall glassware should be used where available.

9.3 Reagents, Standards & Supplies

Purchasing guidelines for equipment, consumables, and reagents must meet the requirements of the specific method and testing procedures for which they are being purchased. Solvents and acids are pre-tested in accordance with TestAmerica's Corporate SOP on Solvent & Acid Lot Testing & Approval, SOP No. CA-Q-S-001. Approval information for the solvents and acids tested under SOP CA-Q-S-001 is stored on the TestAmerica Sharepoint, under Solvent Approvals. A master list of all tested materials, as well as the certificates of analysis for the materials, is stored in the same location.

9.3.1 Purchasing

Chemical reagents, solvents, glassware, and general supplies are ordered as needed to maintain sufficient quantities on hand. Materials used in the analytical process must be of a known quality. The wide variety of materials and reagents available makes it advisable to specify recommendations for the name, brand, and grade of materials to be used in any determination. This information is contained in the method SOP. The analyst completes the JDE Order Request Workbook when requesting reagents, standards, or supplies. The analyst may also check the item out of the on-site consignment system that contains items approved for laboratory use.

9.3.2 Receiving

It is the responsibility of the purchasing manager to receive the shipment. It is the responsibility of the analyst who ordered the materials to document the date materials were received. Once

the ordered reagents or materials are received, the analyst compares the information on the label or packaging to the original order to ensure that the purchase meets the quality level specified. This is documented through the addition of the received date and initials on the packing sheet. These are scanned and saved on the "public" folder on the computer network.

The purchasing manager verifies the lot numbers of received solvents and acids against the pre-approval lists. If a received material is listed as unapproved, or is not listed, it is sequestered and returned to the vendor. Alternatively, the laboratory may test the material for the intended use, and if it is acceptable, document the approval on the approval list. Records of any testing performed locally are maintained on the shared "public" folder on the computer network.

Materials may not be released for use in the laboratory until they have been inspected, verified as suitable for use, and the inspection/verification has been documented.

Safety Data Sheets (SDSs) are available online through the Company's intranet website. Anyone may review these for relevant information on the safe handling and emergency precautions of on-site chemicals.

9.3.3 Specifications

Methods in use in the laboratory specify the grade of reagent that must be used in the procedure. If the quality of the reagent is not specified, analytical reagent grade will be used. It is the responsibility of the analyst to check the procedure carefully for the suitability of grade of reagent.

Chemicals must not be used past the manufacturer's expiration date and must not be used past the expiration time noted in a method SOP. If expiration dates are not provided, the laboratory may contact the manufacturer to determine an expiration date.

The laboratory assumes a five year expiration date on inorganic dry chemicals and solvents unless noted otherwise by the manufacturer or by the reference source method. Chemicals/solvents should not be used past the manufacturer's or SOP's expiration date unless 'verified' (refer to item 3 listed below).

- An expiration date **cannot** be extended if the dry chemical/solvent is discolored or appears otherwise physically degraded, the dry chemical/solvent must be discarded.
- Expiration dates can be extended if the dry chemical/solvent is found to be satisfactory based on acceptable performance of quality control samples (Continuing Calibration Verification (CCV), Blanks, Laboratory Control Sample (LCS), etc.).
- If the dry chemical/solvent is used for the preparation of standards, the expiration dates can be extended 6 months if the dry chemical/solvent is compared to an unexpired independent source in performing the method and the performance of the dry chemical/solvent is found to be satisfactory. The comparison must show that the dry chemical/solvent meets CCV limits. The comparison studies are maintained in each laboratory section.

Wherever possible, standards must be traceable to national or international standards of measurement or to national or international reference materials. Records to that effect are available to the user.

Compressed gases in use are checked for pressure and secure positioning daily. To prevent a tank from going to dryness, or introducing potential impurities, the pressure should be closely watched as it decreases to approximately 15% of the original reading, at which point it should be replaced. For example, a standard sized laboratory gas cylinder containing 3,000 psig of gas should be replaced when it drops to approximately 500 psig. The minimum total pressure must be 120psig for Helium, 100psig for liquid Argon, and 30 psig for Nitrogen. The quality of the gases must meet method or manufacturer specification or be of a grade that does not cause any analytical interference.

Water used in the preparation of standards or reagents must have a specific conductivity of less than 1- µmho/cm (or specific resistivity of greater than 1.0 megohm-cm) at 25°C. The specific conductivity is checked and recorded daily. If the water's specific conductivity is greater than the specified limit, the Facility Manager and appropriate Technical Managers must be notified immediately in order to notify all departments, decide on cessation (based on intended use) of activities, and make arrangements for correction.

The laboratory may purchase reagent grade (or other similar quality) water for use in the laboratory. This water must be certified "clean" by the supplier for all target analytes or otherwise verified by the laboratory prior to use. This verification is documented.

Standard lots are verified before first time use if the laboratory switches manufacturers or has historically had a problem with the type of standard.

Purchased bottleware used for sampling must be certified clean and the certificates must be maintained. If uncertified sampling bottleware is purchased, all lots must be verified clean prior to use. This verification must be maintained.

Records of manufacturer's certification and traceability statements are maintained in electronic files. These records include date of receipt, lot number (when applicable), and expiration date (when applicable). Incorporation of the item into the record indicates that the analyst has compared the new certificate with the previous one for the same purpose and that no difference is noted, unless approved and so documented by the Technical Director or QA Manager.

9.3.4 Storage

Reagent and chemical storage is important from the aspects of both integrity and safety. Light-sensitive reagents may be stored in brown-glass containers. Storage conditions are per the Corporate Environmental Health & Safety Manual (Corp. Doc. No. CW-E-M-001) and method SOPs or manufacturer instructions.

9.4 Purchase of Equipment / Instruments / Software

When a new piece of equipment is needed, either for additional capacity or for replacing inoperable equipment, the analyst or supervisor makes a supply request to the Operations Manager and/or the Laboratory Director. If they agree with the request, the procedures outlined

in TestAmerica's Corporate Policy No. CA-T-P-001, Qualified Products List, are followed. A decision is made as to which piece of equipment can best satisfy the requirements. The appropriate written requests are completed and purchasing places the order.

Upon receipt of a new or used piece of equipment, an identification name is assigned and added to the equipment list. IT must also be notified so that they can synchronize the instrument for back-ups. Its capability is assessed to determine if it is adequate or not for the specific application. For instruments, a calibration curve is generated, followed by MDLs, Demonstration of Capabilities (DOCs), and other relevant criteria (refer to Section 19). For software, its operation must be deemed reliable and evidence of instrument verification must be retained by the IT Department or QA Department. Software certificates supplied by the vendors are filed with the LIMS Administrator. The manufacturer's operation manual is retained in the laboratory.

9.5 Services

Service to analytical instruments (except analytical balances) is performed on an as needed basis. Routine preventative maintenance is discussed in Section 20. The need for service is determined by analysts and/or Technical Managers. The service providers that perform the services are approved by the Operations Manager, Laboratory Director or Quality Assurance Manager.

Analytical balances are serviced and calibrated annually. The calibration and maintenance services are performed on-site, and the balances are returned to use immediately following successful calibration. When the calibration certificates are received, they are reviewed, and documentation of the review is filed with the certificates. If the calibration was unsuccessful, the balance is immediately removed from service and segregated pending either further maintenance or disposal.

Calibration services for support equipment such as thermometers, weight sets, autopipettors, etc, are obtained from vendors with current and valid ISO 17025 accreditation for calibration of the specific piece of equipment. Prior to utilizing the vendor's services, the vendor's accreditation status is verified. Once the equipment has been calibrated, the calibration certificates are reviewed by the QA department, and documentation of the review is filed with the calibration certificates. The equipment is then returned to service within the laboratory.

9.6 Suppliers

TestAmerica selects vendors through a competitive proposal / bid process, strategic business alliances or negotiated vendor partnerships (contracts). This process is defined in the Procurement & Contracts Policy (Policy No. CW-F-P-004). The level of control used in the selection process is dependent on the anticipated spending amount and the potential impact on TestAmerica business. Vendors that provide test and measuring equipment, solvents, standards, certified containers, instrument related service contracts or subcontract laboratory services shall be subject to more rigorous controls than vendors that provide off-the-shelf items of defined quality that meet the end use requirements. The JD Edwards purchasing system includes all suppliers/vendors that have been approved for use.

Evaluation of suppliers is accomplished by ensuring the supplier ships the product or material ordered and that the material is of the appropriate quality. This is documented by signing off on packing slips or other supply receipt documents. The purchasing documents contain the data that adequately describe the services and supplies ordered.

Any issues of vendor performance are to be reported immediately by the laboratory staff to the Corporate Purchasing Group by completing a Vendor Performance Report.

The Corporate Purchasing Group will work through the appropriate channels to gather the information required to clearly identify the problem and will contact the vendor to report the problem and to make any necessary arrangements for exchange, return authorization, credit, etc.

As deemed appropriate, the Vendor Performance Reports will be summarized and reviewed to determine corrective action necessary, or service improvements required by vendors

The laboratory has access to a listing of all approved suppliers of critical consumables, supplies and services. This information is provided through the JD Edwards purchasing system.

9.6.1 New Vendor Procedure

TestAmerica employees who wish to request the addition of a new vendor must complete a J.D. Edwards Vendor Add Request Form.

New vendors are evaluated based upon criteria appropriate to the products or services provided as well as their ability to provide those products and services at a competitive cost. Vendors are also evaluated to determine if there are ethical reasons or potential conflicts of interest with TestAmerica employees that would make it prohibitive to do business with them as well as their financial stability. The QA Department and/or the Technical Services Director are consulted with vendor and product selection that have an impact on quality.

SECTION 10. COMPLAINTS

10.1 Overview

The laboratory considers an effective client complaint handling processes to be of significant business and strategic value. Listening to and documenting client concerns captures ‘client knowledge’ that enables our operations to continually improve processes and client satisfaction. An effective client complaint handling process also provides assurance to the data user that the laboratory will stand behind its data, service obligations and products.

A client complaint is any expression of dissatisfaction with any aspect of our business services (e.g., communications, responsiveness, data, reports, invoicing and other functions) expressed by any party, whether received verbally or in written form. Client inquiries, complaints or noted discrepancies are documented, communicated to management, and addressed promptly and thoroughly.

The laboratory has procedures for addressing both external and internal complaints with the goal of providing satisfactory resolution to complaints in a timely and professional manner.

The nature of the complaint is identified, documented and investigated, and an appropriate action is determined and taken. In cases where a client complaint indicates that an established policy or procedure was not followed, the QA Department must evaluate whether a special audit must be conducted to assist in resolving the issue. A written confirmation or letter to the client, outlining the issue and response taken is recommended as part of the overall action taken.

The process of complaint resolution and documentation utilizes the procedures outlined in Section 12 (Corrective Actions) and is documented following laboratory SOP No. BR-QA-004 *Procedures for Complaint Resolution*.

10.2 External Complaints

An employee that receives a complaint initiates the complaint resolution process by first documenting the complaint according to laboratory SOP No. BR-QA-004 *Procedures for Complaint Resolution*.

Complaints fall into two categories: correctable and non-correctable. An example of a correctable complaint would be one where a report re-issue would resolve the complaint. An example of a non-correctable complaint would be one where a client complains that their data was repeatedly late. Non-correctable complaints should be reviewed for preventive action measures to reduce the likelihood of future occurrence and mitigation of client impact.

The general steps in the complaint handling process are:

- Receiving and Documenting Complaints
- Complaint Investigation and Service Recovery
- Process Improvement

The laboratory shall inform the initiator of the complaint of the results of the investigation and the corrective action taken, if any.

10.3 Internal Complaints

Internal complaints include, but are not limited to: errors and non-conformances, training issues, internal audit findings, and deviations from methods. Corrective actions may be initiated by any staff member who observes a nonconformance and shall follow the procedures outlined in Section 12. In addition, Corporate Management, Sales and Marketing and IT may initiate a complaint by contacting the laboratory or through the corrective action system described in Section 12.

10.4 Management Review

The number and nature of client complaints is reported by the QA Manager to the laboratory and Quality Director in the QA Monthly report. Monitoring and addressing the overall level and nature of client complaints and the effectiveness of the solutions is part of the Annual Management Review (Section 16).

SECTION 11. CONTROL OF NON-CONFORMING WORK

11.1 Overview

When data discrepancies are discovered or deviations and departures from laboratory SOPs, policies and/or client requests have occurred, corrective action is taken immediately. First, the laboratory evaluates the significance of the nonconforming work. Then, a corrective action plan is initiated based on the outcome of the evaluation. If it is determined that the nonconforming work is an isolated incident, the plan could be as simple as adding a qualifier to the final results and/or making a notation in the case narrative. If it is determined that the nonconforming work is a systematic or improper practices issue, the corrective action plan could include a more in depth investigation and a possible suspension of an analytical method. In all cases, the actions taken are documented using the laboratory's corrective action system (refer to Section 12).

Due to the frequently unique nature of environmental samples, sometimes departures from documented policies and procedures are needed**.** When an analyst encounters such a situation, the problem is presented to the supervisor for resolution. The supervisor may elect to discuss it with the Operations Manager or Technical Director or have a representative contact the client to decide on a logical course of action. Once an approach is agreed upon, the analyst documents it using the laboratories corrective action system described in Section 12. This information can then be supplied to the client in the form of a footnote or a case narrative with the report. Refer to SOP No. BR-QA-016 *Nonconformance, Corrective Action & Preventative Action* for procedure to handle such situations.

Project Management may encounter situations where a client may request that a special procedure be applied to a sample that is not standard lab practice. Based on a technical evaluation, the lab may accept or opt to reject the request based on technical or ethical merit. An example might be the need to report a compound that the lab does not normally report. The lab would not have validated the method for this compound following the procedures in Section 19. The client may request that the compound be reported based only on the calibration. Such a request would need to be approved by the Technical Director and QA Manager, documented and included in the project folder. Deviations **must** also be noted on the final report with a statement that the compound is not reported in compliance with TNI (or the analytical method) requirements and the reason. Data being reported to a non-TNI state would need to note the change made to how the method is normally run.

11.2 Responsibilities and Authorities

Under certain circumstances, the Laboratory Director, a Technical Manager, or a member of the QA team may authorize departures from documented procedures or policies. The departures may be a result of procedural changes due to the nature of the sample; a one-time procedure for a client; QC failures with insufficient sample to reanalyze, etc. In most cases, the client will be informed of the departure prior to the reporting of the data. Any departures must be well documented using the laboratory's corrective action procedures. This information may also be documented in an NCM, TALS batch comments, and/or data review checklists as appropriate**.** Any impacted data must be referenced in a case narrative and/or flagged with an appropriate data qualifier.

Any misrepresentation or possible misrepresentation of analytical data discovered by any laboratory staff member must be reported to facility Senior Management within 24-hours. The

Senior Management staff is comprised of the Laboratory Director, the QA Manager, the Operations Manager, and the Technical Manager. The reporting of issues involving alleged violations of the company's Data Integrity or Manual Integration procedures must be conveyed to an ECO (e.g., the VP-QA/EHS) and the laboratory's Quality Director within 24 hours of discovery.

Whether an inaccurate result was reported due to calculation or quantitation errors, data entry errors, improper practices, or failure to follow SOPs, the data must be evaluated to determine the possible effect.

The Laboratory Director, QA Manager, ECOs, VP of Operations and the Quality Directors have the authority and responsibility to halt work, withhold final reports, or suspend an analysis for due cause as well as authorize the resumption of work.

11.3 Evaluation of Significance and Actions Taken

For each nonconforming issue reported, an evaluation of its significance and the level of management involvement needed is made. This includes reviewing its impact on the final data, whether or not it is an isolated or systematic issue, and how it relates to any special client requirements.

The Corporate SOP for Data Recalls, CW-Q-S-005, is the procedure to be followed when it is discovered that erroneous or biased data may have been reported to clients or regulatory agencies.

The Corporate SOP for Internal Investigations, CW-L-S-002, is the procedure to be followed for investigation and correction of situations involved alleged incidents of misconduct or violation of the company's ethics policy.

Laboratory level decisions are documented and approved using the laboratory's standard nonconformance/corrective action reporting in lieu of the data recall determination form contained in TestAmerica's Corporate SOP No. CW-Q-S-005.

11.4 Prevention of Non-Conforming Work

If it is determined that the nonconforming work could recur, further corrective actions must be made following the laboratory's corrective action system. Periodically, as defined by the lab, determine if any nonconforming work has been repeated multiple times. If so, the laboratory's corrective action process may be followed.

11.5 Method Suspension / Restriction (Stop Work Procedures)

In some cases, it may be necessary to suspend/restrict the use of a method or target compound which constitutes significant risk and/or liability to the laboratory. Suspension/restriction procedures can be initiated by any of the persons noted in Section 11.2, Paragraph 5.

Prior to suspension/restriction, confidentiality will be respected, and the problem with the required corrective and preventive action will be stated in writing and presented to the Laboratory Director. The Laboratory Director shall arrange for the appropriate personnel to

meet with the QA Manager as needed. This meeting shall be held to confirm that there is a problem, that suspension/restriction of the method is required and will be concluded with a discussion of the steps necessary to bring the method/target or test fully back on line. In some cases, that may not be necessary if all appropriate personnel have already agreed there is a problem and there is agreement on the steps needed to bring the method, target or test fully back on line. The QA Manager will also initiate a corrective action report as described in Section 12 if one has not already been started. A copy of any meeting notes and agreed upon steps should be faxed or e-mailed by the laboratory to the appropriate VP of Operations and member of Corporate QA. This fax/e-mail acts as notification of the incident.

After suspension/restriction, the lab will hold all reports to clients pending review. No faxing, mailing or distributing through electronic means may occur. The report must not be posted for viewing on the internet. It is the responsibility of the Laboratory Director to hold all reporting and to notify all relevant laboratory personnel regarding the suspension/restriction (e.g., Project Management, Log-in, etc…). Clients will NOT generally be notified at this time. Analysis may proceed in some instances depending on the non-conformance issue.

Within 72 hours, the QA Manager will determine if compliance is now met and reports can be released, OR determine the plan of action to bring work into compliance, and release work. A team, with all principals involved (Laboratory Director, Technical Manager, QA Manager) can devise a start-up plan to cover all steps from client notification through compliance and release of reports. Project Management, and the Directors of Client Services and Sales and Marketing must be notified if clients must be notified or if the suspension/restriction affects the laboratory's ability to accept work. The QA Manager must approve start-up or elimination of any restrictions after all corrective action is complete. This approval is given by final signature on the completed corrective action report.

SECTION 12. CORRECTIVE ACTION

12.1 Overview

A major component of TestAmerica's Quality Assurance (QA) Program is the problem investigation and feedback mechanism designed to keep the laboratory staff informed on quality related issues and to provide insight to problem resolution. When nonconforming work or departures from policies and procedures in the quality system or technical operations are identified, the corrective action procedure provides a systematic approach to assess the issues, restore the laboratory's system integrity, and prevent reoccurrence. Corrective actions are documented using Non-Conformance Memo (NCM) and Corrective Action Reports (CAR) (refer to Figure 12-1).

12.2 General

Problems within the quality system or within analytical operations may be discovered in a variety of ways, such as QC sample failures, internal or external audits, proficiency testing (PT) performance, client complaints, staff observation, etc.,

The purpose of a corrective action system is to:

- Identify non-conformance events and assign responsibility(s) for investigating.

- Resolve non-conformance events and assign responsibility for any required corrective action.
- Identify systematic problems before they become serious.
- Identify and track client complaints and provide resolution.

12.2.1 **Non-Conformance Memo (NCM)** - is used to document the following types of corrective actions:

- Deviations from an established procedure or SOP
- QC outside of limits (non-matrix related)
- Isolated reporting / calculation errors
- Client complaints
- Discrepancies in materials / goods received vs. manufacturer packing slips.

12.2.2 **Corrective Action Report (CAR)** - is used to document the following types of corrective actions:

- Questionable trends that are found in the review of NCMs.
- Issues found while reviewing NCMs that warrant further investigation.
- Internal and external audit findings.
- Failed or unacceptable PT results.
- Corrective actions that cross multiple departments in the laboratory.
- Systematic reporting / calculation errors.
- Client complaints.
- Data recall investigations.
- Identified poor process or method performance trends.
- Excessive revised reports.
- Health and Safety violations.

This will provide background documentation to enable root cause analysis and preventive action.

12.3 Closed Loop Corrective Action Process

Any employee in the company can initiate a corrective action. There are four main components to a closed-loop corrective action process once an issue has been identified: Cause Analysis, Selection and Implementation of Corrective Actions (both short and long term), Monitoring of the Corrective Actions, and Follow-up.

12.3.1 Cause Analysis

- Upon discovery of a non-conformance event, the event must be defined and documented. An NCM or CAR must be initiated, someone is assigned to investigate the issue and the event is investigated for cause. Table 12-1 provides some general guidelines on determining responsibility for assessment.

- The cause analysis step is the key to the process as a long term corrective action cannot be determined until the cause is determined.
- If the cause is not readily obvious, the Technical Manager, Laboratory Director, or QA Manager (or QA designee) is consulted.

12.3.2 Selection and Implementation of Corrective Actions

- Where corrective action is needed, the laboratory shall identify potential corrective actions. The action(s) most likely to eliminate the problem and prevent recurrence are selected and implemented. Responsibility for implementation is assigned.
- Corrective actions shall be to a degree appropriate to the magnitude of the problem identified through the cause analysis.
- Whatever corrective action is determined to be appropriate, the laboratory shall document and implement the changes. The NCM or CAR is used for this documentation.

12.3.3 Root Cause Analysis

Root Cause Analysis is a class of problem solving (investigative) methods aimed at identifying the basic or causal factor(s) that underlie variation in performance or the occurrence of a significant failure. The root cause may be buried under seemingly innocuous events, many steps preceding the perceived failure. At first glance, the immediate response is typically directed at a symptom and not the cause. Typically, root cause analysis would be best with three or more incidents to triangulate a weakness. Corporate SOP Root Cause Analysis (No. CA-Q-S-009) describes the procedure.

Systematically analyze and document the root causes of the more significant problems that are reported. Identify, track, and implement the corrective actions required to reduce the likelihood of recurrence of significant incidents. Trend the root cause data from these incidents to identify root causes that, when corrected, can lead to dramatic improvements in performance by eliminating entire classes of problems.

Identify the one event associated with problem and ask why this event occurred. Brainstorm the root causes of failures; for example, by asking why events occurred or conditions existed; and then why the cause occurred 5 consecutive times until you get to the root cause. For each of these sub events or causes, ask why it occurred. Repeat the process for the other events associated with the incident.

Root cause analysis does not mean the investigation is over. Look at technique, or other systems outside the normal indicators. Often creative thinking will find root causes that ordinarily would be missed, and continue to plague the laboratory or operation.

12.3.4 Monitoring of the Corrective Actions

- The Technical Manager and QA Manager are responsible to ensure that the corrective action taken was effective.
- Ineffective actions are documented and re-evaluated until acceptable resolution is achieved. Technical Managers are accountable to the Laboratory Director to ensure final acceptable resolution is achieved and documented appropriately.

- Each NCM and CAR is entered into a database for tracking purposes and a monthly summary of all corrective actions is printed out for review to aid in ensuring that the corrective actions have taken effect.
- TestAmerica laboratories began using the Incident/Corrective Action Tracker (iCAT) database developed by the company in 2015. (Previously, local Excel spreadsheets served this purpose.) An incident is an event triggering the need for one or more corrective actions as distinct from a corrective action, a potential deficiency stemming from an incident that requires investigation and possibly fixing. The database is independent of TALS, available to all local and corporate managers, and capable of notifying and tracking multiple corrective actions per event, dates, and personnel. iCAT allows associated document upload, categorization (such as, external/internal audit, client service concerns, data quality issues, proficiency testing, etc.), and trend analysis. Refer to Figure 12-1.
- The QA Manager reviews monthly NCMs and CARs for trends. Highlights are included in the QA monthly report (refer to Section 16). If a significant trend develops that adversely affects quality, an audit of the area is performed and corrective action implemented.
- Any out-of-control situations that are not addressed acceptably at the laboratory level may be reported to the Corporate Quality Director by the QA Manager, indicating the nature of the out-of-control situation and problems encountered in solving the situation.

12.3.5 Follow-up Audits

- Follow-up audits may be initiated by the QA Manager and shall be performed as soon as possible when the identification of a nonconformance casts doubt on the laboratory's compliance with its own policies and procedures, or on its compliance with state or federal requirements.
- These audits often follow the implementation of the corrective actions to verify effectiveness. An additional audit would only be necessary when a critical issue or risk to business is discovered.

(Also refer to Section 15.1.4, Special Audits.)

12.4 Technical Corrective Actions

In addition to providing acceptance criteria and specific protocols for technical corrective actions in the method SOPs, the laboratory has general procedures to be followed to determine when departures from the documented policies and procedures and quality control have occurred (refer to Section 11). The documentation of these procedures is through the use of an NCM or CAR.

Table 12-1 includes examples of general technical corrective actions. For specific criteria and corrective actions, refer to the analytical methods or specific method SOPs. The laboratory may also maintain Work Instructions on these items that are available upon request.

Table 12-1 provides some general guidelines for identifying the individual(s) responsible for assessing each QC type and initiating corrective action. The table also provides general guidance on how a data set should be treated if associated QC measurements are unacceptable. Specific procedures are included in Method SOPs, Work Instructions, and QAM

Sections 19 and 20. All corrective actions are reviewed monthly, at a minimum, by the QA Manager and highlights are included in the QA monthly report.

To the extent possible, samples shall be reported only if all quality control measures are acceptable. If the deficiency does not impair the usability of the results, data will be reported with an appropriate data qualifier and/or the deficiency will be noted in the case narrative. Where sample results may be impaired, the Project Manager is notified by an NCM and appropriate corrective action (e.g., reanalysis) is taken and documented**.**

12.5 Basic Corrections

When mistakes occur in records, each mistake shall be crossed-out, [not obliterated (e.g. no white-out)], and the correct value entered alongside. All such corrections shall be initialed (or signed) and dated by the person making the correction. In the case of records stored electronically, the original “uncorrected” file must be maintained intact and a second “corrected” file is created.

This same process applies to adding additional information to a record. All additions made later than the initial must also be initialed (or signed) and dated.

When corrections are due to reasons other than obvious transcription errors, the reason for the corrections (or additions) shall also be documented.

Figure 12-1.
Example – iCAT Corrective Action Report

TestAmerica Burlington - Quality Assurance

Corrective Action 9076

Incident 3222: Internal Audit 2017
Incident Status: Open
Response Due to Client: Thursday, Nov 9, 2017

Created By:	Luke Orchard	Created On:	Wednesday, Oct 11, 2017
Laboratory Function:	ALL	Date Follow-up Due:	Friday, Nov 3, 2017
Corrective Action Type:	ALL	Date Follow-up Done:	
Department:	Lab Admin/QA/H&S/MIS	Response Due to QA:	Friday, Nov 3, 2017
Finding Number:	1	Planned Closure Date:	Thursday, Nov 30, 2017
Is Repeat Finding?:	No	Date Closed:	Friday, Nov 3, 2017
Finding Reference:	1		
Assigned To/Lead:	Luke Orchard		
Priority:	3 (Normal Importance)		
Follow-up Assigned To:	Luke Orchard		
C.A. Status:	Closed-Pending QA Review		

Issue Requiring Corrective Action:
"Out of Service equipment not labeled through-out lab. Examples: - Muffle furnace (WC) - Sonicator 35151 (OP) - Instrument W (Air)"

Investigation/Response:
"Out of Service equipment not labeled through-out lab. Examples: - Muffle furnace (WC) - Sonicator 35151 (OP) - Instrument W (Air)"

Root Cause:
Oversight. Each of these departments has seen excessive turnover in the last year, and new analysts were unaware of this requirement.

Corrective Action Plan:
QA will create "Out Of Service" signs to be applied to equipment that is not currently in use. Equipment that is not to be repaired and used in the near future will be removed from the lab. Department Managers will provide QA with regular updates on equipment statuses during operations meetings.

Corrective Action Documents (1)

FQA051 Out of Service Sign.pdf	Con59AanA59.LONG_DATE_STRING 7:6 AM	

For QA Use Only

QA Comments	Follow Up
Uploaded new TA Burlington controlled form for Out of Service equipment. LPO 11-1-2017	Out of Service Signs have been applied as of 10-12-2017. QA followed-up and verified that this process is being maintained on 11-3-2017

Notifications

Location QA (notification required)

Name	Title
Luke Orchard	Quality Assurance Manager
Hayley Waterland	

Additional Notifications

Name	Title
Don Dawicki	Laboratory Director
William Desjardins	Air/VOA Supervisor
Benjamin Kirchner	CLP/SVOA Supervisor
Matthew Kirk	Operations Manager
Thomas Deaton	Extractions Laboratory Supervisor

Table 12-1. Example – General Corrective Action Procedures

QC Activity ***(Individual Responsible for Initiation/Assessment)***	**Acceptance Criteria**	**Recommended Corrective Action**
Initial Instrument Blank *(Analyst)*	- Instrument response < MDL.	- Prepare another blank. - If same response, determine cause of contamination: reagents, environment, instrument equipment failure, etc..
Initial Calibration Standards *(Analyst, Technical Manager(s))*	- Correlation coefficient > 0.99 or standard concentration value. - % Recovery within acceptance range. - See details in Method SOP.	- Reanalyze standards. - If still unacceptable, remake standards and recalibrate instrument.
Independent Calibration Verification (Second Source) *(Analyst, Technical Manager(s))*	- % Recovery within control limits.	- Remake and reanalyze standard. - If still unacceptable, then remake calibration standards or use new primary standards and recalibrate instrument.
Continuing Calibration Standards *(Analyst, Data Reviewer)*	% Recovery within control limits.	- Reanalyze standard. - If still unacceptable, then recalibrate and rerun affected samples.
Matrix Spike / Matrix Spike Duplicate (MS/MSD) *(Analyst, Data Reviewer)*	- % Recovery within limits documented in ***(state where limits are maintained)***.	- If the acceptance criteria for duplicates or matrix spikes are not met because of matrix interferences, the acceptance of the analytical batch is determined by the validity of the LCS. - If the LCS is within acceptable limits the batch is acceptable. - The results of the duplicates, matrix spikes and the LCS are reported with the data set. - For matrix spike or duplicate results outside criteria the data for that sample shall be reported with qualifiers.

QC Activity ***(Individual Responsible for Initiation/Assessment)***	**Acceptance Criteria**	**Recommended Corrective Action**
Laboratory Control Sample (LCS) *(Analyst, Data Reviewer)*	- % Recovery within limits specified in TALS***.***	- Batch must be re-prepared and re-analyzed. This includes any allowable marginal exceedance. When not using marginal exceedances, the following exceptions apply: 1) when the acceptance criteria for the positive control are exceeded high (i.e., high bias) and there are associated samples that are non-detects, then those non-detects may be reported with data qualifying codes; 2) when the acceptance criteria for the positive control are exceeded low (i.e., low bias), those sample results may be reported if they exceed a maximum regulatory limit/decision level with data qualifying codes. **Note:** If there is insufficient sample or the holding time cannot be met, contact client and report with flags.
Surrogates *(Analyst, Data Reviewer)*	- % Recovery within limits of method or within three standard deviations of the historical mean.	- Individual sample must be repeated. Place comment in LIMS. - Surrogate results outside criteria shall be reported with qualifiers.
Method Blank (MB) *(Analyst, Data Reviewer)*	< Reporting Limit [1]	- Reanalyze blank. - If still positive, determine source of contamination. If necessary, reprocess (i.e. digest or extract) entire sample batch. Report blank results. - Qualify the result(s) if the concentration of a targeted analyte in the MB is at or above the reporting limit AND is > 1/10 of the amount measured in the sample.
Proficiency Testing (PT) Samples *(QA Manager, Technical Manager(s))*	- Criteria supplied by PT Supplier.	- Any failures or warnings must be investigated for cause. Failures may result in the need to repeat a PT sample to show the problem is corrected.
Internal / External Audits *(QA Manager, Technical Manager(s), Laboratory Director)*	- Defined in Quality System documentation such as SOPs, QAM, etc..	- Non-conformances must be investigated through CAR system and necessary corrections must be made.

QC Activity *(Individual Responsible for Initiation/Assessment)*	**Acceptance Criteria**	**Recommended Corrective Action**
Reporting / Calculation Errors (Depends on issue – possible individuals include: Analysts, Data Reviewers, Project Managers, Technical Managers, QA Manager, Corporate QA, Corporate Management)	- SOP CW-Q-S-005, Data Recall	- Corrective action is determined by type of error. Follow the procedures in SOP CW-L-S-002 or your lab's CA SOP.
Client Complaints *(Project Managers, Lab Director/Manager, Sales and Marketing)*	- SOP BR-QA-004, Procedures for Complaint Resolution	- Corrective action is determined by the type of complaint. For example, a complaint regarding an incorrect address on a report will result in the report being corrected and then follow-up must be performed on the reasons the address was incorrect (e.g., database needs to be updated).
QA Monthly Report (Refer to Section 16 for an example) (QA Manager, Lab Director/Manager, *Technical Manager(s)*)	- QAM, SOPs.	- Corrective action is determined by the type of issue. For example, CARs for the month are reviewed and possible trends are investigated.
Health and Safety Violation (Safety Officer, Lab Director/Manager, *Technical Manager(s)*)	- Environmental Health and Safety (EHS) Manual.	- Non-conformance is investigated and corrected through CAR system.

Note:

1. Except as noted below for certain compounds, the method blank should be below the reporting limit. Concentrations up to five times the reporting limit will be allowed for the ubiquitous laboratory and reagent contaminants: methylene chloride, toluene, acetone, 2-butanone and phthalates **provided** they appear in similar levels in the reagent blank and samples. This allowance presumes that the detection limit is significantly below any regulatory limit to which the data are to be compared and that blank subtraction will not occur. For benzene and ethylene dibromide (EDB) and other analytes for which regulatory limits are extremely close to the detection limit, the method blank must be below the method detection limit

SECTION 13. PREVENTIVE ACTION / IMPROVEMENT

13.1 Overview

The laboratory's preventive action programs improve or eliminate potential causes of nonconforming product and/or nonconformance to the quality system. This preventive action process is a proactive and continuous process of improvement activities that can be initiated through feedback from clients, employees, business providers, and affiliates. The QA Department has the overall responsibility to ensure that the preventive action process is in place, and that relevant information on actions is submitted for management review.

Dedicating resources to an effective preventive action system emphasizes the laboratory's commitment to its Quality Program. It is beneficial to identify and address negative trends before they develop into complaints, problems and corrective actions. Additionally, the laboratory continually strives to improve customer service and client satisfaction through continuous improvements to laboratory systems.

Opportunities for improvement may be discovered through any of the following:

- review of the monthly QA Metrics Report,
- trending NCMs,
- review of control charts and QC results,
- trending proficiency testing (PT) results,
- performance of management system reviews,
- trending client complaints,
- review of processing operations, or
- staff observations.

The monthly Management Systems Metrics Report shows performance indicators in all areas of the laboratory and quality system. These areas include revised reports, corrective actions, audit findings, internal auditing and data authenticity audits, client complaints, PT samples, holding time violations, SOPs, ethics training, etc. The metrics report is reviewed monthly be the laboratory management, Corporate QA and TestAmerica's Executive Committee. These metrics are used ~~to~~ in evaluating the management and quality system performance on an ongoing basis and provide a tool for identifying areas for improvement.

Items identified as continuous improvement opportunities to the management system may be issued as goals from the annual management systems review, recommendations from internal audits, white papers, Lesson Learned, Technical Services audit report, Technical Best Practices, or as Corporate or management initiatives.

The laboratory's corrective action process is integral to implementation of preventive actions. A critical piece of the corrective action process is the implementation of actions to prevent further occurrence of a non-compliance event. Historical review of corrective action and non-conformances provides a valuable mechanism for identifying preventive action opportunities.

13.1.1 The following elements are part of a preventive action/process improvement system:

- Identification of an opportunity for preventive action or process improvement.
- Process for the preventive action or improvement.
- Define the measurements of the effectiveness of the process once undertaken.
- Execution of the preventive action or improvement.
- Evaluation of the plan using the defined measurements.
- Verification of the effectiveness of the preventive action or improvement.
- Close-Out by documenting any permanent changes to the Quality System as a result of the Preventive Action or Process Improvement. Documentation of Preventive Action/process Improvement is incorporated into the monthly QA reports, corrective action process and management review.

13.1.2 Any Preventive Actions/Process Improvement undertaken or attempted shall be taken into account during the annual Management Systems Review (Section 16). A highly detailed report is not required; however, a summary of successes and failures within the preventive action program is sufficient to provide management with a measurement for evaluation.

SECTION 14. CONTROL OF RECORDS

The laboratory maintains a records management system appropriate to its needs and that complies with applicable standards or regulations as required. The system produces unequivocal, accurate records that document all laboratory activities. The laboratory retains all original observations, calculations and derived data, calibration records and a copy of the analytical report for a minimum of five years after it has been issued. Exceptions for programs with longer retention requirements are discussed in Section 14.1.2.

14.1 Overview

The laboratory has established procedures for identification, collection, indexing, access, filing, storage, maintenance and disposal of quality and technical records. A record index is listed in Table 14-1. Quality records are maintained by the QA department in a spreadsheet, which is backed up as part of the regular laboratory backup. Records are of two types; either electronic or hard copy paper formats depending on whether the record is computer or hand generated (some records may be in both formats). Technical records are maintained by each laboratory section.

Table 14-1. Record Index[1]

	Record Types [1]:	**Retention Time:**
Technical Records	- Raw Data - Logbooks[2] - Standards - Certificates - Analytical Records - MDLs/IDLs/DOCs - Lab Reports	5 Years from analytical report issue*
Official Documents	- Quality Assurance Manual (QAM) - Work Instructions - Policies - SOPs - Policy Memorandums - Manuals	5 Years from document retirement date*
QA Records	- Internal & External Audits/Responses - Certifications - Corrective/Preventive Actions - Management Reviews - Method & Software Validation / Verification Data - Data Investigation	5 Years from archival* **Data Investigation:** 5 years or the life of the affected raw data storage whichever is greater (beyond 5 years if ongoing project or pending investigation)
Project Records	- Sample Receipt & COC Documents - Contracts and Amendments - Correspondence - QAPP - SAP - Telephone Logbooks - Lab Reports	5 Years from analytical report issue*
Administrative Records	Finance and Accounting	10 years
	EH&S Manual, Permits	7 years
	Disposal Records	Indefinitely
	Employee Handbook	Indefinitely
	Personnel files, Employee Signature & Initials, Administrative Training Records (e.g., Ethics)	Refer to HR Manual
	Administrative Policies Technical Training Records	7 years

[1] Record Types encompass hardcopy and electronic records.
[2] Examples of Logbook types: Maintenance, Instrument Run, Preparation (standard and samples), Standard and Reagent Receipt, Archiving, Balance Calibration, Temperature (hardcopy or electronic records).
* Exceptions listed in Table 14-2.

14.1.1 All records are stored and retained in such a way that they are secure and readily retrievable at the laboratory facility or an Iron Mountain data storage facility that provides a suitable environment to prevent damage or deterioration and to prevent loss**.** All records shall be protected against fire, theft, loss, environmental deterioration, and vermin. In the case of

electronic records, electronic or magnetic sources, storage media are protected from deterioration caused by magnetic fields and/or electronic deterioration.

Access to the data is limited to laboratory and company employees and shall be documented with an access log**.** Records archived off-site are stored in a secure location where a record is maintained of any entry into the storage facility. Whether on-site or off-site storage is used, logs are maintained in each storage box to note removal and return of records. Retention of records are maintained on-site at the laboratory for at least 1 year after their generation and moved offsite for the remainder of the required storage time. Records are maintained for a minimum of five years unless otherwise specified by a client or regulatory requirement.

For raw data and project records, record retention shall be calculated from the date the project report is issued. For other records, such as Controlled Documents, QA, or Administrative Records, the retention time is calculated from the date the record is formally retired. Records related to the programs listed in Table 14-2 have lengthier retention requirements and are subject to the requirements in Section 14.1.3.

14.1.2 Programs with Longer Retention Requirements

Some regulatory programs have longer record retention requirements than the standard record retention time. These are detailed in Table 14-2 with their retention requirements. In these cases, the longer retention requirement is enacted. If special instructions exist such that client data cannot be destroyed prior to notification of the client, the container or box containing that data is marked as to who to contact for authorization prior to destroying the data.

Table 14-2. Example: Special Record Retention Requirements

Program	[1]Retention Requirement
Drinking Water – All States	5 years (project records) 10 years - Radiochemistry (project records)
Drinking Water Lead and Copper Rule	12 years (project records)
Commonwealth of MA – All environmental data 310 CMR 42.14	10 years
FIFRA – 40 CFR Part 160	Retain for life of research or marketing permit for pesticides regulated by EPA
Housing and Urban Development (HUD) Environmental Lead Testing	10 years
Alaska	10 years
Louisiana – All	10 years
Michigan Department of Environmental Quality – all environmental data	10 years
Navy Facilities Engineering Service Center (NFESC)	10 years
NY Potable Water NYCRR Part 55-2	10 years
Ohio VAP	10 years and State contacted prior to disposal
TSCA - 40 CFR Part 792	10 years after publication of final test rule or negotiated test agreement

[1]Note: Extended retention requirements must be noted with the archive documents or are addressed in facility-specific records retention procedures.

14.1.3 The laboratory has procedures to protect and back-up records stored electronically and to prevent unauthorized access to or amendment of these records. All analytical data is maintained as hard copy or in a secure readable electronic format. Laboratory SOP BR-QA-021 covers these procedures. For analytical reports that are maintained as copies in PDF format, refer to Section 19.14.1 for more information.

14.1.4 The record keeping system allows for historical reconstruction of all laboratory activities that produced the analytical data, as well as rapid recovery of historical data (any records stored off site should be accessible within 2 days of a request for such records). The history of the sample from when the laboratory took possession of the samples must be readily understood through the documentation. This shall include inter-laboratory transfers of samples and/or extracts.

- The records include the identity of personnel involved in sampling, sample receipt, preparation, or testing. All analytical work contains the initials (at least) of the personnel involved. The laboratory's copy of the COC is stored electronically with the project files and job records in TALS. The chain of custody would indicate the name of the sampler. If any sampling notes are provided with a work order, they are kept with this package.

- All information relating to the laboratory facilities equipment, analytical test methods, and related laboratory activities, such as sample receipt, sample preparation, or data verification are documented.

- The record keeping system facilitates the retrieval of all working files and archived records for inspection and verification purposes. Instrument data is stored sequentially by instrument. A given day's analyses are maintained in the order of the analysis. Run logs are maintained for each instrument or method; a copy of each day's run log or instrument sequence is stored with the data to aid in re-constructing an analytical sequence. Where an analysis is performed without an instrument, bound logbooks or bench sheets are used to record and file data. Standard and reagent information is recorded in logbooks or entered into the LIMS for each method as required.

- Changes to hardcopy records shall follow the procedures outlined in Section 12 and 19. Changes to electronic records in LIMS or instrument data are recorded in audit trails.

- The reason for a signature or initials on a document is clearly indicated in the records such as "sampled by," "prepared by," "reviewed by", or "analyzed by".

- All generated data except those that are generated by automated data collection systems, are recorded directly, promptly and legibly in permanent dark ink.

- Hard copy data may be scanned into PDF format for record storage as long as the scanning process can be verified in order to ensure that no data is lost and the data files and storage media must be tested to verify the laboratory's ability to retrieve the information prior to the destruction of the hard copy that was scanned.

- Also refer to Section 19.14.1 'Computer and Electronic Data Related Requirements'**.**

14.2 Technical and Analytical Records

14.2.1 The laboratory retains records of original observations, derived data and sufficient information to establish an audit trail, calibration records, staff records and a copy of each analytical report issued, for a minimum of five years unless otherwise specified by a client or regulatory requirement. The records for each analysis shall contain sufficient information to enable the analysis to be repeated under conditions as close as possible to the original. The records shall include the identity of laboratory personnel responsible for the performance of each analysis and reviewing results.

14.2.2 Observations, data and calculations are recorded real-time and are identifiable to the specific task.

14.2.3 Changes to hardcopy records shall follow the procedures outlined in Section 12 and 19. Changes to electronic records in LIMS or instrument data are recorded in audit trails.

The essential information to be associated with analysis, such as strip charts, tabular printouts, computer data files, analytical notebooks, and run logs, include:

- laboratory sample ID code**;**
- Date of analysis; Time of Analysis is also required if the holding time is seventy-two (72) hours or less, or when time critical steps are included in the analysis (e.g., drying times, incubations, etc.); instrumental analyses have the date and time of analysis recorded as part of their general operations. Where a time critical step exists in an analysis, location for such a time is included as part of the documentation in a specific logbook or on a benchsheet.
- Instrumentation identification and instrument operating conditions/parameters;
- analysis type**;**
- all manual calculations and manual integrations**;**
- analyst's or operator's initials/signature**;**
- sample preparation including cleanup, volumes, weights, meter readings, calculations, reagents**;**
- test results**;**
- standard and reagent origin, receipt, preparation, and use**;**
- calibration criteria, frequency and acceptance criteria**;**
- data and statistical calculations, review, confirmation, interpretation, assessment and reporting conventions**;**
- quality control protocols and assessment**;**
- electronic data security, software documentation and verification, software and hardware audits, backups, and records of any changes to automated data entries; and
- Method performance criteria including expected quality control requirements. These are

indicated both in the LIMS and on specific analytical report formats**.**

14.2.4 All logbooks used during receipt, preparation, storage, analysis, and reporting of samples or monitoring of support equipment shall undergo a documented supervisory or peer review on a monthly basis.

14.3 Laboratory Support Activities

In addition to documenting all the above-mentioned activities, the following are retained QA records and project records (previous discussions in this section relate where and how these data are stored):

- all original raw data, whether hard copy or electronic, for calibrations, samples and quality control measures, including analysts' work sheets and data output records (chromatograms, strip charts, and other instrument response readout records)**;**
- a written description or reference to the specific test method used which includes a description of the specific computational steps used to translate parametric observations into a reportable analytical value**;**
- copies of final reports**;**
- archived SOPs**;**
- correspondence relating to laboratory activities for a specific project**;**
- all corrective action reports, audits and audit responses**;**
- proficiency test results and raw data; and
- results of data review, verification, and crosschecking procedures

14.3.1 Sample Handling Records

Records of all procedures to which a sample is subjected while in the possession of the laboratory are maintained. These include but are not limited to records pertaining to:

- sample preservation including appropriateness of sample container and compliance with holding time requirement;
- sample identification, receipt, acceptance or rejection and login;
- sample storage and tracking including shipping receipts, sample transmittal / COC forms; and
- procedures for the receipt and retention of samples, including all provisions necessary to protect the integrity of samples.

14.4 Administrative Records

The laboratory also maintains the administrative records in either electronic or hard copy form. Refer to Table 14-1.

14.5 Records Management, Storage and Disposal

All records (including those pertaining to test equipment), certificates and reports are safely stored, held secure and in confidence to the client. Certification related records are available upon request.

All information necessary for the historical reconstruction of data is maintained by the laboratory. Records that are stored only on electronic media must be supported by the hardware and software necessary for their retrieval.

Records that are stored or generated by computers or personal computers have hard copy, write-protected backup copies, or an electronic audit trail controlling access**.**

The laboratory has a record management system (a.k.a., document control) for control of laboratory notebooks, instrument logbooks, standards logbooks, and records for data reduction, validation, storage and reporting. Document control procedures are described in laboratory SOP No. BR-QA-003.

14.5.1 Transfer of Ownership

In the event that the laboratory transfers ownership or goes out of business, the laboratory shall ensure that the records are maintained or transferred according to client's instructions. Upon ownership transfer, record retention requirements shall be addressed in the ownership transfer agreement and the responsibility for maintaining archives is clearly established. In addition, in cases of bankruptcy, appropriate regulatory and state legal requirements concerning laboratory records must be followed. In the event of the closure of the laboratory, all records will revert to the control of the corporate headquarters. Should the entire company cease to exist, as much notice as possible will be given to clients and the accrediting bodies who have worked with the laboratory during the previous 5 years of such action.

14.5.2 Records Disposal

Records are removed from the archive and destroyed after 5 years unless otherwise specified by a client or regulatory requirement. On a project specific or program basis, clients may need to be notified prior to record destruction. Records are destroyed in a manner that ensures their confidentiality such as shredding, mutilation or incineration. (Refer to Tables 14-1 and 14-2).

Electronic copies of records must be destroyed by erasure or physically damaging off-line storage media so no records can be read.

If a third party records management company is hired to dispose of records, a "Certificate of Destruction" is required.

SECTION 15. AUDITS

15.1 Internal Audits

Internal audits are performed to verify that laboratory operations comply with the requirements of the lab's quality system and with the external quality programs under which the laboratory operates. Audits are planned and organized by the QA staff. Personnel conducting the audits should be independent of the area being evaluated. Auditors will have sufficient authority, access to work areas, and organizational freedom necessary to observe all activities affecting

quality and to report the assessments to laboratory management and, when requested, to corporate management.

Audits are conducted and documented as described in the TestAmerica Corporate SOP on performing Internal Auditing, SOP No. CW-Q-S-003. The types and frequency of routine internal audits are described in Table 15-1. Special or ad hoc assessments may be conducted as needed under the direction of the QA staff.

Table 15-1. Types of Internal Audits and Frequency

Description	Performed by	Frequency
Quality Systems Audits	QA Department, QA approved designee, or Corporate QA	All areas of the laboratory annually
QA Technical Audits (Method Audits)	Joint responsibility: a) QA Manager or designee b) Technical Manager or Designee (Refer to CW-Q-S-003)	QA Technical Audits Frequency: 50% of methods annually
SOP Method Compliance	Joint responsibility: a) QA Manager or designee b) Technical Manager or Designee (Refer to CW-Q-S-003)	SOP Compliance Review Frequency: • Every 2 years • 100% of SOPs annually (DoD methods)
Special	QA Department or Designee	Surveillance or spot checks performed as needed, e.g., to confirm corrective actions from other audits.
Performance Testing	Analysts with QA oversight	Two successful per year for each TNI-field of testing or as dictated by regulatory requirements

15.1.1 Annual Quality Systems Audit

An annual quality systems audit is required to ensure compliance to analytical methods and SOPs, TestAmerica's Data Integrity and Ethics Policies, TNI quality systems, client and state requirements, and the effectiveness of the internal controls of the analytical process, including but not limited to data review, quality controls, preventive action and corrective action. The completeness of earlier corrective actions is assessed for effectiveness & sustainability. The audit is divided into sections for each operating or support area of the lab, and each section is comprehensive for a given area. The area audits may be performed on a rotating schedule throughout the year to ensure adequate coverage of all areas. This schedule may change as situations in the laboratory warrant.

15.1.2 QA Technical Audits

QA technical audits assess data authenticity and analyst integrity. These audits are based on client projects, associated sample delivery groups, and the methods performed. Reported results are compared to raw data to verify the authenticity of results. The validity of calibrations and QC results are compared to data qualifiers, footnotes, and case narratives. Documentation is assessed by examining run logs and records of manual integrations. Manual calculations are

checked. Where possible, electronic audit miner programs (e.g., Chrom AuditMiner) are used to identify unusual manipulations of the data deserving closer scrutiny. QA technical audits will include all methods within a two-year period. All analysts should be reviewed over the course of a two year period through at least one QA Technical Audit

15.1.3 SOP Method Compliance

Compliance of all SOPs with the source methods and compliance of the operational groups with the SOPs will be assessed by the Technical Manager or qualified designee at least every two years and annually for methods and administrative SOPs related to DoD programs.

15.1.4 Special Audits

Special audits are conducted on an as needed basis, generally as a follow up to specific issues such as client complaints, corrective actions, PT results, data audits, system audits, validation comments, regulatory audits or suspected ethical improprieties. Special audits are focused on a specific issue, and report format, distribution, and timeframes are designed to address the nature of the issue.

15.1.5 Performance Testing

The laboratory participates semi-annually in performance audits conducted through the analysis of PT samples provided by a third party. The laboratory generally participates in the following types of PT studies: Drinking Water, Non-potable Water, Soil, and Air.

It is TestAmerica's policy that PT samples be treated as typical samples in the production process. Furthermore, where PT samples present special or unique problems, in the regular production process they may need to be treated differently, as would any special or unique request submitted by any client. The QA Manager must be consulted and in agreement with any decisions made to treat a PT sample differently due to some special circumstance.

Written responses to unacceptable PT results are required. In some cases it may be necessary for blind QC samples to be submitted to the laboratory to show a return to control.

15.2 External Audits

External audits are performed when certifying agencies or clients conduct on-site inspections or submit performance testing samples for analysis. It is TestAmerica's policy to cooperate fully with regulatory authorities and clients. The laboratory makes every effort to provide the auditors with access to personnel, documentation, and assistance. Laboratory supervisors are responsible for providing corrective actions to the QA Manager who coordinates the response for any deficiencies discovered during an external audit. Audit responses are due in the time allotted by the client or agency performing the audit. When requested, a copy of the audit report and the labs corrective action plan will be forwarded to Corporate Quality.

The laboratory cooperates with clients and their representatives to monitor the laboratory's performance in relation to work performed for the client. The client may only view data and systems related directly to the client's work. All efforts are made to keep other client information confidential.

15.2.1 Confidential Business Information (CBI) Considerations

During on-site audits, auditors may come into possession of information claimed as business confidential. A business confidentiality claim is defined as "a claim or allegation that business information is entitled to confidential treatment for reasons of business confidentiality or a request for a determination that such information is entitled to such treatment." When information is claimed as business confidential, the laboratory must place on (or attach to) the information at the time it is submitted to the auditor, a cover sheet, stamped or typed legend or other suitable form of notice, employing language such as "trade secret", "proprietary" or "company confidential". Confidential portions of documents otherwise non-confidential must be clearly identified. CBI may be purged of references to client identity by the responsible laboratory official at the time of removal from the laboratory. However, sample identifiers may not be obscured from the information. Additional information regarding CBI can be found in within the 2009 TNI standards.

15.3 Audit Findings

Audit findings are documented using the corrective action process and iCAT database. The laboratory's corrective action responses for both types of audits may include action plans that could not be completed within a predefined timeframe. In these instances, a completion date must be set and agreed to by operations management and the QA Manager.

Developing and implementing corrective actions to findings is the responsibility of the Operations Manager and the Supervisor where the finding originated. Findings that are not corrected by specified due dates are reported monthly to management in the QA monthly report. When requested, a copy of the audit report and the labs corrective action plan will be forwarded to Corporate Quality.

If any audit finding casts doubt on the effectiveness of the operations or on the correctness or validity of the laboratory's test results, the laboratory shall take timely corrective action, and shall notify clients in writing if the investigations show that the laboratory results have been affected. Once corrective action is implemented, a follow-up audit is scheduled to ensure that the problem has been corrected.

Clients must be notified promptly in writing, of any event such as the identification of defective measuring or test equipment that casts doubt on the validity of results given in any test report or amendment to a test report. The investigation must begin within 24-hours of discovery of the problem and all efforts are made to notify the client within two weeks after the completion of the investigation.

SECTION 16. MANAGEMENT REVIEWS

16.1 Quality Assurance Report

A comprehensive QA Report shall be prepared each month by the laboratory's QA Department and forwarded to the Laboratory Director, their Quality Director, as well as the VP of Operations. All aspects of the QA system are reviewed to evaluate the suitability of policies and procedures. During the course of the year, the Laboratory Director, VP of Operations or Corporate QA may request that additional information be added to the report.

On a monthly basis, Corporate QA compiles information from all the monthly laboratory reports. The Corporate Quality Directors prepare a report that includes a compilation of all metrics and notable information and concerns regarding the QA programs within the laboratories. The report also includes a listing of new regulations that may potentially impact the laboratories. This report is presented to the Senior Management Team and VPs of Operations.

16.2 Annual Management Review

The senior lab management team, comprised of the Laboratory Director, Operations Manager, Technical Director, and QA Manager, conducts a review annually of its quality systems and LIMS to ensure its continuing suitability and effectiveness in meeting client and regulatory requirements and to introduce any necessary changes or improvements. It will also provide a platform for defining goals, objectives and action items that feed into the laboratory planning system. Corporate Operations and Corporate QA personnel may be included in this meeting at the discretion of the Laboratory Director. The LIMS review consists of examining any audits, complaints or concerns that have been raised through the year that are related to the LIMS. The laboratory will summarize any critical findings that cannot be solved by the lab and report them to Corporate IT.

This management systems review (Corporate SOP No. CW-Q-S-004 and Work Instruction No. CW-Q-WI-003) uses information generated during the preceding year to assess the “big picture” by ensuring that routine actions taken and reviewed on a monthly basis are not components of larger systematic concerns. The monthly review should keep the quality systems current and effective, therefore, the annual review is a formal senior management process to review specific existing documentation. Significant issues from the following documentation are compiled or summarized by the QA Manager prior to the review meeting:

- Matters arising from the previous annual review.
- Prior Monthly QA Reports issues.
- Laboratory QA Metrics.
- Review of report reissue requests.
- Review of client feedback and complaints.
- Issues arising from any prior management or staff meetings.
- Minutes from prior senior lab management meetings. Issues that may be raised from these meetings include:
    - Adequacy of staff, equipment and facility resources.
    - Adequacy of policies and procedures.
    - Future plans for resources and testing capability and capacity.
- The annual internal double blind PT program sample performance (if performed),
- Compliance to the Ethics Policy and Data Integrity Plan. Including any evidence/incidents of inappropriate actions or vulnerabilities related to data Integrity.

A report is generated by the QA Manager and management. The report is distributed to the appropriate VP of Operation and the Quality Director. The report includes, but is not limited to:

- The date of the review and the names and titles of participants.
- A reference to the existing data quality related documents and topics that were reviewed.
- Quality system or operational changes or improvements that will be made as a result of the review [e.g., an implementation schedule including assigned responsibilities for the changes (Action Table)].

Changes to the quality systems requiring update to the laboratory QA Manual shall be included in the next revision of the QA Manual.

16.3 Potential Integrity Related Managerial Reviews

Potential integrity issues (data or business related) must be handled and reviewed in a confidential manner until such time as a follow-up evaluation, full investigation, or other appropriate actions have been completed and issues clarified. TestAmerica's Corporate Internal Investigations SOP shall be followed (SOP No. CW-L-S-002). All investigations that result in finding of inappropriate activity are documented and include any disciplinary actions involved, corrective actions taken, and all appropriate notifications of clients.

TestAmerica's President and CEO, Executive VP of Operations, VP of Client & Technical Services, VPs of Operations and Quality Directors receive a monthly report from the VP-QA/EHS summarizing any current data integrity or data recall investigations. The VPs of Operations are also made aware of progress on these issues for their specific labs.

SECTION 17. PERSONNEL

17.1 Overview

The laboratory's management believes that its highly qualified and professional staff is the single most important aspect in assuring a high level of data quality and service. The staff consists of professionals and support personnel as outlined in the organization chart in Figure 4-1.

All personnel must demonstrate competence in the areas where they have responsibility. Any staff that is undergoing training shall have appropriate supervision until they have demonstrated their ability to perform their job function on their own. Staff shall be qualified for their tasks based on appropriate education, training, experience and/or demonstrated skills as required.

The laboratory employs sufficient personnel with the necessary education, training, technical knowledge and experience for their assigned responsibilities.

All personnel are responsible for complying with all QA/QC requirements that pertain to the laboratory and their area of responsibility. Each staff member must have a combination of experience and education to adequately demonstrate a specific knowledge of their particular area of responsibility. Technical staff must also have a general knowledge of lab operations, test methods, QA/QC procedures and records management.

Laboratory management is responsible for formulating goals for lab staff with respect to education, training and skills and ensuring that the laboratory has a policy and procedures for

identifying training needs and providing training of personnel. The training shall be relevant to the present and anticipated responsibilities of the lab staff.

The laboratory only uses personnel that are employed by or under contract to, the laboratory. Contracted personnel, when used, must meet competency standards of the laboratory and work in accordance to the laboratory's quality system.

17.2 Education and Experience Requirements for Technical Personnel

The laboratory makes every effort to hire analytical staffs that possess a college degree (AA, BA, BS) in an applied science with some chemistry in the curriculum. Exceptions can be made based upon the individual's experience and ability to learn. Selection of qualified candidates for laboratory employment begins with documentation of minimum education, training, and experience prerequisites needed to perform the prescribed task. Minimum education and training requirements for TestAmerica employees are outlined in job descriptions and are generally summarized for analytical staff in the table below.

The laboratory maintains job descriptions for all personnel who manage, perform or verify work affecting the quality of the environmental testing the laboratory performs. Job Descriptions are located on the TestAmerica intranet site's Human Resources web-page (Also see Section 4 for position descriptions/responsibilities).

As a general rule for analytical staff:

Specialty	Education	Experience
Extractions, Digestions, some electrode methods (pH, DO, Redox, etc.), or Titrimetric and Gravimetric Analyses	H.S. Diploma	On the job training (OJT)
GFAA, CVAA, FLAA, Single component or short list Chromatography (e.g., Fuels, BTEX-GC, IC	A college degree in an applied science or 2 years of college and at least 1 year of college chemistry	Or 2 years prior analytical experience is required
ICP, ICPMS, Long List or complex chromatography (e.g., Pesticides, PCB, Herbicides, HPLC, etc.), GCMS	A college degree in an applied science or 2 years of college chemistry	or 5 years of prior analytical experience
Spectra Interpretation	A college degree in an applied science or 2 years of college chemistry	And 2 years relevant experience Or 5 years of prior analytical experience

Specialty	Education	Experience
Technical Managers – **General**	Bachelor's Degree in an applied science or engineering with 24 semester hours in chemistry An advanced (MS, PhD.) degree may substitute for one year of experience	And 2 years experience in environmental analysis of representative analytes for which they will oversee

When an analyst does not meet these requirements, they can perform a task under the direct supervision of a qualified analyst, peer reviewer or supervisor, and are considered an analyst in training. The person supervising an analyst in training is accountable for the quality of the analytical data and must review and approve data and associated corrective actions.

17.3 Training

The laboratory is committed to furthering the professional and technical development of employees at all levels.

Orientation to the laboratory's policies and procedures, in-house method training, and employee attendance at outside training courses and conferences all contribute toward employee proficiency. Below are examples of various areas of required employee training:

Required Training	Time Frame	Employee Type
Environmental Health & Safety	Prior to lab work	All
Ethics – New Hires	1 week of hire	All
Ethics – Comprehensive	90 days of hire	All
Data Integrity	30 days of hire	Technical and PMs
Quality Assurance	90 days of hire	All
Ethics – Comprehensive Refresher	Annually	All
Initial Demonstration of Capability (DOC)	Prior to unsupervised method performance	Technical

The laboratory maintains records of relevant authorization/competence, education, professional qualifications, training, skills and experience of technical personnel (including contracted personnel) as well as the date that approval/authorization was given. These records are kept on file at the laboratory. Also refer to "Demonstration of Capability" in Section 19.

The training of technical staff is kept up to date by:

- Each employee must have documentation in their training file that they have read, understood and agreed to follow the most recent version of the laboratory QA Manual and SOPs in their area of responsibility. This documentation is updated as SOPs are updated.
- Documentation from any training courses or workshops on specific equipment, analytical techniques or other relevant topics are maintained in their training file.

- Documentation of proficiency (refer to Section 19).
- An Ethics Agreement signed by each staff member (renewed each year) and evidence of annual ethics training.
- A Confidentiality Agreement signed by each staff member signed at the time of employment.
- Human Resources maintains documentation and attestation forms on employment status & records; benefit programs; timekeeping/payroll; and employee conduct (e.g., ethics violations). This information is maintained in the employee's secured personnel file.

Evidence of successful training could include such items as:

- Adequate documentation of training within operational areas, including one-on-one technical training for individual technologies, and particularly for people cross-trained.
- Analysts knowledge to refer to QA Manual for quality issues.
- Analysts following SOPs, i.e., practice matches SOPs.
- Analysts regularly communicate to supervisors and QA if SOPs need revision, rather than waiting for auditors to find problems.

Further details of the laboratory's training program are described in the Laboratory Training SOP BR-QA-011.

17.4 Data Integrity and Ethics Training Program

Establishing and maintaining a high ethical standard is an important element of a Quality System. Ethics and data integrity training is integral to the success of TestAmerica and is provided for each employee at TestAmerica. It is a formal part of the initial employee orientation within 1 week of hire followed by technical data integrity training within 30 days, comprehensive training within 90 days, and an annual refresher for all employees. Senior management at each facility performs the ethics training for their staff.

In order to ensure that all personnel understand the importance TestAmerica places on maintaining high ethical standards at all times; TestAmerica has established a Corporate Ethics Policy (Policy No. CW-L-P-004) and an Ethics Statement (CW-L-WI-002). All initial and annual training is documented by signature on the signed Ethics Statement demonstrating that the employee has participated in the training and understands their obligations related to ethical behavior and data integrity.

Violations of this Ethics Policy will not be tolerated. Employees who violate this policy will be subject to disciplinary actions up to and including termination. Criminal violations may also be referred to the Government for prosecution. In addition, such actions could jeopardize TestAmerica's ability to do work on Government contracts, and for that reason, TestAmerica has a Zero Tolerance approach to such violations.

Employees are trained as to the legal and environmental repercussions that result from data misrepresentation. Key topics covered in the presentation include:

- Organizational mission and its relationship to the critical need for honesty and full disclosure in all analytical reporting.
- Ethics Policy

- How and when to report ethical/data integrity issues. Confidential reporting.
- Record keeping.
- Discussion regarding data integrity procedures.
- Specific examples of breaches of ethical behavior (e.g. peak shaving, altering data or computer clocks, improper macros, etc., accepting/offering kickbacks, illegal accounting practices, unfair competition/collusion)
- Internal monitoring. Investigations and data recalls.
- Consequences for infractions including potential for immediate termination, debarment, or criminal prosecution.
- Importance of proper written narration / data qualification by the analyst and project manager with respect to those cases where the data may still be usable but are in one sense or another partially deficient.

Additionally, a data integrity hotline (1-800-736-9407) is maintained by TestAmerica and administered by the Corporate Quality Department.

SECTION 18. ACCOMMODATIONS AND ENVIRONMENTAL CONDITIONS

18.1 Overview

The laboratory is a 22,000 ft^2 secure laboratory facility with controlled access and designed to accommodate an efficient workflow and to provide a safe and comfortable work environment for employees. All visitors sign in and are escorted by laboratory personnel. Access is controlled by various measures.

The laboratory is equipped with structural safety features. Each employee is familiar with the location, use, and capabilities of general and specialized safety features associated with their workplace. The laboratory provides and requires the use of protective equipment including safety glasses, protective clothing, gloves, etc., OSHA and other regulatory agency guidelines regarding required amounts of bench and fume hood space, lighting, ventilation (temperature and humidity controlled), access, and safety equipment are met or exceeded.

Traffic flow through sample preparation and analysis areas is minimized to reduce the likelihood of contamination. Adequate floor space and bench top area is provided to allow unencumbered sample preparation and analysis space. Sufficient space is also provided for storage of reagents and media, glassware, and portable equipment. Ample space is also provided for refrigerated sample storage before analysis and archival storage of samples after analysis. Laboratory HVAC and deionized water systems are designed to minimize potential trace contaminants.

The laboratory is separated into specific areas for sample receiving, sample preparation, volatile organic sample analysis, non-volatile organic sample analysis, inorganic sample analysis, geotechnical sample analysis, and administrative functions.

18.2 Environment

Laboratory accommodation, test areas, energy sources, lighting are adequate to facilitate proper performance of tests. The facility is equipped with heating, ventilation, and air

conditioning (HVAC) systems appropriate to the needs of environmental testing performed at this laboratory.

The environment in which these activities are undertaken does not invalidate the results or adversely affect the required accuracy of any measurements.

The laboratory provides for the effective monitoring, control and recording of environmental conditions that may affect the results of environmental tests as required by the relevant specifications, methods, and procedures.

When any of the method or regulatory required environmental conditions change to a point where they may adversely affect test results, analytical testing will be discontinued until the environmental conditions are returned to the required levels.

Environmental conditions of the facility housing the computer network and LIMS are regulated to protect against raw data loss.

18.3 Work Areas

There is effective separation between neighboring areas when the activities therein are incompatible with each other. Examples include:

- Volatile organic chemical handling areas, including sample preparation and waste disposal, and volatile organic chemical analysis areas.

Access to and use of all areas affecting the quality of analytical testing is defined and controlled by secure access to the laboratory building as described below in the Building Security section.

Adequate measures are taken to ensure good housekeeping in the laboratory and to ensure that any contamination does not adversely affect data quality. These measures include regular cleaning to control dirt and dust within the laboratory. Work areas are available to ensure an unencumbered work area. Work areas include:

- Access and entryways to the laboratory.
- Sample receipt areas.
- Sample storage areas.
- Chemical and waste storage areas.
- Data handling and storage areas.
- Sample processing areas.
- Sample analysis areas.

18.4 Floor Plan

A floor plan can be found in Appendix 1.

18.5 Building Security

Building key cards are distributed to employees as necessary.

Visitors to the laboratory sign in and out in a visitor's logbook. A visitor is defined as any person who visits the laboratory who is not an employee of the laboratory. In addition to signing into the laboratory, the Environmental, Health and Safety Manual contains requirements for visitors and vendors. There are specific safety forms that must be reviewed and signed. Visitors (with the exception of company employees) are escorted by laboratory personnel at all times, or the location of the visitor is noted in the visitor's logbook.

SECTION 19. TEST METHODS AND METHOD VALIDATION

19.1 Overview

The laboratory uses methods that are appropriate to meet our clients' requirements and that are within the scope of the laboratory's capabilities. These include sampling, handling, transport, storage and preparation of samples, and, where appropriate, an estimation of the measurement of uncertainty as well as statistical techniques for analysis of environmental data.

Instructions are available in the laboratory for the operation of equipment as well as for the handling and preparation of samples. All instructions, Standard Operating Procedures (SOPs), reference methods and manuals relevant to the working of the laboratory are readily available to all staff. Deviations from published methods are documented (with justification) in the laboratory's approved SOPs. SOPs are submitted to clients for review at their request. Significant deviations from published methods require client approval and regulatory approval where applicable.

19.2 Standard Operating Procedures (SOPS)

The laboratory maintains SOPs that accurately reflect all phases of the laboratory such as assessing data integrity, corrective actions, handling customer complaints as well as all analytical methods and sampling procedures. The method SOPs are derived from the most recently promulgated/approved, published methods and are specifically adapted to the laboratory facility. Modifications or clarifications to published methods are clearly noted in the SOPs. All SOPs are controlled in the laboratory.

- All SOPs contain a revision number, effective date, and appropriate approval signatures. Controlled copies are available to all staff.
- Procedures for writing an SOP are incorporated by reference to TestAmerica's Corporate SOP entitled 'Writing a Standard Operating Procedure', No. CW-Q-S-002.
- SOPs are reviewed at a minimum of every 2 years (annually for Drinking Water and DoD SOPs), and where necessary, revised to ensure continuing suitability and compliance with applicable requirements.

19.3 Laboratory Methods Manual

For each test method, the laboratory shall have available the published referenced method as well as the laboratory developed SOP.

Note: If more stringent standards or requirements are included in a mandated test method or regulation than those specified in this manual, the laboratory shall demonstrate that such

requirements are met. If it is not clear which requirements are more stringent, the standard from the method or regulation is to be followed. Any exceptions or deviations from the referenced methods or regulations are noted in the specific analytical SOP.

The laboratory maintains an SOP Index for both technical and non-technical SOPs. Technical SOPs are maintained to describe a specific test method. Non-technical SOPs are maintained to describe functions and processes not related to a specific test method.

19.4 Selection of Methods

Since numerous methods and analytical techniques are available, continued communication between the client and laboratory is imperative to assure the correct methods are utilized. Once client methodology requirements are established, this and other pertinent information is summarized by the Project Manager. These mechanisms ensure that the proper analytical methods are applied when the samples arrive for log-in. For non-routine analytical services (e.g., special matrices, non-routine compound lists), the method of choice is selected based on client needs and available technology. The methods selected should be capable of measuring the specific parameter of interest, in the concentration range of interest, and with the required precision and accuracy.

19.4.1 Sources of Methods

Routine analytical services are performed using standard EPA-approved methodology. In some cases, modification of standard approved methods may be necessary to provide accurate analyses of particularly complex matrices. When the use of specific methods for sample analysis is mandated through project or regulatory requirements, only those methods shall be used.

When clients do not specify the method to be used or methods are not required, the methods used will be clearly validated and documented in an SOP and available to clients and/or the end user of the data.

The analytical methods used by the laboratory are those currently accepted and approved by the U. S. EPA and the state or territory from which the samples were collected. Reference methods include:

- *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, US EPA, January 1996.*
- *Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act; Analysis and Sampling Procedures; 40CFR Part 136 as amended by Method Update Rule; May 18, 2012.*
- *Methods for Chemical Analysis of Water and Wastes, EPA 600 (4-79-020), 1983.*
- *Methods for the Determination of Inorganic Substances in Environmental Samples, EPA-600/R-93/100, August 1993.*
- *Methods for the Determination of Metals in Environmental Samples, EPA/600/4-91/010, June 1991. Supplement I: EPA-600/R-94/111, May 1994.*
- *Methods for the Determination of Organic Compounds in Drinking Water, EPA-600/4-88-039, December 1988, Revised, July 1991, Supplement I, EPA-600-4-90-020, July 1990,*

Supplement II, EPA-600/R-92-129, August 1992. Supplement III EPA/600/R-95/131 - August 1995 (EPA 500 Series) (EPA 500 Series methods)

- *Technical Notes on Drinking Water Methods, EPA-600/R94-173, October 1994*
- *NIOSH Manual of Analytical Methods, 4th ed., August 1994.*
- *Statement of Work for Inorganics & Organics Analysis, SOM and ISM, current versions, USEPA Contract Laboratory Program Multi-media, Multi-concentration.*
- *Standard Methods for the Examination of Water and Wastewater, 18th/19th /20th/ on-line edition; Eaton, A.D. Clesceri, L.S. Greenberg, A.E. Eds; American Water Works Association, Water Pollution Control Federation, American Public Health Association: Washington, D.C.*
- *Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846), Third Edition, September 1986, Final Update I, July 1992, Final Update IIA, August 1993, Final Update II, September 1994; Final Update IIB, January 1995; Final Update III, December 1996; Final Update IV, January 2008; Final Update V, August 2015.*
- *Annual Book of ASTM Standards, American Society for Testing & Materials (ASTM), Philadelphia, PA.*
- *National Status and Trends Program, National Oceanographic and Atmospheric Administration, Volume I-IV, 1985-1994.*
- *Manual for the Certification of Laboratories Analyzing Drinking Water (EPA 815-R-05-004, January 2005)*
- *Code of Federal Regulations (CFR) 40, Parts 136, 141, 172, 173, 178, 179 and 261*

The laboratory reviews updated versions to all the aforementioned references for adaptation based upon capabilities, instrumentation, etc., and implements them as appropriate. As such, the laboratory strives to perform only the latest versions of each approved method as regulations allow or require.

Other reference procedures for non-routine analyses may include methods established by specific states (e.g., Underground Storage Tank methods), ASTM or equipment manufacturers. Sample type, source, and the governing regulatory agency requiring the analysis will determine the method utilized.

The laboratory shall inform the client when a method proposed by the client may be inappropriate or out of date. After the client has been informed, and they wish to proceed contrary to the laboratory's recommendation, it will be documented.

19.4.2 Demonstration of Capability

Before the laboratory may institute a new method and begin reporting results, the laboratory shall confirm that it can properly operate the method. In general, this demonstration does not test the performance of the method in real world samples, but in an applicable and available clean matrix sample. If the method is for the testing of analytes that are not conducive to spiking, demonstration of capability may be performed on quality control samples.

A demonstration of capability (DOC) is performed whenever there is a change in instrument type (e.g., new instrumentation), matrix, method or personnel (e.g., analyst hasn't performed the test within the last 12 months).

Note: The laboratory shall have a DOC for all analytes included in the methods that the laboratory performs, and proficiency DOCs for each analyst shall include all analytes that the laboratory routinely performs. Addition of non-routine analytes does not require new DOCs for all analysts if those analysts are already qualified for routine analytes tested using identical chemistry and instrument conditions.

The initial demonstration of capability must be thoroughly documented and approved by the Technical Manager and QA Manager prior to independently analyzing client samples. All associated documentation must be retained in accordance with the laboratories archiving procedures.

The laboratory must have an approved SOP, demonstrate satisfactory performance, and conduct an MDL study (when applicable). There may be other requirements as stated within the published method or regulations (i.e., retention time window study).

Note: In some instances, a situation may arise where a client requests that an unusual analyte be reported using a method where this analyte is not normally reported. If the analyte is being reported for regulatory purposes, the method must meet all procedures outlined within this QA Manual (SOP, MDL, and Demonstration of Capability). If the client states that the information is not for regulatory purposes, the result may be reported as long as the following criteria are met:

- The instrument is calibrated for the analyte to be reported using the criteria for the method and ICV/CCV criteria are met (unless an ICV/CCV is not required by the method or criteria are per project DQOs).
- The laboratory's nominal or default reporting limit (RL) is equal to the quantitation limit (QL), must be at or above the lowest non-zero standard in the calibration curve and must be reliably determined. Project RLs are client specified reporting levels which may be higher than the QL. Results reported below the QL must be qualified as estimated values. Also see Section 19.6.1.3, Relationship of Limit of Detection (LOD) to Quantitation Limit (QL).
- The client request is documented and the lab informs the client of its procedure for working with unusual compounds. The final report must be footnoted: *Reporting Limit based on the low standard of the calibration curve.*

19.4.3 <u>Initial Demonstration of Capability (IDOC) Procedures</u>

The following procedure is the general requirement for IDOC. Other procedures may be appropriate for a method, and are detailed in laboratory SOP BR-QA-011.

19.4.3.1 The spiking standard used must be prepared independently from those used in instrument calibration.

19.4.3.2 The analyte(s) shall be diluted in a volume of clean matrix sufficient to prepare four aliquots at the concentration specified by a method or the laboratory SOP.

19.4.3.3 At least four aliquots shall be prepared (including any applicable clean-up procedures) and analyzed according to the test method (either concurrently or over a period of days).

19.4.3.4 Using all of the results, calculate the mean recovery in the appropriate reporting units and the standard deviations for each parameter of interest.

19.4.3.5 When it is not possible to determine the mean and standard deviations, such as for presence, absence and logarithmic values, the laboratory will assess performance against criteria described in the Method SOP.

19.4.3.6 Compare the information obtained above to the corresponding acceptance criteria for precision and accuracy in the test method (if applicable) or in laboratory generated acceptance criteria (LCS or interim criteria) if there is no mandatory criteria established. If any one of the parameters do not meet the acceptance criteria, the performance is unacceptable for that parameter.

19.4.3.7 When one or more of the tested parameters fail at least one of the acceptance criteria, the analyst must proceed according to either option listed below:

- Locate and correct the source of the problem and repeat the test for all parameters of interest beginning with 19.4.3.3 above.
- Beginning with 19.4.3.3 above, repeat the test for all parameters that failed to meet criteria. Repeated failure, however, will confirm a general problem with the measurement system. If this occurs, locate and correct the source of the problem and repeat the test for all compounds of interest beginning with 19.4.3.1 above.

Note: Results of successive LCS analyses can be used to fulfill the DOC requirement.

A certification statement (refer to Figure 19-1) shall be used to document the completion of each initial demonstration of capability. A copy of the certification is archived in the analyst's training folder.

19.5 Laboratory Developed Methods and Non-Standard Methods

Any new method developed by the laboratory must be fully defined in an SOP and validated by qualified personnel with adequate resources to perform the method. Method specifications and the relation to client requirements must be clearly conveyed to the client if the method is a non-standard method (not a published or routinely accepted method). The client must also be in agreement to the use of the non-standard method.

19.6 Validation of Methods

Validation is the confirmation by examination and the provision of objective evidence that the particular requirements for a specific intended use are fulfilled.

All non-standard methods, laboratory designed/developed methods, standard methods used outside of their scope, and major modifications to published methods must be validated to confirm they are fit for their intended use. The validation will be as extensive as necessary to meet the needs of the given application. The results are documented with the validation procedure used and contain a statement as to the fitness for use.

19.6.1 Method Validation and Verification Activities for All New Methods

While method validation can take various courses, the following activities can be required as part of method validation. Method validation records are designated QC records and are archived accordingly.

19.6.1.1 Determination of Method Selectivity – Method selectivity is the demonstrated ability to discriminate the analyte(s) of interest from other compounds in the specific matrix or matrices from other analytes or interference. In some cases to achieve the required selectivity for an analyte, a confirmation analysis is required as part of the method.

19.6.1.2 Determination of Method Sensitivity – Sensitivity can be both estimated and demonstrated. Whether a study is required to estimate sensitivity depends on the level of method development required when applying a particular measurement system to a specific set of samples. Where estimations and/or demonstrations of sensitivity are required by regulation or client agreement, such as the procedure in 40 CFR Part 136 Appendix B, under the Clean Water Act, these shall be followed.

19.6.1.3 Relationship of Limit of Detection (LOD) to the Limit of Quantitation (OQL) – An important characteristic of expression of sensitivity is the difference in the LOD and the LOQ. The LOD is the minimum level at which the presence of an analyte can be reliably concluded. The QL is the minimum concentration of analyte that can be quantitatively determined with acceptable precision and bias. For most instrumental measurement systems, there is a region where semi-quantitative data is generated around the LOD (both above and below the estimated MDL or LOD) and below the LOQ. In this region, detection of an analyte may be confirmed but quantification of the analyte is unreliable within the accuracy and precision guidelines of the measurement system. When an analyte is detected below the LOQ, and the presence of the analyte is confirmed by meeting the qualitative identification criteria for the analyte, the analyte can be reliably reported, but the amount of the analyte can only be estimated. If data is to be reported in this region, it must be done so with a qualification that denotes the semi-quantitative nature of the result.

19.6.1.4 Determination of Interferences – A determination that the method is free from interferences in a blank matrix is performed.

19.6.1.5 Determination of Range – Where appropriate to the method, the quantitation range is determined by comparison of the response of an analyte in a curve to established or targeted criteria. Generally the upper quantitation limit is defined by highest acceptable calibration concentration. The lower quantitation limit or LOQ cannot be lower than the lowest non-zero calibration level, and can be constrained by required levels of bias and precision.

19.6.1.6 Determination of Accuracy and Precision – Accuracy and precision studies are generally performed using replicate analyses, with a resulting percent recovery and measure of reproducibility (standard deviation, relative standard deviation) calculated and measured against a set of target criteria.

19.6.1.7 Documentation of Method – The method is formally documented in an SOP. If the method is a minor modification of a standard laboratory method that is already documented in

an SOP, an SOP Attachment describing the specific differences in the new method is acceptable in place of a separate SOP.

19.6.1.8 Continued Demonstration of Method Performance – Continued demonstration of Method Performance is addressed in the SOP. Continued demonstration of method performance is generally accomplished by batch specific QC samples such as LCS, method blanks or PT samples.

19.7 Method Detection Limits (MDL) / Limits of Detection (LOD)

Method detection limits (MDL) are initially determined in accordance with 40 CFR Part 136, Appendix B or alternatively by other technically acceptable practices that have been accepted by regulators. MDL is also sometimes referred to as Limit of Detection (LOD). The MDL theoretically represents the concentration level for each analyte within a method at which the analyst is 99% confident that the true value can be differentiated from blanks. The MDL is determined for each analyte initially during the method validation process and updated as required in the analytical methods, whenever there is a significant change in the procedure or equipment, or based on project specific requirements. Generally, the analyst prepares at least seven replicates of solution spiked at one to five times the estimated method detection limit (most often at the lowest standard in the calibration curve) into the applicable matrix with all the analytes of interest. Each of these aliquots is extracted (including any applicable clean-up procedures) and analyzed in the same manner as the samples. Where possible, the seven replicates should be analyzed over 2-4 days to provide a more realistic MDL.

Refer to the laboratory SOP No. BR-QA-005 for details on the laboratory's MDL process.

19.8 Instrument Detection Limits (IDL)

The IDL is sometimes used to assess the reasonableness of the MDLs or in some cases required by the analytical method or program requirements. IDLs are most used in metals analyses but may be useful in demonstration of instrument performance in other areas.

IDLs are calculated to determine an instrument's sensitivity independent of any preparation method. IDLs are calculated either using 7 replicate spike analyses, like MDL but without sample preparation, or by the analysis of 10 instrument blanks and calculating 3 x the absolute value of the standard deviation.

If IDL is > than the MDL, it may be used as the reported MDL.

19.9 Verification of Detection and Reporting Limits

Once an MDL is established, it must be verified quarterly (MDLv), on each instrument, by analyzing a quality control sample (prepared as a sample) at no more than 3 times the calculated MDL for single analyte analyses (e.g. most wet chemistry methods, Atomic Absorption, etc.) and no more than 4 times the calculated MDL for multiple analyte methods (e.g. GC, GCMS, ICP, etc.). The analytes must be qualitatively identified. This verification does not apply to methods that are not readily spiked (e.g. pH, turbidity, etc.) or where the lab does not report to the MDL. If the MDL does not verify, then the lab will not report to the MDL, or redevelop their MDL or use the level where qualitative identification is established. MDLs in

most cases are re-determined annually, but must be verified at least quarterly, dependent on certification requirements.

For DoD accredited methods, once the MDL is determined, it must be verified on each instrument used for the given method. TestAmerica defines the DoD QSM Detection Limit (DL) as being equal to the MDL. TestAmerica also defines the DoD QSM Limit of Detection (LOD) as being equal to the lowest concentration standard that successfully verifies the MDL, also referred to as the MDLV standard. MDL and MDLV standards are extracted/digested and analyzed through the entire analytical process. The MDL and MDLV determinations do not apply to methods that are not readily spiked (e.g. pH, turbidity, etc.) or where the lab does not report to the MDL. If the MDLV standard is not successful, then the laboratory will redevelop their MDL or perform and pass two consecutive MDLVs at a higher concentration and set the LOD at the higher concentration. Initial and quarterly verification is required for all methods listed in the laboratory's DoD ELAP Scope of Accreditation. Refer to the laboratory SOP BR-QA-005 Method Detection Limits (MDLs/DLs) for further details.

When the laboratory establishes a LOQ, it must be initially verified by the analysis of a low level standard or QC sample at 1-2 times the reporting limit and annually thereafter. The annual requirement is waived for methods that have an annually verified MDL. The laboratory will comply with any regulatory requirements.

Where applicable, the laboratory quantitation limit is equivalent to the DoD Limit of Quantitation (LOQ), which is at a concentration equal to or greater than the lowest non-zero calibration standard. The DoD QSM requires the laboratory to perform an initial characterization of the bias and precision at the LOQ and quarterly LOQ verifications thereafter. If the quarterly verification results are not consistent with three-standard deviation confidence limits established initially, then the bias and precision will be reevaluated and clients contacted for any on-going projects. For DoD projects, TestAmerica makes a distinction between the Reporting Limit (RL) and the LOQ. The RL is a level at or above the LOQ that is used for specific project reporting purposes, as agreed to between the laboratory and the client. The RL cannot be lower than the LOQ concentration, but may be higher.

19.10 Retention Time Windows

Most organic analyses and some inorganic analyses use chromatography techniques for qualitative and quantitative determinations. For every chromatography analysis or as specific in the reference method, each analyte will have a specific time of elution from the column to the detector. This is known as the analytes retention time. The variance in the expected time of elution is defined as the retention time window. As the key to analyte identification in chromatography, retention time windows must be established on every column for every analyte used for that method. Complete details are available in the laboratory SOPs.

19.11 Evaluation of Selectivity

The laboratory evaluates selectivity by following the checks within the applicable analytical methods, which include mass spectral tuning, second column confirmation, ICP interelement interference checks, chromatography retention time windows, and sample blanks.

19.12 Estimation of Uncertainty of Measurement

19.12.1 Uncertainty is "a parameter associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the measurand" (as defined by the International Vocabulary of Basic and General Terms in Metrology, ISO Geneva, 1993, ISBN 92-67-10175-1). Knowledge of the uncertainty of a measurement provides additional confidence in a result's validity. Its value accounts for all the factors which could possibly affect the result, such as adequacy of analyte definition, sampling, matrix effects and interferences, climatic conditions, variances in weights, volumes, and standards, analytical procedure, and random variation. Some national accreditation organizations require the use of an "expanded uncertainty": the range within which the value of the measurand is believed to lie within at least a 95% confidence level with the coverage factor k=2.

19.12.2 Uncertainty is not error. Error is a single value, the difference between the true result and the measured result. On environmental samples, the true result is never known. The measurement is the sum of the unknown true value and the unknown error. Unknown error is a combination of systematic error, or bias, and random error. Bias varies predictably, constantly, and independently from the number of measurements. Random error is unpredictable, assumed to be Gaussian in distribution, and reducible by increasing the number of measurements.

19.12.3 The minimum uncertainty associated with results generated by the laboratory can be determined by using the Laboratory Control Sample (LCS) accuracy range for a given analyte. The LCS limits are used to assess the performance of the measurement system since they take into consideration all of the laboratory variables associated with a given test over time (except for variability associated with the sampling and the variability due to matrix effects). The percent recovery of the LCS is compared either to the method-required LCS accuracy limits or to the statistical, historical, in-house LCS accuracy limits.

19.12.4 To calculate the uncertainty for the specific result reported, multiply the result by the decimal of the lower end of the LCS range percent value for the lower end of the uncertainty range, and multiply the result by the decimal of the upper end of the LCS range percent value for the upper end of the uncertainty range. These calculated values represent uncertainties at approximately the 99% confidence level with a coverage factor of k = 3. As an example, for a reported result of 1.0 mg/L with an LCS recovery range of 50 to 150%, the estimated uncertainty in the result would be 1.0 +/- 0.5 mg/L.

19.12.5 In the case where a well-recognized test method specifies limits to the values of major sources of uncertainty of measurement (e.g., 524.2, 525, etc.) and specifies the form of presentation of calculated results, no further discussion of uncertainty is required.

19.13 Sample Reanalysis Guidelines

Because there is a certain level of uncertainty with any analytical measurement, a sample re-preparation (where appropriate) and subsequent analysis (hereafter referred to as 'reanalysis') may result in either a higher or lower value from an initial sample analysis. There are also variables that may be present (e.g., sample homogeneity, analyte precipitation over time, etc.) that may affect the results of a reanalysis. Based on the above comments, the laboratory will

reanalyze samples at a client's request with the following caveats. **Client specific Contractual Terms & Conditions for reanalysis protocols may supersede the following items.**

- Homogenous samples: If a reanalysis agrees with the original result to within the RPD limits for MS/MSD or Duplicate analyses, or within ± 1 reporting limit for samples ≤ 5x the reporting limit, the original analysis will be reported. At the client's request, both results may be reported on the same report but not on two separate reports.

- If the reanalysis does not agree (as defined above) with the original result, then the laboratory will investigate the discrepancy and reanalyze the sample a third time for confirmation if sufficient sample is available.

- Any potential charges related to reanalysis are discussed in the contract terms and conditions or discussed at the time of the request. The client will typically be charged for reanalysis unless it is determined that the lab was in error.

19.14 Control of Data

The laboratory has policies and procedures in place to ensure the authenticity, integrity, and accuracy of the analytical data generated by the laboratory.

19.14.1 Computer and Electronic Data Related Requirements

The three basic objectives of our computer security procedures and policies are shown below. More detail is outlined in corporate IT policies and procedures. The laboratory is currently running TestAmerica LIMS (TALS) which is a custom in-house developed LIMS that has been highly customized to meet the needs of the laboratory. It is referred to as LIMS for the remainder of this section. The LIMS utilizes an SQL database which is an industry standard relational database platform. It is referred to as Database for the remainder of this section.

19.14.1.1 Maintain the Database Integrity – Assurance that data is reliable and accurate through data verification (review) procedures, password-protecting access, anti-virus protection, data change requirements, as well as an internal LIMS permissions procedure.

- LIMS Database Integrity is achieved through data input validation, internal user controls, and data change requirements.
- Spreadsheets and other software developed in-house must be verified with documentation through hand calculations prior to use. Cells containing calculations must be lock-protected and controlled.
- Instrument hardware and software adjustments are safeguarded through maintenance logs, audit trails and controlled access.

19.14.1.2 Ensure Information Availability – Protection against loss of information or service is ensured through scheduled back-ups, stable file server network architecture, secure storage of media, line filter, Uninterruptible Power Supply (UPS), and maintaining older versions of software as revisions are implemented.

19.14.1.3 **Maintain Confidentiality** – Ensure data confidentiality through physical access controls such as password protection or website access approval when electronically transmitting data.

19.14.2 Data Reduction

The complexity of the data reduction depends on the analytical method and the number of discrete operations involved (e.g., extractions, dilutions, instrument readings and concentrations). The analyst calculates the final results from the raw data or uses appropriate computer programs to assist in the calculation of final reportable values.

Manual integration of peaks will be documented and reviewed and the raw data will be flagged in accordance with the TestAmerica Corporate SOP No. CA-Q-S-002, *Acceptable Manual Integration Practices* and laboratory SOP No. BR-QA-006.

Analytical results are reduced to appropriate concentration units specified by the analytical method, taking into account factors such as dilution, sample weight or volume, etc. Blank correction will be applied only when required by the method or per manufacturer's indication; otherwise, it should not be performed. Calculations are independently verified by appropriate laboratory staff. Calculations and data reduction steps for various methods are summarized in the respective analytical SOPs or program requirements.

19.14.2.1 All raw data must be retained in the worklist folder, computer file (if appropriate), and/or runlog. All criteria pertinent to the method must be recorded. The documentation is recorded at the time observations or calculations are made and must be signed or initialed/dated (month/day/year). It must be easily identifiable who performed which tasks if multiple people were involved.

19.14.2.2 In general, concentration results are reported in milligrams per liter (mg/l) or micrograms per liter (µg/l) for liquids and milligrams per kilogram (mg/kg) or micrograms per kilogram (µg/kg) for solids. For values greater than 10,000 mg/l, results can be reported in percent, i.e., 10,000 mg/l = 1**%.** Default Units are defined in each lab SOP.

19.14.2.3 In reporting, the analyst or the instrument output records the raw data result using values of known certainty plus one uncertain digit. If final calculations are performed external to LIMS, the results should be entered in LIMS with at least three significant figures. In general, results are reported to the number of significant figures required for the project, and programmed into the LIMS formatter used by the project manager.

19.14.2.4 For those methods that do not have an instrument printout or an instrumental output compatible with the LIMS, the raw results and dilution factors are entered directly into LIMS by the analyst, and the software calculates the final result for the analytical report. LIMS has a defined significant figure criterion for each analyte.

19.14.2.5 The laboratory strives to import data directly from instruments or calculation spreadsheets to ensure that the reported data are free from transcription and calculation errors. For those analyses with an instrumental output compatible with the LIMS, the raw results and dilution factors are transferred into LIMS electronically after reviewing the quantitation report, and removing unrequested or poor spectrally-matched compounds. The analyst prints a copy of what has been entered to check for errors. This printout and the instrument's printout of calibrations, concentrations, retention times, chromatograms, and mass spectra, if applicable,

are retained with the data file. The data file is stored in a on the instrument computer; periodically, and backed up via the procedures in laboratory SOP No. BR-IT-001.

19.14.3 Logbook / Worksheet Use Guidelines

Logbooks and worksheets are filled out 'real time' and have enough information on them to trace the events of the applicable analysis/task. (e.g. calibrations, standards, analyst, sample ID, date, time on short holding time tests, temperatures when applicable, calculations are traceable, etc.)

- Corrections are made following the procedures outlined in Section 12.
- Logbooks are controlled by the QA department. A record is maintained of all logbooks in the lab.
- Unused portions of pages must be "Z"'d out, signed and dated.
- Worksheets are created with the approval of the QA Manager at the facility. The QA Manager controls all worksheets following the procedures in Section 6.

19.14.4 Review / Verification Procedures

Review procedures are outlined in several SOPs to ensure that reported data are free from calculation and transcription errors, that QC parameters have been reviewed and evaluated before data is reported. The primary data review SOP is BR-QA-019, but review procedures more specific to an individual task are found in individual method SOPs. The laboratory also has an SOP discussing Manual Integrations to ensure the authenticity of the data, CA-Q-S-002. The general review concepts are discussed below, more specific information can be found in the SOPs.

19.14.4.1 Log-In Review - The data review process starts at the sample receipt stage. Sample control personnel review chain-of-custody forms and project instructions from the project management group. This is the basis of the sample information and analytical instructions entered into the LIMS. The log-in instructions are reviewed by the personnel entering the information, and a second level review is conducted by the project management staff.

19.14.4.2 First Level Data Review - The next level of data review occurs with the analysts. As data are generated, analysts review their work to ensure that the results meet project and SOP requirements. First level reviews include inspection of all raw data (e.g., instrument output for continuous analyzers, chromatograms, spectra, and manual integrations), evaluation of calibration/calibration verification data in the day's analytical run, evaluation of QC data, and reliability of sample results. The analyst transfers data into LIMS, data qualifiers are added as needed. All first level reviews are documented.

19.14.4.3 Second Level Data Review – All analytical data are subject to review by a second qualified analyst or supervisor. Second level reviews include inspection of all raw data (e.g., instrument output, chromatograms, and spectra) including 100% of data associated with any changes made by the primary analyst, such as manual integrations or reassignment of peaks to different analytes, or elimination of false negative analytes. The second review also includes evaluation of initial calibration/calibration verification data in the day's analytical run, evaluation of QC data, reliability of sample results, qualifiers and NCM narratives. Manual calculations are checked in second level review. All second level reviews are documented.

Issues that deem further review include the following:

- QC data are outside the specified control limits for accuracy and precision
- Reviewed sample data does not match with reported results
- Unusual detection limit changes are observed
- Samples having unusually high results
- Samples exceeding a known regulatory limit
- Raw data indicating some type of contamination or poor technique
- Inconsistent peak integration
- Transcription errors
- Results outside of calibration range

19.14.4.4 Unacceptable analytical results may require reanalysis of the samples. Any problems are brought to the attention of the Laboratory Director, Project Manager, Quality Assurance Manager, Technical Manager, or Supervisor for further investigation. Corrective action is initiated whenever necessary.

19.14.4.5 The results are then entered or directly transferred into the report and a hard copy (or .pdf) is printed for the client.

19.14.4.6 As a final review prior to the release of the report, the Project Manager reviews the results for appropriateness and completeness. This review and approval ensures that client requirements have been met and that the final report has been properly completed. The process includes, but is not limited to, verifying that chemical relationships are evaluated, COC is followed, cover letters/ narratives are present, flags are appropriate, and project specific requirements are met.

19.14.4.7 Any project that requires a data package is subject to a tertiary data review for transcription errors and acceptable quality control requirements. The Project Manager then signs the final report. The accounting personnel also check the report for any clerical or invoicing errors. When complete, the report is sent out to the client.

19.14.5 Manual Integrations

Computerized data systems provide the analyst with the ability to re-integrate raw instrument data in order to optimize the interpretation of the data. Though manual integration of data is an invaluable tool for resolving variations in instrument performance and some sample matrix problems, when used improperly, this technique would make unacceptable data appear to meet quality control acceptance limits. Improper re-integrations lead to legally indefensible data, a poor reputation, or possible laboratory decertification. Because guidelines for re-integration of data are not provided in the methods and most methods were written prior to widespread implementation of computerized data systems, the laboratory trains all analytical staff on proper manual integration techniques using TestAmerica's Corporate SOP (CA-Q-S-002) as the guideline .

19.14.5.1 The analyst must adjust baseline or the area of a peak in some situations, for example when two compounds are not adequately resolved or when a peak shoulder needs to

be separated from the peak of interest. The analyst must use professional judgment and common sense to determine when manual integrating is required. Analysts are encouraged to ask for assistance from a senior analyst or manager when in doubt.

19.14.5.2 Analysts shall not increase or decrease peak areas for the sole purpose of achieving acceptable QC recoveries that would have otherwise been unacceptable. The intentional recording or reporting of incorrect information (or the intentional omission of correct information) is against company principles and policy and is grounds for immediate termination.

19.14.5.3 Client samples, performance evaluation samples, and quality control samples are all treated equally when determining whether or not a peak area or baseline should be manually adjusted.

19.14.5.4 All manual integrations receive a second level review. Manual integrations must be indicated on an expanded scale “after” chromatograms such that the integration performed can be easily evaluated during data review. Expanded scale “before” chromatograms are also required for all manual integrations on QC parameters (calibrations, calibration verifications, laboratory control samples, internal standards, surrogates, etc.) unless the laboratory has another documented corporate approved procedure in place that can demonstrate an active process for detection and deterrence of improper integration practices.

Figure 19-1. Example - Demonstration of Capability Documentation

Analyst Demonstration of Capability

TestAmerica Burlington

1/19/2018

Preparation Method(s):	3541
Analytical Method(s):	8082A
Matrix:	Solid
Method Description:	Polychlorinated Biphenyls (PCBs) by Gas Chromatography
Preparation SOP No:	BR-EX-027r2_3541
Analytical SOP No:	BR-GC-005r12.1_8082A

We, the undersigned, CERTIFY that:

1. The analyst identified above, using the cited test method with the specifications in the cited SOP, which is in use at this facility for the analysis of samples under the laboratory's Quality Assurance Plan, has completed the Demonstration of Capability (DOC).
2. The test method(s) was performed by the analyst identified on this certificate.
3. A copy of test method(s) and laboratory SOPs are available for all personnel on-site. **These documents have been reviewed by the analyst as part of this DOC.**
4. The data associated with the demonstration of capability are true, accurate, complete and self-explanatory.
5. All raw data necessary to reconstruct and validate these analyses have been retained at the facility. The associated information is organized and available for review.

John Murray	John Murray	1/22/18
Analyst	**Signature**	**Date**
Ben Kirchner		1/22/18
Dept Supervisor	**Signature**	**Date**
Luke Orchard	Luke Orchard	1-22-18
Quality Assurance Officer	**Signature**	**Date**

Company Confidential & Proprietary

SECTION 20. EQUIPMENT and CALIBRATIONS

20.1 Overview

The laboratory purchases the most technically advanced analytical instrumentation for sample analyses. Instrumentation is purchased on the basis of accuracy, dependability, efficiency and sensitivity. Each laboratory is furnished with all items of sampling, preparation, analytical testing and measurement equipment necessary to correctly perform the tests for which the laboratory has capabilities. Each piece of equipment is capable of achieving the required accuracy and complies with specifications relevant to the method being performed. Before being placed into use, the equipment (including sampling equipment) is calibrated and checked to establish that it meets its intended specification. The calibration routines for analytical instruments establish the range of quantitation. Calibration procedures are specified in laboratory SOPs. A list of laboratory instrumentation is presented in Table 20-1.

Equipment is only operated by authorized and trained personnel. Manufacturer's instructions for equipment use are readily accessible to all appropriate laboratory personnel.

20.2 Preventive Maintenance

The laboratory follows a well-defined maintenance program to ensure proper equipment operation and to prevent the failure of laboratory equipment or instrumentation during use. This program of preventive maintenance helps to avoid delays due to instrument failure.

Routine preventive maintenance procedures and frequency, such as cleaning and replacements, should be performed according to the procedures outlined in the manufacturer's manual. Qualified personnel must also perform maintenance when there is evidence of degradation of peak resolution, a shift in the calibration curve, loss of sensitivity, or failure to continually meet one of the quality control criteria.

Table 20-2 lists examples of scheduled routine maintenance. It is the responsibility of each supervisor to ensure that instrument maintenance logs are kept for all equipment in his/her department. Preventative maintenance procedures may also be outlined in analytical SOPs or instrument manuals.

Instrument maintenance logs are controlled and are used to document instrument problems, instrument repair and maintenance activities. Maintenance logs shall be kept for all major pieces of equipment. Instrument maintenance logs may also be used to specify instrument parameters.

- Documentation must include all major maintenance activities such as contracted preventive maintenance and service and in-house activities such as the replacement of electrical components, lamps, tubing, valves, columns, detectors, cleaning and adjustments.
- Each entry in the instrument log includes the Analyst's initials, the date, a detailed description of the problem (or maintenance needed/scheduled), a detailed explanation of the solution or maintenance performed, and a verification that the equipment is functioning properly (state what was used to determine a return to control. e.g. CCV run on *'date'* was acceptable, or instrument recalibrated on 'date' with acceptable verification, etc.) must also be documented in the instrument records.

- When maintenance or repair is performed by an outside agency, service receipts detailing the service performed can be affixed into the logbooks adjacent to pages describing the maintenance performed. This stapled in page must be signed across the page entered and the logbook so that it is clear that a page is missing if only half a signature is found in the logbook.

If an instrument requires repair (subjected to overloading or mishandling, gives suspect results, or otherwise has shown to be defective or outside of specified limits) it shall be taken out of operation and tagged as out-of-service or otherwise isolated until such a time as the repairs have been made and the instrument can be demonstrated as operational by calibration and/or verification or other test to demonstrate acceptable performance. The laboratory shall examine the effect of this defect on previous analyses.

In the event of equipment malfunction that cannot be resolved, service shall be obtained from the instrument vendor manufacturer, or qualified service technician, if such a service can be tendered. If on-site service is unavailable, arrangements shall be made to have the instrument shipped back to the manufacturer for repair. Back up instruments, which have been approved, for the analysis shall perform the analysis normally carried out by the malfunctioning instrument. If the back-up is not available and the analysis cannot be carried out within the needed timeframe, the samples shall be subcontracted.

At a minimum, if an instrument is sent out for service or transferred to another facility, it must be recalibrated and the laboratory MDL verified (using an MDLV) prior to return to lab operations.

20.3 Support Equipment

This section applies to all devices that may not be the actual test instrument, but are necessary to support laboratory operations. These include but are not limited to: balances, ovens, refrigerators, freezers, water baths, temperature measuring devices, thermal/pressure sample preparation devices and volumetric dispensing devices if quantitative results are dependent on their accuracy, as in standard preparation and dispensing or dilution into a specified volume. All raw data records associated with the support equipment are retained to document instrument performance.

20.3.1 Weights and Balances

The accuracy of the balances used in the laboratory is checked every working day, before use. All balances are placed on stable counter tops.

Each balance is checked prior to initial serviceable use with at least two certified ASTM type 1 weights spanning its range of use (weights that have been calibrated to ASTM type 1 weights may also be used for daily verification). ASTM type 1 weights used only for calibration of other weights (and no other purpose) are inspected for corrosion, damage or nicks at least annually and if no damage is observed, they are calibrated at least every 5 years by an outside calibration laboratory. Any weights (including ASTM Type 1) used for daily balance checks or other purposes are recalibrated/recertified annually to NIST standards (this may be done internally if laboratory maintains “calibration only” ASTM type 1 weights).
All balances are serviced annually by a qualified service representative, who supplies the laboratory with a certificate that identifies traceability of the calibration to the NIST standards.

All of this information is recorded in logs, and the recalibration/recertification certificates are kept on file.

20.3.2 pH, Conductivity, and Turbidity Meters

The pH meters used in the laboratory are accurate to ± 0.1 pH units, and have a scale readability of at least 0.05 pH units. The meters automatically compensate for the temperature, and are calibrated with at least two working range buffer solutions before each use.

Conductivity meters are also calibrated before each use with a known standard to demonstrate the meters do not exceed an error of 1% or one umhos/cm.

Turbidity meters are also calibrated before each use. All of this information is documented in logs.

Consult pH and Conductivity, and Turbidity SOPs for further information.

20.3.3 Thermometers

All thermometers are calibrated on an annual basis with a NIST-traceable thermometer at temperatures bracketing the range of use.

IR thermometers, digital probes and thermocouples are calibrated quarterly. IR Thermometers should be calibrated over the full range of use, including ambient, iced (4°C) and frozen (0°C to -5°C), per the Drinking Water Manual.

The laboratory's digital NIST thermometer is recalibrated every year. The laboratory's mercury NIST thermometer is recalibrated every five years, unless the thermometer has been exposed to temperature extremes or apparent separation of internal liquid. The thermometers are calibrated by an approved outside service and the provided certificate of traceability is kept on file. The NIST thermometers have increments of 0.1 degree, and have ranges applicable to method and certification requirements. The NIST traceable thermometers are used for no other purpose than to calibrate other thermometers.

All of this information is documented in logbooks. Monitoring method-specific temperatures, including incubators, heating blocks, water baths, and ovens, is documented in TALS or method-specific logbooks. More information on this subject can be found in the laboratory SOP BR-QA-012, Thermometer Calibrations, and individual method SOPs.

20.3.4 Refrigerators/Freezer Units, Waterbaths, Ovens and Incubators

The temperatures of all refrigerator units and freezers used for sample and standard storage are monitored each working day. On non-working days the minimum and maximum temperatures between the time of the last temperature reading and the next working day are monitored.

Ovens and waterbaths are monitored on days of use.

All of this equipment has a unique identification number, and is assigned a unique thermometer for monitoring.

Sample storage refrigerator temperatures are kept between > 0ºC and ≤ 6 ºC.

Specific temperature settings/ranges for other refrigerators, ovens waterbaths, and incubators can be found in method specific SOPs.

All of this information is documented in Daily Temperature Logbooks and method-specific logbooks.

20.3.5 Autopipettors, Dilutors, and Syringes

Mechanical volumetric dispensing devices including burettes (except Class A Glassware and Glass microliter syringes) are given unique identification numbers and the delivery volumes are verified gravimetrically, at a minimum, on a quarterly basis.

For those dispensers that are not used for analytical measurements, a label is / can be applied to the device stating that it is not calibrated. Any device not regularly verified cannot be used for any quantitative measurements.

Micro-syringes are purchased from Hamilton Company. Each syringe is NIST-traceable. The laboratory keeps on file an “Accuracy and Precision Statement of Conformance” from Hamilton attesting established accuracy.

20.4 Instrument Calibrations

Calibration of analytical instrumentation is essential to the production of quality data. Strict calibration procedures are followed for each method. These procedures are designed to determine and document the method detection limits, the working range of the analytical instrumentation and any fluctuations that may occur from day to day.

Sufficient raw data records are retained to allow an outside party to reconstruct all facets of the initial calibration. Records contain, but are not limited to, the following: calibration date, method, instrument, analyst(s) initials or signatures, analysis date, analytes, concentration, response, type of calibration (Avg RF, curve, or other calculations that may be used to reduce instrument responses to concentration.)

Sample results must be quantitated from the initial calibration and may not be quantitated from any continuing instrument calibration verification unless otherwise required by regulation, method or program.

If the initial calibration results are outside of the acceptance criteria, corrective action is performed and any affected samples are reanalyzed if possible. If the reanalysis is not possible, any data associated with an unacceptable initial calibration will be reported with appropriate data qualifiers (refer to Section 12).

Note: Instruments are calibrated initially and as needed after that and at least annually.

20.4.1 Calibration Standards

Calibration standards are prepared using the procedures indicated in the Reagents and Standards section of the determinative method SOP. If a reference method does not specify the number of calibration standards, a minimum of 3 calibration points will be used.

Standards for instrument calibration are obtained from a variety of sources. All standards are traceable to national or international standards of measurement, or to national or international standard reference materials.

The lowest concentration calibration standard that is analyzed during an initial calibration must be at or below the stated reporting limit for the method based on the final volume of extract (or sample).

The other concentrations define the working range of the instrument/method or correspond to the expected range of concentrations found in actual samples that are also within the working range of the instrument/method. Results of samples not bracketed by initial instrument calibration standards (within calibration range to at least the same number of significant figures used to report the data) must be reported as having less certainty, e.g., defined qualifiers or flags (additional information may be included in the case narrative). The exceptions to these rules are ICP and ICPMS methods which may define the working range with periodic linear dynamic range studies, rather than through the range of concentrations of daily calibration standards.

All initial calibrations are verified with a standard obtained from a second source and traceable to a national standard, when available (or vendor certified different lot if a second source is not available). For unique situations, such as air analysis where no other source or lot is available, a standard made by a different analyst at a different time or a different preparation would be considered a second source. This verification occurs immediately after the calibration curve has been analyzed, and before the analysis of any samples.

20.4.1.1 Calibration Verification

The calibration relationship established during the initial calibration must be verified initially and at least daily as specified in the laboratory method SOPs in accordance with the referenced analytical methods and in the 2009 TNI Standard. The process of calibration verification applies to both external standard and internal standard calibration techniques, as well as to linear and non-linear calibration models. Initial calibration verification is with a standard source secondary (second source standard) to the calibration standards, but continuing calibration verifications may use the same source standards as the calibration curve.

Note: The process of calibration verification referred to here is fundamentally different from the approach called "calibration" in some methods. As described in those methods, the calibration factors or response factors calculated during calibration are used to update the calibration factors or response factors used for sample quantitation. This approach, while employed in other EPA programs, amounts to a daily single-point calibration.

All target analytes and surrogates, including those reported as non-detects, must be included in periodic calibration verifications for purposes of retention time confirmation and to demonstrate

that calibration verification criteria are being met, i.e., RPD, per 2009 TNI Std. EL-V1M4 Sec. 1.7.2.

All samples must be bracketed by periodic analyses of standards that meet the QC acceptance criteria (e.g., calibration and retention time). The frequency is found in the determinative method SOPs.

Note: If an internal standard calibration is being used then bracketing calibration verification standards are not required, only daily verifications are needed. The results from these verification standards must meet the calibration verification criteria and the retention time criteria (if applicable).

Generally, the initial calibrations must be verified at the beginning of each 12-hour analytical shift during which samples are analyzed. (Some methods may specify more or less frequent verifications). The 12-hour analytical shift begins with the injection of the calibration verification standard (or the MS tuning standard in MS methods). The shift ends after the completion of the analysis of the last sample, QC, or standard that can be injected within 12-hours of the beginning of the shift.

A continuing instrument calibration verification (CCV) must be repeated at the beginning and, for methods that have quantitation by external calibration models, at the end of each analytical batch. Some methods have more frequent CCV requirements - see specific method SOPs. Most inorganic methods require the CCV to be analyzed after ever 10 samples or injections, including matrix or batch QC samples.

If the results of a CCV are outside the established acceptance criteria and analysis of a second consecutive (and immediate) CCV fails to produce results within acceptance criteria, corrective action shall be performed. Once corrective actions have been completed & documented, the laboratory shall demonstrate acceptable instrument / method performance by analyzing two consecutive CCVs, or a new initial instrument calibration shall be performed.

Sample analyses and reporting of data may not occur or continue until the analytical system is calibrated or calibration verified. However, data associated with an unacceptable calibration verification may be fully usable under the following special conditions, and reported based upon discussion and approval of the client:

a). when the acceptance criteria for the CCV are exceeded high (i.e., high bias) and the associated samples within the batch are non-detects, then those non-detects may be reported with a footnote or case narrative explaining the high bias. Otherwise the samples affected by the unacceptable CCV shall be re-analyzed after a new calibration curve has been established, evaluated and accepted; or

b). when the acceptance criteria for the CCV are exceeded low (i.e., low bias), those sample results may be reported if they exceed a maximum regulatory limit/decision level. Otherwise the samples affected by the unacceptable CCV shall be re-analyzed after a new calibration curve has been established, evaluated and accepted.

Samples reported by the 2 conditions identified above will be appropriately flagged.

20.4.1.2 Verification of Linear and Non-Linear Calibrations

Calibration verification for calibrations involves the calculation of the percent drift or the percent difference of the instrument response between the initial calibration and each subsequent analysis of the verification standard. (These calculations are available in the laboratory method SOPs. Verification standards are evaluated based on the % Difference from the average CF or RF of the initial calibration or based on % Drift or % Recovery if a linear or quadratic curve is used.

Regardless of whether a linear or non-linear calibration model is used, if initial verification criterion is not met, then no sample analyses may take place until the calibration has been verified or a new initial calibration is performed that meets the specifications listed in the method SOPs. If the calibration cannot be verified after the analysis of a single verification standard, then adjust the instrument operating conditions and/or perform instrument maintenance, and analyze another aliquot of the verification standard. If the calibration cannot be verified with the second standard, then a new initial calibration is performed.

- When the acceptance criteria for the calibration verification are exceeded high, i.e., high bias, and there are associated samples that are non-detects, then those non-detects may be reported. Otherwise, the samples affected by the unacceptable calibration verification shall be reanalyzed after a new calibration curve has been established, evaluated and accepted.

- When the acceptance criteria for the calibration verification are exceeded low, i.e., low bias, those sample results may be reported if they exceed a maximum regulatory limit/decision level. Otherwise, the samples affected by the unacceptable verification shall be reanalyzed after a new calibration curve has been established, evaluated and accepted. Alternatively, a reporting limit standard may be analyzed to demonstrate that the laboratory can still support non-detects at their reporting limit.

20.5 Tentatively Identified Compounds (TICs) – GC/MS Analysis

For samples containing components not associated with the calibration standards, a library search may be made for the purpose of tentative identification. The necessity to perform this type of identification will be determined by the purpose of the analyses being conducted. Data system library search routines should not use normalization routines that would misrepresent the library or unknown spectra when compared to each other.

Note: If the TIC compound is not part of the client target analyte list but is calibrated by the laboratory and is both qualitatively and/or quantitatively identifiable, it should not be reported as a TIC. If the compound is reported on the same form as true TICs, it should be qualified and/or narrated that the reported compound is qualitatively and quantitatively (if verification in control) reported compared to a known standard that is in control (where applicable).

For example, the RCRA permit or waste delisting requirements may require the reporting of non-target analytes. Only after visual comparison of sample spectra with the nearest library searches may the analyst assign a tentative identification.

20.6 GC/MS Tuning

Prior to any GCMS analytical sequence, including calibration, the instrument parameters for the tune and subsequent sample analyses within that sequence must be set.

Prior to tuning/auto-tuning the mass spec, the parameters may be adjusted within the specifications set by the manufacturer or the analytical method. These generally don't need any adjustment but it may be required based on the current instrument performance. If the tune verification does not pass it may be necessary to clean the source or perform additional maintenance. Any maintenance is documented in the maintenance log.

Table 20-1. Example: Instrumentation List

Equipment/ Instrument	Manufacturer	Model Number	Serial Number	Year Put into Service	Condition When Received
Analytical Balance	Mettler	AE200	L17317	2013	Used
Analytical Balance	Mettler	ML204	1123452701	2010	NEW
Analytical Balance	Metler	ML204	1123452699	2010	NEW
Automated Distillation Apparatus	Westco	Easy Dist	1090	2002	NEW
Automated Distillation Apparatus	Westco	Easy Dist	1091	2002	NEW
Conductivity Meter	Oakton	CON110	297661	2004	NEW
CVAA	Leeman (CV4)	HydraAA112-0064-1	8015	2008	NEW
GC/ECD/ECD	Agilent (7424)	6890N	US10332093	2003	NEW
GC/ECD/ECD	Agilent (3283)	6890N	US10805001	2008	NEW
GC/ECD/ECD	Agilent (7227)	6890N	CN10602095	2006	NEW
GC/ECD/ECD	Agilent (0825)	6890N	US10202136	2002	NEW
GC/FID/TCD	Agilent (1031)	7890A	CN10301031	2010	NEW
GC/ECD/ECD	Agilent (5253)	6890N	CN10723008	2007	NEW
GC/ECD/ECD	Agilent (0911)	6890N	US10230082	2002	NEW
GC/ECD/ECD	Agilent (5005)	6890N	CN10615005	2009	USED
GC/FID/TCD	Varian (CP3800)	CP-3800	S/N 10328	2003	NEW
GC/FPD/FPD	Hewlett-Packard (2860)	5890II	2950A27078	1990	UNKNOWN
GC/MS	Hewlett-Packard (N)	5890II / 5971	3203A40979	1998	NEW
GC/MS	Agilent (B)	6890N/ 5973	CN10317006	2003	NEW
GC/MS	Agilent (C)	6890N / 5973	CN10424016	UNKNOWN	NEW
GC/MS	Agilent (G)	6890N / 5973	CN10437065	UNKNOWN	USED
GC/MS	Agilent (E)	6890N / 5973	CN10453004	2005	NEW

GC/MS	Agilent (F)	6890N/ 5973	CN10531065	2005	NEW
GC/MS	Agilent (S)	7890A/5975	CN10211095	2010	NEW
GC/MS	Agilent (T)	7890A/5975	CN10211037	2010	USED
GC/MS	Hewlett-Packard (L)	5890II / 5971	3203A40982	1998	NEW
GC/MS	Agilent (D)	6890N / 5973	CN10439015	2004	NEW
GC/MS	Hewlett-Packard (P)	5890II / 5971	3203A40985	1992	USED
GC/MS	Hewlett-Packard (R)	5890II / 5971	3203A40984	1992	NEW
GC/MS	Hewlett-Packard (U)	5890II Plus/ 5972	3336A61535	1997	NEW
GC/MS	Agilent (H)	6890N / 5975	CN10608102	2006	NEW
GC/MS	Agilent (Z)	6890A/ 5973	US00036343	2000	NEW
GC/MS	Agilent (J)	6890N / 5973	CN10430052	2009	USED
GC/MS	Agilent (AA)	6890 / 5973	US00035345	2013	USED
GC/MS	Hewlett-Packard (AC)	6890 / 5973	US00030199	2013	USED
GC/MS	Agilent (W)	7890A / 5975B	CN1231116	2012	USED
GC/MS	Agilent (X)	6890N / 5975	CN10526012	2013	USED
GPC	J2 Scientific (I)	Autoinject 110	02D-1030-2.1	2002	NEW
GPC	J2 Scientific (H)	Autoinject 110	02D-1031-2.1	2001	NEW
HPLC/UV	Dionex (1488)	P680	1680407	1991	UNKNOWN
HPLC/UV/PDA	Waters (1208)	600	60004790RP	1988	NEW
Hydrogen Generator	Parker Hannafin	H2-1200	H2-100492	2013	NEW
ICP-MS	Thermo Elemental (METICPMS2)	X7	X0288	2003	NEW
ICP-OES	Thermo Electron Corp (METICP7)	iCAP 6500	ICP 20063302	2006	NEW
HPLC	Waters (3062)	616	MX5NM6829M	UNKNOWN	NEW
pH Meter	Denver Instruments	UB-5	UB503B365	UNKNOWN	UNKNOWN
pH Meter	Denver Instruments	UB-5	UB5083018	UNKNOWN	UNKNOWN
Soxtherm	Gerhardt (SOXA)	SE3AS306A	4012396	UNKNOWN	UNKNOWN
Soxtherm	Gerhardt (SOXB)	SE3AS306A	4022047	UNKNOWN	UNKNOWN
Soxtherm	Gerhardt (SOXC)	SE3AS306A	4022046	UNKNOWN	UNKNOWN
Soxtherm	Gerhardt (SOXD)	SE3AS306A	4022045	UNKNOWN	UNKNOWN
Soxtherm	Gerhardt (SOXE)	SE3AS306A	4022030	UNKNOWN	UNKNOWN
Soxtherm	Gerhardt (SOXF)	SE3AS306A	4012397	UNKNOWN	UNKNOWN
Elemental Analyzer (TOC)	Carlo Erba	NA 1500	220465	1991	UNKNOWN
Elemental Analyzer (TOC)	Carlo Erba	EA1108	249146	1991	UNKNOWN

Flow Injection Analyzer	Lachat	QuikChem 8000	A83000-2167	2000	UNKNOWN

Table 20-2. Example: Schedule of Routine Maintenance

Instrument	Procedure	Frequency
Leeman Mercury Analyzer	Check Peristaltic Pump tubing	As required
	Lubricate Autosampler rods	Monthly
	Clean Autosampler	Weekly
	Check and fill Rinse Vessel	As required
	Check and fill Stannous Chloride	As required
	Check Waste Vessel	Daily
	Empty Waste Vessel	As required
ICP	Check Peristaltic Pump tubing	As required
	Clean Torch	Daily
	Replace Torch	As required
	Check and fill Rinse Vessel	As required
	Check and fill IS Vessel	As required
	Fill Standards Cup	Daily
	Check Waste Vessel	Daily
	Empty Waste Vessel	As required
	Check and clean Cones	As required
	Perform Auto Peak Adjustment	As required
ICP MS	Check Peristaltic Pump tubing	As required
	Clean Torch	As required
	Check and fill Rinse Vessel	As required
	Check and fill IS Vessel	As required
	Fill standards cup	Daily
	Check Waste Vessel	Daily
	Empty Waste Vessel	As required
	Check and clean Cones	As required
UV-Vis Spectrophotometer	Clean ambient flow cell	As required
	Wavelength verification check	As required
	Clean Cuvette with Cuvette Cleaning Solution	As required
Hewlett Packard GC/MS (VOA)	Clean Injection Port and Liner	As required
	Change Septa	As required
	Cut 2-3 inches from GC Column	As required
	Fill Autosampler rinse vials	As required
	Clean Purge and Trap mount and purge vessel	As required
	Check Purge Flow	As required
Hewlett Packard GC/MS (SVOA)	Clean Injection Port and Liner	Daily
	Change Septa	Daily
	Replace or clip Guard Column	Daily
	Replace or clip Analytical Column	Daily
	Fill Autosampler rinse vials	Daily
Hewlett Packard GC/MS (Air)	Check GC / Entech Column Interface	As required
	Check Nitrogen Tank Volume	As required
	Check Nitrogen Valves Software and Valves	As required
	Cut 2-3 inches from GC Column	As required

Instrument	Procedure	Frequency
Gas Chromatograph	Replace Septa Clean and replace Injection Port Liner Replace or clip Guard Column Replace or clip Analytical Column Bake, Re-foil, Refurbish Detector	As required As required As required As required As required
Zero Air Generator	Change pre-filter cartridge Replace catalyst module Check Indicator Beads in Moisture Filters Bake and Refill Mol Sieve Dry Rite Beads	Annually Indicator Light Blinks Daily As required
Hydrogen Generator	Fill Water Reservoir Replace Water in Water Reservoir Replace Ionic Bags in Water Reservoir	Daily Semi-Annually Semi-Annually
HPLC	Change Transfer Lines Replace Guard Column Replace Analytical Column Replace or clean Pump Head Check Valves Change Plunger Seals Change Suppressor Change Eluent Generator Cartridge and CR-ATC	As required As required As required As required As required As required As required
LC/MS/MS	Replace Guard Column Replace Analytical Column Replace or clean Pump Head Check Valves Change Plunger Seals Change In Line Filter Clean or Change Sample Cone Clean Source	As required As required As required As required As required As required As required
Balances	Class “1” traceable weight check Clean pan and check if level Field service	Daily, when used Daily Annually
Lachat	Change Tubing Replace Bulb	As required As required
Conductivity Meter	Calibrate	Daily
Turbidimeter	Calibrate Check light bulb	As required Daily, when used
Drying Ovens	Temperature monitoring Temperature adjustments	Daily As required
Refrigerators/ Freezers	Temperature monitoring Temperature adjustment Defrosting/cleaning	Daily As required As required
pH/Specific Ion Meter	Calibrate Clean electrode	Daily As required
Centrifuge	Check brushes and bearings	Every 6 months or as needed
Water baths	Temperature monitoring Water replaced	Daily, when used Monthly or as needed

SECTION 21. MEASUREMENT TRACEABILITY

21.1 Overview

Traceability of measurements shall be assured using a system of documentation, calibration, and analysis of reference standards. Laboratory equipment that are peripheral to analysis and whose calibration is not necessarily documented in a test method analysis or by analysis of a reference standard shall be subject to ongoing certifications of accuracy. At a minimum, these must include procedures for checking specifications of ancillary equipment: balances, thermometers, temperature, Deionized (DI) and Reverse Osmosis (RO) water systems, automatic pipettes and other volumetric measuring devices. (Refer to Section 20.3). With the exception of Class A Glassware and Glass microliter syringes, quarterly accuracy checks are performed for all mechanical volumetric devices. Wherever possible, subsidiary or peripheral equipment is checked against standard equipment or standards that are traceable to national or international standards. Class A Glassware and Glass microliter syringes should be routinely inspected for chips, acid etching or deformity (e.g., bent needle). If the Class A glassware or syringe is suspect, the accuracy of the glassware will be assessed prior to use.

21.2 NIST-Traceable Weights and Thermometers

Reference standards of measurement shall be used for calibration only and for no other purpose, unless it can be shown that their performance as reference standards would not be invalidated.

For NIST-traceable weights and thermometers, the laboratory requires that all calibrations be conducted by a calibration laboratory accredited by A2LA, NVLAP (National Voluntary Laboratory Accreditation Program), or another accreditation organization that is a signatory to a MRA (Mutual Recognition Arrangement) of one or more of the following cooperations – ILAC (International Laboratory Accreditation Cooperation) or APLAC (Asia–Pacific Laboratory Accreditation Cooperation). A calibration certificate and scope of accreditation is kept on file at the laboratory.

An external certified service engineer services laboratory balances on an annual basis. This service is documented on each balance with a signed and dated certification sticker. Balance calibrations are checked each day of use. All mercury thermometers are calibrated annually against a traceable reference thermometer. Temperature readings of ovens, refrigerators, and incubators are checked on each day of use.

21.3 Reference Standards / Materials

Reference standards/materials, where commercially available, are traceable to certified reference materials. Commercially prepared reference standards, to the extent available, are purchased from vendors that are accredited to ISO Guide 34 and ISO/IEC Guide 17025. All reference standards from commercial vendors shall be accompanied with a certificate that includes at least the following information:

- Manufacturer
- Analytes or parameters calibrated
- Identification or lot number
- Calibration method
- Concentration with associated uncertainties
- Purity

If a standard cannot be purchased from a vendor that supplies a Certificate of Analysis, the purity of the standard is documented by analysis. The receipt of all reference standards must be documented. Reference standards are labeled with a unique Standard Identification Number and expiration date. All documentation received with the reference standard is retained as a QC record and references the Standard Identification Number.

All reference, primary and working standards/materials, whether commercially purchased or laboratory prepared, must be checked regularly to ensure that the variability of the standard or material from the 'true' value does not exceed method requirements. The accuracy of calibration standards is checked by comparison with a standard from a second source. In cases where a second standard manufacturer is not available, a vendor certified different lot is acceptable for use as a second source. For unique situations, such as air analysis where no other source or lot is available, a standard made by a different analyst would be considered a second source. The appropriate Quality Control (QC) criteria for specific standards are defined in laboratory SOPs. In most cases, the analysis of an Initial Calibration Verification (ICV) or LCS (where there is no sample preparation) is used as the second source confirmation. These checks are generally performed as an integral part of the analysis method (e.g. calibration checks, laboratory control samples).

All standards and materials must be stored and handled according to method or manufacturer's requirements in order to prevent contamination or deterioration. Refer to the Corporate Environmental Health & Safety Manual or laboratory SOPs. For safety requirements, please refer to method SOPs and the laboratory Environmental Health and Safety Manual.

Standards and reference materials shall not be used after their expiration dates unless their reliability is verified by the laboratory and their use is approved by the Quality Assurance Manager. The laboratory must have documented contingency procedures for re-verifying expired standards.

21.4 Documentation and Labeling of Standards, Reagents, and Reference Materials

Reagents must be at a minimum the purity required in the test method. The date of reagent receipt and the expiration date are documented. The lots for most of the common solvents and acids are tested for acceptability prior to company-wide purchase. [Refer to TestAmerica's Corporate SOP (CA-Q-S-001), Solvent and Acid Lot Testing and Approval.]

All manufacturer or vendor supplied Certificate of Analysis or Purity must be retained, stored appropriately, and readily available for use and inspection. These records are maintained in the LIMS. Records must be kept of the date of receipt and date of expiration of standards, reagents and reference materials. In addition, records of preparation of laboratory standards, reagents, and reference materials must be retained, stored appropriately, and be readily available for use and inspection. For detailed information on documentation and labeling, please refer to laboratory SOP BR-QA-002.

Commercial materials purchased for preparation of calibration solutions, spike solutions, etc.., are usually accompanied with an assay certificate or the purity is noted on the label. If the assay purity is 96% or better, the weight provided by the vendor may be used without correction. If the assay purity is less than 96% a correction will be made to concentrations applied to solutions prepared from the stock commercial material. Blended gas standard cylinders use a nominal

concentration if the certified value is within +/-15%, otherwise the certified values is used for the canister concentration.

21.4.1 All standards, reagents, and reference materials must be labeled in an unambiguous manner. Standards are logged into the laboratory's LIMS system, and are assigned a unique identification number. The following information is typically recorded in the electronic database within the LIMS.

- Standard ID
- Description of Standard
- Department
- Preparer's name
- Final volume and number of vials prepared
- Solvent type and lot number
- Preparation Date
- Expiration Date
- Standard source type (stock or daughter)
- Standard type (spike, surrogate, other)
- Parent standard ID (if applicable)
- Parent Standard Analyte Concentration (if applicable)
- Parent Standard Amount used (if applicable)
- Component Analytes
- Final concentration of each analyte
- Comment box (text field)

Records are maintained electronically for standard and reference material preparation. These records show the traceability to purchased stocks or neat compounds. These records also include method of preparation, date of preparation, expiration date and the preparer's name or initials. Preparation procedures are provided in the Method SOPs.

21.4.2 All standards, reagents, and reference materials must be clearly labeled with a minimum of the following information:

- Expiration Date (include prep date for reagents)
- Standard ID (from LIMS)
- Special Health/Safety warnings if applicable

Records must also be maintained of the date of receipt for commercially purchased items or date of preparation for laboratory prepared items. Special Health/Safety warnings must also be available to the analyst. This information is maintained in test method SOPs and on the company's intranet.

21.4.3 In addition, the following information may be helpful:

- Date opened (for multi-use containers, if applicable)

- Description of standard (if different from manufacturer's label or if standard was prepared in the laboratory)
- Concentration (if applicable)
- Initials of analyst preparing standard or opening container

All containers of prepared reagents must include an expiration date and an ID number to trace back to preparation.

Procedures for preparation of reagents can be found in the Method SOPs.

Standard ID numbers must be traceable through associated logbooks, worksheets and preparation/analytical batch records.

All reagents and standards must be stored in accordance to the following priority: 1) with the manufacturer's recommendations; 2) with requirements in the specific analytical methods as specified in the laboratory SOP.

SECTION 22. SAMPLING

22.1 Overview

The laboratory does not provide sampling services. The laboratory's responsibility in the sample collection process lies in supplying the sampler with the necessary coolers, reagent water, sample containers, preservatives, sample labels, custody seals, COC forms, ice, and packing materials required to properly preserve, pack, and ship samples to the laboratory

22.2 Sampling Containers

The laboratory offers clean sampling containers for use by clients. These containers are obtained from reputable container manufacturers and meet EPA specifications as required. Certificates of cleanliness for bottles and preservatives are provided by the supplier and are maintained at the laboratory. Alternatively, the certificates may be maintained by the supplier and available to the laboratory on-line.

22.2.1 Preservatives

Upon request, preservatives are provided to the client in pre-cleaned sampling containers. In some cases containers may be purchased pre-preserved from the container supplier. Whether prepared by the laboratory or bought pre-preserved, the grades of the preservatives are at a minimum:

- Hydrochloric Acid – Reagent ACS (Certified VOA Free) or equivalent
- Methanol – Purge and Trap grade
- Nitric Acid – Instra-Analyzed or equivalent
- Sodium Bisulfate – ACS Grade or equivalent
- Sodium Hydroxide – Instra-Analyzed or equivalent
- Sulfuric Acid – Instra-Analyzed or equivalent

- Sodium Thiosulfate – ACS Grade or equivalent

22.3 Definition of Holding Time

The date and time of sampling documented on the COC form establishes the day and time zero. As a general rule, when the maximum allowable holding time is expressed in "days" (e.g., 14 days, 28 days), the holding time is based on calendar day measured. Holding times expressed in "hours" (e.g., 6 hours, 24 hours, etc.) are measured from date and time zero. Holding times for analysis include any necessary reanalysis. However, there are some programs that determine holding time compliance based on the date and specific time of analysis compared to the time of sampling regardless of how long the holding time is. Where required by method or program, the laboratory calculates holding time based on Verified Time of Sample Receipt.

22.4 Sampling Containers, Preservation Requirements, Holding Times

The preservation and holding time criteria specified in the laboratory SOPs are derived from the source documents for the methods. If method required holding times or preservation requirements are not met, the reports will be qualified using a flag, footnote or case narrative. As soon as possible or "ASAP" is an EPA designation for tests for which rapid analysis is advised, but for which neither EPA nor the laboratory have a basis for a holding time.

22.5 Sample Aliquots / Subsampling

Taking a representative sub-sample from a container is necessary to ensure that the analytical results are representative of the sample collected in the field. The size of the sample container, the quantity of sample fitted within the container, and the homogeneity of the sample need consideration when sub-sampling for sample preparation. It is the laboratory's responsibility to take a representative subsample or aliquot of the sample provided for analysis.

Analysts should handle each sample as if it is potentially dangerous. At a minimum, safety glasses, gloves, and lab coats must be worn when preparing aliquots for analysis.

Guidelines on taking sample aliquots & subsampling are located SOP No. BR-QA-020 and test method SOPs.

SECTION 23. HANDLING OF SAMPLES

Sample management procedures at the laboratory ensure that sample integrity and custody are maintained and documented from sampling/receipt through disposal.

23.1 Chain of Custody (COC)

The COC form is the written documented history of any sample and is initiated when bottles are sent to the field, or at the time of sampling. This form is completed by the sampling personnel and accompanies the samples to the laboratory where it is received and stored under the laboratory's custody. The purpose of the COC form is to provide a legal written record of the handling of samples from the time of collection until they are received at the laboratory. It also serves as the primary written request for analyses from the client to the laboratory. The COC form acts as a purchase order for analytical services when no other contractual agreement is in effect. An example of a COC form may be found in Figure 23-1.

23.1.1 Field Documentation

The information the sampler needs to provide at the time of sampling on the container label is:

- Sample identification
- Date and time
- Preservative

During the sampling process, the COC form is completed and must be legible (see Figure 23-1). This form includes information such as:

- Client name, address, phone number and fax number (if available)
- Project name and/or number
- The sample identification
- Date, time and location of sampling
- Sample collectors name
- The matrix description
- The container description
- The total number of each type of container
- Preservatives used
- Analysis requested
- Requested turnaround time (TAT)
- Any special instructions
- Purchase Order number or billing information (e.g. quote number) if available
- The date and time that each person received or relinquished the sample(s), including their signed name.

When the sampling personnel deliver the samples directly to TestAmerica personnel, the samples are stored in a cooler with ice, as applicable, and remain solely in the possession of the client's field technician until the samples are delivered to the laboratory personnel. The sample collector must assure that each container is in his/her physical possession or in his/her view at all times, or stored in such a place and manner to preclude tampering. The field technician relinquishes the samples in writing on the COC form to the sample control personnel at the laboratory or to a TestAmerica courier. When sampling personnel deliver the samples through a common carrier (Fed-Ex, UPS), the CoC relinquished date/time is completed by the field personnel and samples are released to the carrier. Samples are only considered to be received by lab when personnel at the fixed laboratory facility have physical contact with the samples.

Note: Independent couriers are not required to sign the COC form. The COC is usually kept in the sealed sample cooler. The receipt from the courier is stored in log-in by date; it lists all receipts each date.

23.1.2 Legal / Evidentiary Chain-of-Custody

If the client requests legal COC, sample management personnel will initiate an internal COC for laboratory use by analysts and a sample disposal record.

23.2 Sample Receipt

Samples are received at the laboratory by designated sample receiving personnel and a unique laboratory project identification number is assigned. Each sample container shall be assigned a unique sample identification number that is cross-referenced to the client identification number such that traceability of test samples is unambiguous and documented. Each sample container is affixed with a durable sample identification label. Sample acceptance, receipt, tracking and storage procedures are summarized in the following sections. Detailed sample receipt information is maintained in laboratory SOP BR-SM-001.

23.2.1 Laboratory Receipt

When samples arrive at the laboratory, sample receiving personnel inspect the coolers and samples. The integrity of each sample must be determined by comparing sample labels or tags with the COC and by visual checks of the container for possible damage. Any non-conformance, irregularity, or compromised sample receipt must be documented in an NCM and brought to the immediate attention of the client. The COC, shipping documents, documentation of any non-conformance, irregularity, or compromised sample receipt, record of client contact, and resulting instructions become part of the project record.

23.2.1.1 Unique Sample Identification

All samples that are processed through the laboratory receive a unique sample identification to ensure that there can be no confusion regarding the identity of such samples at anytime. This system includes identification for all samples, subsamples and subsequent extracts and/or digestates.

The laboratory assigns a unique identification (e.g., Sample ID) code to each sample container received at the laboratory. This Primary ID is made up of the following information (consisting of 4 components):

Example: 200 - 9608 - A - 1

200 = Location ID

9608 = Login ID

A = Container Occurrence

1 = Sample Number

The above example shows a particular job which is at TestAmerica Burlington (Laboratory 200). The login ID is 9608 (unique to a particular client/job occurrence). The container code indicates it is the first container ("A") of Sample #1.

If the primary container goes through a prep step that creates a "new" container, then the new container is considered secondary and gets another ID. An example of this being a client sample in a 1-Liter amber bottle is sent through a Liquid/Liquid Extraction and an extraction vial is created from this step. The vial would be a SECONDARY container. The secondary ID has 5 components.

Example: 200 - 9608 - A - 1 - **A** ←——— **Secondary Container Occurrence**

Example: 200-9608-A-1-A, would indicate the PRIMARY container listed above that went through a step that created the 1st occurrence of a Secondary container.

With this system, a client sample can literally be tracked throughout the laboratory in every step from receipt to disposal.

23.3 Sample Acceptance Policy

The laboratory has a written sample acceptance policy (Figure 23-2) that clearly outlines the circumstances under which samples shall be accepted or rejected. These include:

- a COC filled out completely;
- samples must be properly labeled;
- proper sample containers with adequate volume for the analysis (Sampling Guide) and necessary QC;
- samples must be preserved according to the requirements of the requested analytical method (Sampling Guide);
- sample holding times must be adhered to (Sampling Guide);

The project manager will be notified if any sample is received in damaged condition.

Data from samples which do not meet these criteria are flagged and the nature of the variation from policy is defined.

23.3.1 After inspecting the samples, the sample receiving personnel sign and date the COC form, make any necessary notes of the samples' conditions and store them in appropriate refrigerators or storage locations.

23.3.2 Any deviations from these checks that question the suitability of the sample for analysis, or incomplete documentation as to the tests required will be resolved by consultation with the client. If the sample acceptance policy criteria are not met, the laboratory shall either:

- Retain all correspondence and/or records of communications with the client regarding the disposition of rejected samples, or

- Fully document any decision to proceed with sample analysis that does not meet sample acceptance criteria.

Once sample acceptance is verified, the samples are logged into the LIMS according SOP No. BR-SM-001.

23.4 Sample Storage

In order to avoid deterioration, contamination or damage to a sample during storage and handling, from the time of receipt until all analyses are complete, samples are stored in refrigerators, freezers or protected locations suitable for the sample matrix In addition, samples to be analyzed for volatile organic parameters are stored in separate refrigerators designated for

volatile organic parameters only. Samples are never to be stored with reagents, standards or materials that may create contamination.

To ensure the integrity of the samples during storage, refrigerator blanks are maintained in the volatile sample refrigerators and analyzed weekly.

Analysts and technicians retrieve the sample container allocated to their analysis from the designated refrigerator and place them on carts, analyze the sample, and return the remaining sample or empty container to the refrigerator from which it originally came. All unused portions of samples, including empty sample containers, are returned to the secure sample control area.

Access to the laboratory is controlled such that sample storage need not be locked at all times unless a project specifically demands it. Samples are accessible to laboratory personnel only. Visitors to the laboratory are prohibited from entering the refrigerator and laboratory areas unless accompanied by an employee of TestAmerica.

23.5 Hazardous Samples and Foreign Soils

To minimize exposure to personnel and to avoid potential accidents, hazardous and foreign soil samples are stored in an isolated area designated for each sample type.

For any sample that is known to be hazardous at the time of receipt or, if after completion of analysis the result exceeds the acceptable regulatory levels, a Hazardous Sample Notice must be completed by the analyst. This form may be completed by Sample Control, Project Managers, or analysts and must be attached to the report. The sample is moved to the Hazardous Sample storage refrigerator. All hazardous samples are either returned to the client or disposed of appropriately through a hazardous waste disposal firm that lab-packs all hazardous samples and removes them from the laboratory. Detailed procedures are listed in laboratory SOP BR-EH-001.

Foreign and USDA-regulated soil samples are marked with an orange sticker and are stored in a quarantined area in the laboratory. All samples and sample residue is heat-treated prior to disposal in accordance with the laboratory's Foreign Soil Importation Permit. Handling requirements are detailed in laboratory SOP BR-EH-003.

23.6 Sample Shipping

In the event that the laboratory needs to ship samples, the samples are placed in a cooler with enough ice to ensure the samples remain just above freezing and at or below 6.0°C during transit. The samples are carefully surrounded by packing material to avoid breakage (yet maintain appropriate temperature). A trip blank is enclosed for those samples requiring water/solid volatile organic analyses (see Note). The chain-of-custody form is signed by the sample control technician and attached to the shipping paperwork. Samples are generally shipped overnight express or hand-delivered by a TestAmerica courier to maintain sample integrity. All personnel involved with shipping and receiving samples must be trained to maintain the proper chain-of-custody documentation and to keep the samples intact and on ice. The Environmental, Health and Safety Manual contains additional shipping requirements.

Note: If a client does not request trip blank analysis on the COC or other paperwork, the laboratory will not analyze the trip blanks that were supplied. However, in the interest of good

client service, the laboratory will advise the client at the time of sample receipt that it was noted that they did not request analysis of the trip blank; and that the laboratory is providing the notification to verify that they are not inadvertently omitting a key part of regulatory compliance testing.

23.7 Sample Disposal

Samples should be retained for a minimum of 30 days after the project report is sent, however, provisions may be made for earlier disposal of samples once the holding time is exceeded. Some samples are required to be held for longer periods based on regulatory or client requirements (e.g., 60 days after project report is sent). The laboratory must follow the longer sample retention requirements where required by regulation or client agreement. Several possibilities for sample disposal exist: the sample may be consumed completely during analysis, the sample may be returned to the customer or location of sampling for disposal, or the sample may be disposed of in accordance with the laboratory's waste disposal procedures (SOP BR-EH-001). All procedures in the laboratory Environmental, Health and Safety Manual are followed during disposal. Samples are normally maintained in the laboratory no longer than two months from receipt unless otherwise requested. Unused portions of samples found or suspected to be hazardous according to state or federal guidelines may be returned to the client upon completion of the analytical work.

If a sample is part of a known litigation, the affected legal authority, sample data user, and/or submitter of the sample must participate in the decision about the sample's disposal. All documentation and correspondence concerning the disposal decision process must be kept on file. Pertinent information includes the date of disposal, nature of disposal (such as sample depletion, hazardous waste facility disposal, return to client), names of individuals who conducted the arrangements and physically completed the task. The laboratory will remove or deface sample labels prior to disposal unless this is accomplished through the disposal method (e.g., samples are incinerated). A Waste Disposal Record should be completed.

Figure 23-1. Example: Chain of Custody (COC)

TestAmerica Burlington
30 Community Drive
Suite 11
South Burlington, VT 05403-6809
phone 802.660.1990 fax 802.660.1919

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:

Client Contact	Project Manager:	Site Contact:	Date:	COC No:
Your Company Name here	Tel/Fax:	Lab Contact:	Carrier:	_____ of _____ COCs
Address	Analysis Turnaround Time			Sampler:
City/State/Zip	☐ CALENDAR DAYS ☐ WORKING DAYS			For Lab Use Only:
(xxx) xxx-xxxx Phone	TAT if different from Below _____			Walk-in Client:
(xxx) xxx-xxxx FAX	☐ 2 weeks			Lab Sampling:
Project Name:	☐ 1 week			
Site:	☐ 2 days			Job / SDG No.:
P O #	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)																Sample Specific Notes:

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other _____

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return to Client ☐ Disposal by Lab ☐ Archive for _____ Months

Special Instructions/QC Requirements & Comments:

Custody Seals Intact: ☐ Yes ☐ No	Custody Seal No.:		Cooler Temp. (°C): Obs'd:_____ Corr'd:_____		Therm ID No.:_____
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Form No. CA-C-WI-002, Rev. 4.14, dated 9/22/2017

Company Confidential & Proprietary

Figure 23-2. Example: Sample Acceptance Policy

The receipt of samples is acknowledged on the chain of custody (COC) form with the signature and date/time of the sample custodian. Any deficiencies identified during sample receipt are recorded and communicated to the laboratory project manager (PM), who will contact the client and fully document any decision to proceed with analysis in the project record. Consultation with the client should be immediate and timely (next business day or as specified in the project plan). Correspondence records and/or records of conversations concerning the decision to proceed with analysis and/or the disposition of rejected samples are maintained in the project record, and should be maintained in association with the sample receipt checklist. All data associated with samples that did not meet the sample acceptance criteria must be qualified with a Non-Conformance Memo (NCM) and/or noted in the project narrative that accompanies the final test report.

Per State and/or Federal Regulation, the client is responsible to ensure that samples are shipped in accordance with DOT/IATA requirements, and that radioactive materials may only be delivered to licensed facilities. Any samples containing (or suspected to contain) Source, Byproduct, or Special Nuclear Material as defined by 10 CFR should be delivered directly to facilities licensed to handle such radioactive material. Natural material or ores containing naturally occurring radionuclides may be delivered to any TestAmerica facility or courier as long as the activity concentration of the material does not exceed 270 pCi/g alpha or 2700 pCi/g beta (49 CFR Part 173).

Sample receipt is considered deficient when the following conditions are observed:

- Shipping cooler and/or samples are received outside the thermal preservation range specified for the test method.
- Sample bottles are received broken or leaking
- Samples are received beyond holding time
- Samples are received without the appropriate preservation
- Samples are not received in appropriate containers
- Chain of Custody and other sample receipt paperwork (CLP Traffic Report) does not match the samples received
- Chain of Custody was not received or is incomplete*
- Custody seals are broken
- Evidence of tampering with the cooler and/or samples
- Headspace in 40 mL or 22 mL VOA vials
- Seepage of extraneous water or other material into the samples
- Inadequate sample volume
- Illegible, impermanent ink, or non-unique sample labeling
- One or more coolers missing from a multi parcel shipment
- Shipping container is damaged

**Complete documentation shall include sample identification, the location date/time of collection, collector's name, preservation type, sample type and any special remarks concerning the sample.*

Figure 23-3. Example: Cooler Receipt Form

PRE-LOG IN SAMPLE RECEIPT & HANDLING CHECKLIST

Tracking Information				
Log-In #	**Project #**			
PM:	**Client :**			
Log-In Date:	**INTERNAL COC (ICOC) Required?** ☐ **Yes** ☐ **No**			
Log-In Performed By:	*If yes, attach a copy of ICOC Form to Checklist*			
Sample Receipt Information				
Date Received:	Received By: (Print Name)			
Time Received:	*Signature:*			
Delivery Type: ☐ Shipping Service ☐ Courier ☐ Hand # Coolers Received:				
Condition of Shipping Coolers/Containers	Yes	No	NA	Comments
There is no evidence of tampering?				
Custody seals are present and intact?				
Are custody seal numbers provided?				
If yes, list cutody seal numbers:				
Packing Material: ☐ Bubble Wrap ☐ Cardboard ☐ Corrugated Paper ☐ Shredded Paper ☐ Styrofoam ☐ Vermimiculite ☐ None				
☐ Foam Insert ☐ Other (specify)				
Check Performed By:	Check Recorded By:			
Temperature Check				
Thermal Preservation: ☐ Wet Ice ☐ Blue Ice ☐ None ☐ Other (Specify)				
If none, is thermal preservation required?				
IR Gun ID:	IR Readings Taken By:			
IR Gun Correction Factor (CF):	IR Readings Recorded By:			
Is a temperature blank provided? ☐ Yes ☐ No *If yes, use temperature blank for measurement*				
If no, specify the sample ID used to take measurement for each cooler for which measurement was taken.				
Record the observed temp reading below. Record the adjusted temp reading in TALS. Adjusted Temp = Observed Temp + CF				
Cooler 1 ℃	ID & Bottle Type:			
Cooler 2 ℃	ID & Bottle Type:			
Cooler 3 ℃	ID & Bottle Type:			
Cooler 4 ℃	ID & Bottle Type:			
Cooler 5 ℃	ID & Bottle Type:			
Criteria: Routine: ≤6℃ CLP SOW: ≤10℃ Summa Canisters, Tedlar Bags, & Geotechnical : Ambient Samples should not be frozen unless freezing does not impact integrity of sample, such as for biota or biological tissue. Some programs require 4±2℃ or other criteria; the PM must apply the proper criteria to their project and notify client of outliers. Criteria for samples delivered same day of collection: Evidence of chilling, such as ice in the shipping cooler.				
pH Check for Aqueous Inorganic Samples	Yes	No	NA	Comments
pH is within criteria for all methods?				
If no, does client require pH adjustment?				
If yes, was pH adjustment performed?				
Does 24 hour wait time apply for metals?				
If pH adjustment was performed, attach a copy of the preservation sheet to this checklist.				
pH Checks Performed By:				
Perchlorate (EPA 331.0 and SW-846 6850)	Yes	No	NA	Comments
Headspace: minimum of 1/3 of container?				
Paperwork Review	Yes	No	NA	Comments
Is receipt paperwork complete & legible?				
CLP: Is Traffic Report / COC Present?				
Notify PM of discrepancies.				
Scan COC and Airbill to PDF				
Post-Sampling Pressure Check Form attached?				
Check Performed By:				
Secondary Label Review Performed By:	**Date:**			
Comments				

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TestAmerica Burlington

SECTION 24. ASSURING THE QUALITY OF TEST RESULTS

24.1 Overview

In order to assure our clients of the validity of their data, the laboratory continuously evaluates the quality of the analytical process. The analytical process is controlled not only by instrument calibration as discussed in Section 20, but also by routine process quality control measurements (e.g. Blanks, Laboratory Control Samples (LCS), Matrix Spikes (MS), duplicates (DUP), surrogates, Internal Standards (IS)). These quality control checks are performed as required by the method or regulations to assess precision and accuracy. Quality control samples are to be treated in the exact same manner as the associated field samples being tested. In addition to the routine process quality control samples, Proficiency Testing (PT) Samples (concentrations unknown to laboratory) are analyzed to help ensure laboratory performance.

24.2 Controls

Sample preparation or pre-treatment is commonly required before analysis. Typical preparation steps include homogenization, grinding, solvent extraction, sonication, acid digestion, distillation, reflux, evaporation, drying and ashing. During these pre-treatment steps, samples are arranged into discreet manageable groups referred to as preparation (prep) batches. Prep batches provide a means to control variability in sample treatment. Control samples are added to each prep batch to monitor method performance and are processed through the entire analytical procedure with investigative/field samples.

24.3 Negative Controls

Table 24-1. Example – Negative Controls

Control Type	Details
Method Blanks (MB)	are used to assess preparation and analysis for possible contamination during the preparation and processing steps.
	The specific frequency of use for method blanks during the analytical sequence is defined in the specific standard operating procedure for each analysis. Generally it is 1 for each batch of samples; not to exceed 20 environmental samples.
	The method blank is prepared from a clean matrix similar to that of the associated samples that is free from target analytes (e.g., Reagent water, Ottawa sand, glass beads, etc.) and is processed along with and under the same conditions as the associated samples. The method blank goes through all of the steps of the process (including as necessary: filtration, clean-ups, etc.).
	Reanalyze or qualify associated sample results when the concentration of a targeted analyte in the blank is at or above the reporting limit as established by the method or by regulation, AND is greater than 1/10 of the amount measured in the sample.
Calibration Blanks	are prepared and analyzed along with calibration standards where applicable. They are prepared using the same reagents that are used to prepare the standards. In some analyses the calibration blank may be included in the calibration curve.
Instrument Blanks	are blank reagents or reagent water that may be processed during an analytical sequence in order to assess contamination in the analytical system. In general, instrument blanks are used to differentiate between contamination caused by the analytical system and that caused by the sample handling or sample prep process. Instrument blanks may also be inserted throughout the analytical sequence to minimize the effect of carryover from samples with high analyte content.

Table 24-1. Example – Negative Controls

Control Type	Details
Trip Blanks [1]	are required to be submitted by the client with each shipment of samples requiring aqueous and solid volatiles analyses (or as specified in the client's project plan). Additionally, trip blanks may be prepared and analyzed for volatile analysis of air samples, when required by the client. A trip blank may be purchased (certified clean) or is prepared by the laboratory by filling a clean container with pure deionized water that has been purged to remove any volatile compounds. Appropriate preservatives are also added to the container. The trip blank is sent with the bottle order and is intended to reflect the environment that the containers are subjected to throughout shipping and handling and help identify possible sources if contamination is found. The field sampler returns the trip blank in the cooler with the field samples.
Field Blanks [1]	are sometimes used for specific projects by the field samplers. A field blank prepared in the field by filling a clean container with pure reagent water and appropriate preservative, if any, for the specific sampling activity being undertaken. (EPA OSWER)
Equipment Blanks [1]	are also sometimes created in the field for specific projects. An equipment blank is a sample of analyte-free media which has been used to rinse common sampling equipment to check effectiveness of decontamination procedures. (TNI)
Holding Blanks	also referred to as refrigerator or freezer blanks, are used to monitor the sample storage units for volatile organic compounds during the storage of VOA samples in the laboratory

[1] When known, these field QC samples should not be selected for matrix QC as it does not provide information on the behavior of the target compounds in the field samples. Usually, the client sample ID will provide information to identify the field blanks with labels such as "FB", "EB", or "TB."

Evaluation criteria and corrective action for these controls are defined in the specific standard operating procedure for each analysis.

24.4 Positive Controls

Control samples (e.g., QC indicators) are analyzed with each batch of samples to evaluate data based upon (1) Method Performance (Laboratory Control Sample (LCS) or Blank Spike (BS)), which entails both the preparation and measurement steps; and (2) Matrix Effects (Matrix Spike (MS)) (Matrix spikes are not applicable to air) or Sample Duplicate (MD, DUP), which evaluates field sampling accuracy, precision, representativeness, interferences, and the effect of the matrix on the method performed. Each regulatory program and each method within those programs specify the control samples that are prepared and/or analyzed with a specific batch

Note that frequency of control samples vary with specific regulatory, methodology and project specific criteria. Complete details on method control samples are as listed in each analytical SOP.

24.4.1 Method Performance Control - Laboratory Control Sample (LCS)

The LCS measures the accuracy of the method in a blank matrix and assesses method performance independent of potential field sample matrix affects in a laboratory batch.

The LCS is prepared from a clean matrix similar to that of the associated samples that is free from target analytes (for example: Reagent water, Ottawa sand, glass beads, etc.) and is processed along with and under the same conditions as the associated samples. The LCS is spiked with verified known amounts of analytes or is made of a material containing known and verified amounts of analytes, taken through all preparation and analysis steps along with the field samples. Where there is no preparation taken for an analysis (such as in aqueous

volatiles), or when all samples and standards undergo the same preparation and analysis process (such as Phosphorus), a calibration verification standard is reported as the LCS. In some instances where there is no practical clean solid matrix available, aqueous LCS's may be processed for solid matrices; final results may be calculated as mg/kg or ug/kg, assuming 100% solids and a weight equivalent to the aliquot used for the corresponding field samples, to facilitate comparison with the field samples.

Certified pre-made reference material purchased from a NIST/A2LA accredited vendor may also be used for the LCS when the material represents the sample matrix or the analyte is not easily spiked (e.g. solid matrix LCS for metals, TDS, etc.).

The specific frequency of use for LCS during the analytical sequence is defined in the specific standard operating procedure for each analysis. It is generally 1 for each batch of samples; not to exceed 20 environmental samples.

If the mandated or requested test method, or project requirements, do not specify the spiking components, the laboratory shall spike all reportable components to be reported in the Laboratory Control Sample (and Matrix Spike) where applicable (e.g. no spike of pH). However, in cases where the components interfere with accurate assessment (such as simultaneously spiking chlordane, toxaphene and PCBs in Method 608), the test method has an extremely long list of components or components are incompatible, at a minimum, a representative number of the listed components (see below) shall be used to control the test method. The selected components of each spiking mix shall represent all chemistries, elution patterns and masses, permit specified analytes and other client requested components. However, the laboratory shall ensure that all reported components are used in the spike mixture within a two-year time period.

- For methods that have 1-10 target analytes, spike all components.
- For methods that include 11-20 target analytes, spike at least 10 or 80%, whichever is greater.
- For methods with more than 20 target analytes, spike at least 16 components.
- Exception: Due to analyte incompatibility in pesticides, Toxaphene and Chlordane are only spiked at client request based on specific project needs.
- Exception: Due to analyte incompatibility between the various PCB aroclors, aroclors 1016 and 1260 are used for spiking as they cover the range of all of the aroclors. Specific aroclors may be used by request on a project specific basis.

24.5 Sample Matrix Controls

Table 24-3. Sample Matrix Control

Control Type	Details	
Matrix Spikes (MS)	Use	used to assess the effect sample matrix of the spiked sample has on the precision and accuracy of the results generated by the method used;
	Typical Frequency [1]	At a minimum, with each matrix-specific batch of samples processed, an MS is carried through the complete analytical procedure. Unless specified by the client, samples used for spiking are randomly selected and rotated between different client projects. If the mandated or requested test method does not specify the spiking components, the laboratory shall spike all reportable components to be reported in the Laboratory Control Sample and Matrix Spike. Refer to the method SOP for complete details
	Description	essentially a sample fortified with a known amount of the test analyte(s).

Table 24-3. Sample Matrix Control

Control Type	Details	
Surrogate	Use	Measures method performance to sample matrix (organics only).
	Typical Frequency [1]	Are added to all samples, standards, and blanks, for all organic chromatography methods except when the matrix precludes its use or when a surrogate is not available. The recovery of the surrogates is compared to the acceptance limits for the specific method. Poor surrogate recovery may indicate a problem with sample composition and shall be reported, with data qualifiers, to the client whose sample produced poor recovery.
	Description	Are similar to matrix spikes except the analytes are compounds with properties that mimic the analyte of interest and are unlikely to be found in environment samples.
Duplicates[2]	Use	For a measure of analytical precision, with each matrix-specific batch of samples processed, a matrix duplicate (MD or DUP) sample, matrix spike duplicate (MSD), or LCS duplicate (LCSD) is carried through the complete analytical procedure.
	Typical Frequency [1]	Duplicate samples are usually analyzed with methods that do not require matrix spike analysis.
	Description	Performed by analyzing two aliquots of the same field sample independently or an additional LCS.
Internal Standards	Use	Are spiked into all environmental and quality control samples (including the initial calibration standards) to monitor the qualitative aspect of organic and some inorganic analytical measurements.
	Typical Frequency [1]	All organic and ICP methods as required by the analytical method.
	Description	Used to correct for matrix effects and to help troubleshoot variability in analytical response and are assessed after data acquisition. Possible sources of poor internal standard response are sample matrix, poor analytical technique or instrument performance.

[1] See the specific analytical SOP for type and frequency of sample matrix control samples.
[2] LCSD's are normally not performed except when regulatory agencies or client specifications require them. The recoveries for the spiked duplicate samples must meet the same laboratory established recovery limits as the accuracy QC samples. If an LCSD is analyzed both the LCS and LCSD must meet the same recovery criteria and be included in the final report. The precision measurement is reported as "Relative Percent Difference" (RPD). Poor precision between duplicates (except LCS/LCSD) may indicate non-homogeneous matrix or sampling.

24.6 Acceptance Criteria (Control Limits)

As mandated by the test method and regulation, each individual analyte in the LCS, MS, or Surrogate Spike is evaluated against the control limits published in the test method. Where there are no established acceptance criteria, the laboratory calculates in-house control limits with the use of control charts or, in some cases, utilizes client project specific control limits. When this occurs, the regulatory or project limits will supersede the laboratory's in-house limits.

Note: For methods, analytes and matrices with very limited data (e.g., unusual matrices not analyzed often), interim limits are established using available data or by analogy to similar methods or matrices.

Once control limits have been established, they are verified, reviewed, and updated if necessary on an annual basis unless the method requires more frequent updating. Control limits are established per method (as opposed to per instrument) regardless of the number of instruments utilized.

Laboratory generated % Recovery acceptance (control) limits are generally established by taking $\pm$ 3 Standard Deviations (99% confidence level) from the average recovery of a minimum of 20-30 data points (more points are preferred).

- Regardless of the calculated limit, the limit should be no tighter than the Calibration Verification (ICV/CCV). (Unless the analytical method specifies a tighter limit).

- In-house limits cannot be any wider than those mandated in a regulated analytical method. Client or contract required control limits are evaluated against the laboratory's statistically derived control limits to determine if the data quality objectives (DQOs) can be achieved. If laboratory control limits are not consistent with DQOs, then alternatives must be considered, such as method improvements or use of an alternate analytical method.

- The lowest acceptable recovery limit will be 10% (the analyte must be detectable and identifiable). Exception: The lowest acceptable recovery limit for Benzidine will be 5% and the analyte must be detectable and identifiable.

- The maximum acceptable recovery limit will be 150%.

- The maximum acceptable RPD limit will be 35% for waters and 40% for soils. The minimum RPD limit is 10%.

- If either the high or low end of the control limit changes by $\leq$ 5% from previous, the control chart is visually inspected and, using professional judgment, they may be left unchanged if there is no affect on laboratory ability to meet the existing limits.

24.6.1 The lab must be able to generate a current listing of their control limits and track when the updates are performed. In addition, the laboratory must be able to recreate historical control limits. More detailed procedures on generating control limits are listed in laboratory SOP BR-QA-013. The Quality Assurance department maintains an archive of all limits used within the laboratory.

24.6.2 A LCS that is within the acceptance criteria establishes that the analytical system is in control and is used to validate the process. Samples that are analyzed with an LCS with recoveries outside of the acceptance limits may be determined as out of control and should be reanalyzed if possible. If reanalysis is not possible, then the results for all affected analytes for samples within the same batch must be qualified when reported. The internal corrective action process (see Section 12) is also initiated if an LCS exceeds the acceptance limits. Sample results may be qualified and reported without reanalysis if:

- The analyte results are below the reporting limit and the LCS is above the upper control limit.

- If the analytical results are above the relevant regulatory limit and the LCS is below the lower control limit.

24.6.3 If the MS/MSDs do not meet acceptance limits, the MS/MSD and the associated spiked sample is reported with a qualifier for those analytes that do not meet limits. If obvious preparation errors are suspected, or if requested by the client, unacceptable MS/MSDs are reprocessed and reanalyzed to prove matrix interference. A more detailed discussion of acceptance criteria and corrective action can be found in the lab's method SOPs and in Section 12.

24.6.4 If a surrogate standard falls outside the acceptance limits, and if there is not obvious chromatographic matrix interference, reanalyze the sample to confirm a possible matrix effect. If the recoveries confirm or there was obvious chromatographic interference, results are reported from the original analysis and a qualifier is added. If the reanalysis meets surrogate recovery criteria, the second run is reported (or both are reported if requested by the client).

24.7 Additional Procedures to Assure Quality Control

The laboratory has written and approved method SOPs to assure the accuracy of the test method including calibration (see Section 20), use of certified reference materials (see Section 21) and use of PT samples (see Section 15).

A discussion regarding MDLs, Limit of Detection (LOD) and Limit of Quantitation (LOQ) can be found in Section 19.

- Use of formulae to reduce data is discussed in the method SOPs and in Section 20.
- Selection of appropriate reagents and standards is included in Section 9 and 21.
- A discussion on selectivity of the test is included in Section 5.
- Constant and consistent test conditions are discussed in Section 18.
- The laboratories sample acceptance policy is included in Section 23.

SECTION 25. REPORTING RESULTS

25.1 Overview

The results of each test are reported accurately, clearly, unambiguously, and objectively in accordance with State and Federal regulations as well as client requirements. Analytical results are issued in a format that is intended to satisfy customer and laboratory accreditation requirements as well as provide the end user with the information needed to properly evaluate the results. Where there is conflict between client requests and laboratory ethics or regulatory requirements, the laboratory's ethical and legal requirements are paramount, and the laboratory will work with the client during project set up to develop an acceptable solution. Refer to Section 7.

A variety of report formats are available to meet specific needs.

In cases where a client asks for simplified reports, there must be a written request from the client. There still must be enough information that would show any analyses that were out of conformance (QC out of limits) and there should be a reference to a full report that is made available to the client. Review of reported data is included in Section 19.

25.2 Test Reports

Analytical results are reported in a format that is satisfactory to the client and meets all requirements of applicable accrediting authorities and agencies. A variety of report formats are available to meet specific needs. The report is printed on laboratory letterhead, reviewed, and

signed by the appropriate project manager. At a minimum, the standard laboratory report shall contain the following information:

25.2.1 A report title (e.g. Analytical Report For Samples) with a “sample results” column header.

25.2.2 Each report cover page printed on company letterhead, which includes the laboratory name, address and telephone number.

25.2.3 A unique identification of the report (e.g. work order number) and on each page an identification in order to ensure the page is recognized as part of the report and a clear identification of the end.

Note: Page numbers of report are typically represented as page # of ##. Where the first number is the page number and the second is the total number of pages.

25.2.4 A copy of the chain of custody (COC).

- Any COCs involved with Subcontracting are included.

25.2.5 The name and address of client and a project name/number, if applicable.

25.2.6 Client project manager or other contact

25.2.7 Description and unambiguous identification of the tested sample(s) including the client identification code.

25.2.8 Date of receipt of sample, date and time of collection, and date(s) of test preparation and performance, and time of preparation or analysis if the required holding time for either activity is less than or equal to 72 hours.

25.2.9 Date reported or date of revision, if applicable.

25.2.10 Method of analysis including method code (EPA, Standard Methods, etc.).

25.2.11 Reporting limit or Contract Required Reporting Limit.

25.2.12 Method detection limits (if requested)

25.2.13 Definition of Data qualifiers and reporting acronyms (e.g. ND).

25.2.14 Sample results.

25.2.15 QC data consisting of method blank, surrogate, LCS, and MS/MSD recoveries and control limits.

25.2.16 Condition of samples at receipt including temperature. This may be accomplished in a narrative or by attaching sample login sheets (Refer to Sec. 25.2.4 – Item 3 regarding additional addenda).

25.2.17 A statement to the effect that the results relate only to the items tested and the sample as received by the laboratory.

25.2.18 A signature and title of the person(s) accepting responsibility for the content of the report and date of issue. Authorized signatories are qualified Project Managers appointed by the Manager of Project Managers.

25.2.19 When TNI accreditation is required, the lab shall certify that the test results meet all requirements of TNI or provide reasons and/or justification if they do not.

25.2.20 Where applicable, a narrative to the report that explains the issue(s) and corrective action(s) taken in the event that a specific accreditation or certification requirement was not met.

25.2.21 When soil samples are analyzed, a specific identification as to whether soils are reported on a “wet weight” or “dry weight” basis.

25.2.22 Appropriate laboratory certification number for the state of origin of the sample, if applicable.

25.2.23 If only part of the report is provided to the client (client requests some results before all of it is complete), it must be clearly indicated on the report (e.g., partial report, or preliminary). A complete report must be sent once all of the work has been completed.

25.2.24 Any non-TestAmerica subcontracted analysis results are provided as a separate report on the official letterhead of the subcontractor. All TestAmerica subcontracting is clearly identified on the report as to which laboratory performed a specific analysis.

25.2.25 A Certification Summary Report, where required, will document that, unless otherwise noted, all analytes tested and reported by the laboratory were covered by the noted certifications.

Note: Refer to the Corporate SOP on Electronic Reporting and Signature Policy (No. CA-I-P-002) for details on internally applying electronic signatures of approval.

25.3 Reporting Level or Report Type

The laboratory offers four levels of quality control reporting. Each level, in addition to its own specific requirements, contains all the information provided in the preceding level. The packages provide the following information in addition to the information described above:

- Level 1 is a report with all of the elements outlined in Section 25.2 above, excluding 25.2.15 (QC data)
- Level II is a Level I report plus summary information, including results for the method blank reported to the laboratory MDL, percent recovery for laboratory control samples and matrix spike samples, and the RPD values for all MSD and sample duplicate analyses.

- Level III contains all the information supplied in Level II, but presented on the CLP-like summary forms, and relevant calibration information. A Level II report is not included, unless specifically requested. No raw data is provided.
- Level IV is the same as Level III with the addition of all raw supporting data.

25.3.1 Electronic Data Deliverables (EDDs)

EDDs are routinely offered as part of TestAmerica's services in addition to the test report as described in Section 25.2. When NELAP accreditation is required and both a test report and EDD are provided to the client, the official version of the test report will be the combined information of the report and the EDD. TestAmerica Burlington offers a variety of EDD formats including Environmental Restoration Information Management System (ERPIMS), Staged Electronic Data Deliverable (SEDD) Environmental Quality Information System (EQuIS), Electronic Deliverable Format (EDF), Excel and custom files.

EDD specifications are submitted to the IT department by the PM for review and undergo the contract review process. Once the facility has committed to providing data in a specific electronic format, the coding of the format may need to be performed. This coding is documented and validated. The validation of the code is retained by the IT department.

EDDs shall be subject to a review to ensure their accuracy and completeness. If EDD generation is automated, review may be reduced to periodic screening if the laboratory can demonstrate that it can routinely generate that EDD without errors. Any revisions to the EDD format must be reviewed until it is demonstrated that it can routinely be generated without errors. If the EDD can be reproduced accurately and if all subsequent EDDs can be produced error-free, each EDD does not necessarily require a review.

25.4 Supplemental Information for Test

The lab identifies any unacceptable QC analyses or any other unusual circumstances or observations such as environmental conditions and any non-standard conditions that may have affected the quality of a result. This is typically in the form of a footnote or a qualifier and/or a narrative explaining the discrepancy in the front of the report.

Numeric results with values outside of the calibration range, either high or low are qualified as 'estimated'.

Where quality system requirements are not met, a statement of compliance/non-compliance with requirements and/or specifications is required, including identification of test results derived from any sample that did not meet TNI sample acceptance requirements such as improper container, holding time, or temperature.

Where applicable, a statement on the estimated uncertainty of measurements; information on uncertainty is needed when a client's instructions so require.

Opinions and Interpretations - The test report contains objective information, and generally does not contain subjective information such as opinions and interpretations. If such information is required by the client, the Laboratory Director will determine if a response can be prepared. If so, the Laboratory Director will designate the appropriate member of the management team to

prepare a response. The response will be fully documented, and reviewed by the Laboratory Director, before release to the client. There may be additional fees charged to the client at this time, as this is a non-routine function of the laboratory.

When opinions or interpretations are included in the report, the laboratory provides an explanation as to the basis upon which the opinions and interpretations have been made. Opinions and interpretations are clearly noted as such and where applicable, a comment should be added suggesting that the client verify the opinion or interpretation with their regulator.

25.5 Environmental Testing Obtained From Subcontractors

If the laboratory is not able to provide the client the requested analysis, the samples would be subcontracted following the procedures outlined in the Corporate SOP on Subcontracting (SOP No. CA-L-S-002).

Data reported from analyses performed by a subcontractor laboratory are clearly identified as such on the analytical report provided to the client. Results from a subcontract laboratory outside of TestAmerica are reported to the client on the subcontract laboratory's original report stationery and the report includes any accompanying documentation.

25.6 Client Confidentiality

In situations involving the transmission of environmental test results by telephone, facsimile or other electronic means, client confidentiality must be maintained.

TestAmerica will not intentionally divulge to any person (other than the Client or any other person designated by the Client in writing) any information regarding the services provided by TestAmerica or any information disclosed to TestAmerica by the Client. Furthermore, information known to be potentially endangering to national security or an entity's proprietary rights will not be released.

Note: This shall not apply to the extent that the information is required to be disclosed by TestAmerica under the compulsion of legal process. TestAmerica will, to the extent feasible, provide reasonable notice to the client before disclosing the information.

Note: Authorized representatives of an accrediting authority are permitted to make copies of any analyses or records relevant to the accreditation process, and copies may be removed from the laboratory for purposes of assessment.

25.6.1 Report deliverable formats are discussed with each new client. If a client requests that reports be faxed or e-mailed, the reports are faxed with a cover sheet or e-mailed with the following note that includes a confidentiality statement similar to the following:

This material is intended only for the use of the individual(s) or entity to which it is addressed, and may contain information that is privileged and confidential. If you are not the intended recipient, or the employee or agent responsible for delivering this material to the intended recipient, you are hereby notified that any dissemination, distribution or copying of this communication is strictly prohibited. If you have received this communication in error, please notify us immediately by telephone at the 1-800-765-0980 (or for e-mails: please notify us

immediately by e-mail or by phone (1-800-765-0980) and delete this material from any computer).

25.7 Format of Reports

The format of reports is designed to accommodate each type of environmental test carried out and to minimize the possibility of misunderstanding or misuse.

25.8 Amendments to Test Reports

Corrections, additions, or deletions to reports are only made when justification arises through supplemental documentation. Justification is documented using the laboratory's corrective action system (refer to Section 12).

The revised report is retained on the Archive data server, as is the original report. The revised report will have the word "revised" or "amended" next to the date rather than the word "reported".

When the report is re-issued, a notation of "report re-issue" is placed on the cover/signature page of the report *or at the top of the narrative page* with a brief explanation of reason for the re-issue and a reference back to the last final report generated. *For Example*: *Report was revised on 11/3/08 to include toluene in sample NQA1504 per client's request. This final report replaces the final report generated on 10/27/08 at 10:47am.*

25.9 Policies on Client Requests for Amendments

25.9.1 Policy on Data Omissions or Reporting Limit Increases

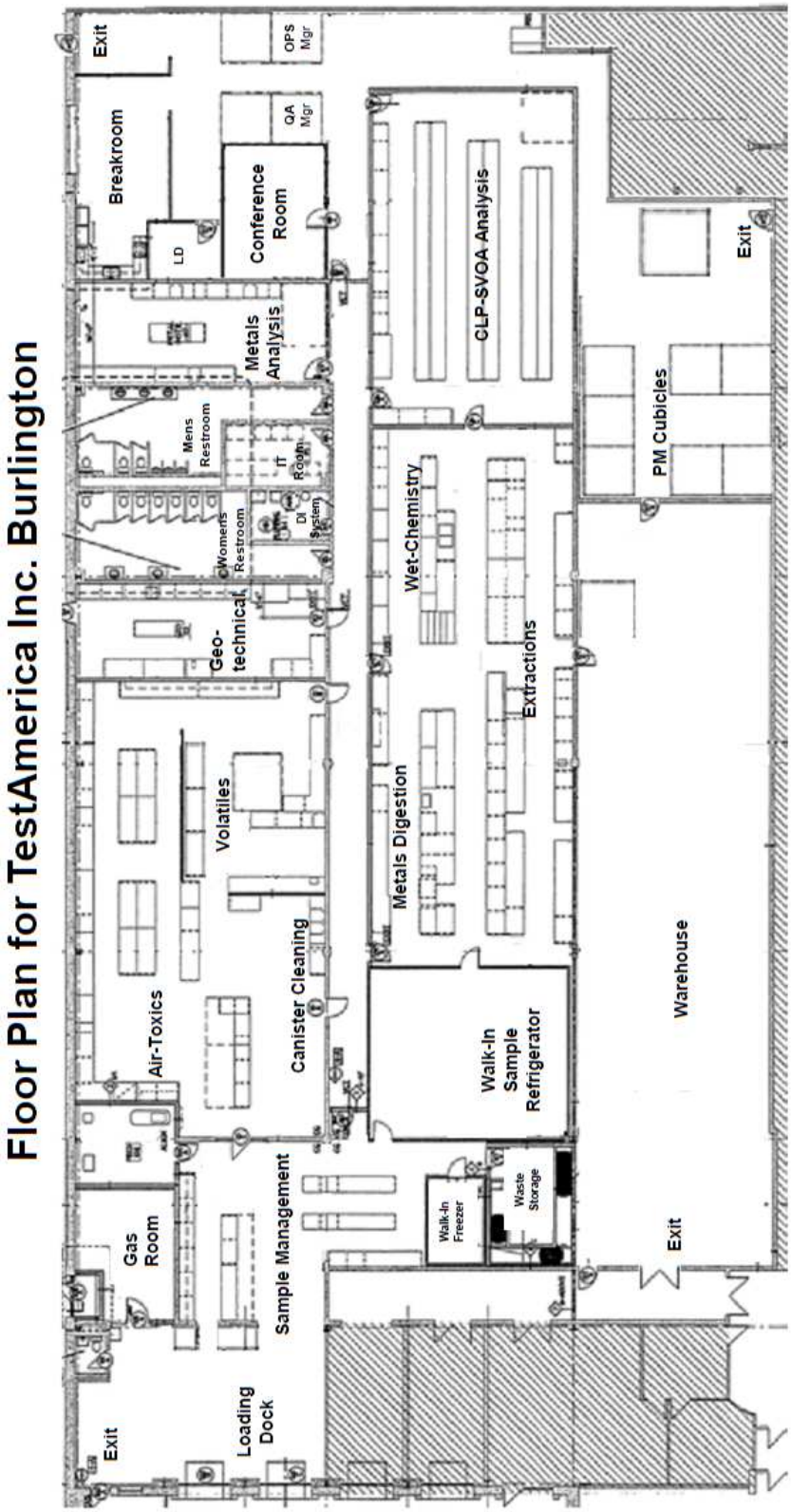
Fundamentally, our policy is simply to not omit previously reported results (including data qualifiers) or to not raise reporting limits and report sample results as ND. This policy has few exceptions. Exceptions are:

- Laboratory error.
- Sample identification is indeterminate (confusion between COC and sample labels).
- An incorrect analysis (not analyte) was requested (e.g., COC lists 8315 but client wanted 8310). A written request for the change is required.
- Incorrect limits reported based on regulatory requirements.
- The requested change has absolutely *no possible* impact on the interpretation of the analytical results and there is *no possibility* of the change being interpreted as misrepresentation by anyone inside or outside of our company.

25.9.2 Multiple Reports

TestAmerica does not issue multiple reports for the same work order where there is different information on each report (this does not refer to copies of the same report) unless required to meet regulatory needs and approved by QA.

Appendix 1. Laboratory Floor Plan



Appendix 2. Glossary/Acronyms (EL-V1M2 Sec. 3.1)

Glossary:

Acceptance Criteria: Specified limits placed on characteristics of an item, process, or service defined in requirement documents. (ASQC)

Accreditation: The process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications or standards, thereby accrediting the laboratory.

Accuracy: The degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator. (QAMS)

Analyst: The designated individual who performs the "hands-on" analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality.

Analytical Uncertainty: A subset of Measurement Uncertainty that includes all laboratory activities performed as part of the analysis. (TNI)

Anomaly: A condition or event, other than a deficiency, that may affect the quality of the data, whether in the laboratory's control or not.

Assessment: The evaluation process used to measure or establish the performance, effectiveness, and conformance of an organization and/or its systems to defined criteria (to the standards and requirements of laboratory accreditation). (TNI)

Audit: A systematic and independent examination of facilities, equipment, personnel, training, procedures, record-keeping, data validation, data management, and reporting aspects of a system to determine whether QA/QC and technical activities are being conducted as planned and whether these activities will effectively achieve quality objectives. (TNI)

Batch: Environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A **preparation batch** is composed of one (1) to twenty (20) environmental samples of the same quality systems matrix, meeting the above mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be twenty-four (24) hours. An **analytical batch** is composed of prepared environmental samples (extracts, digestates or concentrates) which are analyzed together as a group. An analytical batch can include prepared samples originating from various quality system matrices and can exceed twenty (20) samples. (TNI)

Bias: The systematic or persistent distortion of a measurement process, which causes errors in one direction (i.e., the expected sample measurement is different from the sample's true value). (TNI)

Blank: A sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results. (ASQC)

Calibration: A set of operations that establish, under specified conditions, the relationship between values of quantities indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material, and the corresponding values realized by standards. (TNI)

1) In calibration of support equipment the values realized by standards are established through the use of reference standards that are traceable to the International System of Units (SI).

2) In calibration according to methods, the values realized by standards are typically established through the use of Reference Materials that are either purchased by the laboratory with a certificate of analysis or purity, or prepared by the laboratory using support equipment that has been calibrated or verified to meet specifications.

Calibration Curve: The mathematical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response. (TNI)

Calibration Standard: A substance or reference material used to calibrate an instrument (QAMS)

Certified Reference Material (CRM): A reference material accompanied by a certificate, having a value, measurement uncertainty, and stated metrological traceability chain to a national metrology institute. (TNI)

Chain of Custody (COC) Form: Record that documents the possession of the samples from the time of collection to receipt in the laboratory. This record generally includes: the number and types of containers; the mode of collection; the collector; time of collection; preservation; and requested analyses. (TNI)

Compromised Samples: Those samples which are improperly sampled, insufficiently documented (chain of custody and other sample records and/or labels), improperly preserved, collected in improper containers, or exceeding holding times when delivered to a laboratory. Under normal conditions, compromised samples are not analyzed. If emergency situation require analysis, the results must be appropriately qualified.

Confidential Business Information (CBI): Information that an organization designates as having the potential of providing a competitor with inappropriate insight into its management, operation or products. TNI and its representatives agree to safeguard identified CBI and to maintain all information identified as such in full confidentiality.

Confirmation: Verification of the identity of a component through the use of an approach with a different scientific principle from the original method. These may include, but are not limited to Second Column Confirmation; Alternate wavelength; Derivatization; Mass spectral interpretation; Alternative detectors or Additional Cleanup procedures. (TNI)

Conformance: An affirmative indication or judgment that a product or service has met the requirements of the relevant specifications, contract, or regulation; also the state of meeting the requirements. (ANSI/ASQC E4-1994)

Correction: Actions necessary to correct or repair analysis specific non-conformances. The acceptance criteria for method specific QC and protocols as well as the associated corrective actions. The analyst will most frequently be the one to identify the need for this action as a result of calibration checks and QC sample analysis**.** No significant action is taken to change behavior, process or procedure.

Corrective Action: The action taken to eliminate the causes of an existing nonconformity, defect or other undesirable situation in order to prevent recurrence. (ISO 8402)

Data Audit: A qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data re of acceptable quality (i.e., that they meet specified acceptance criteria).

Data Reduction: The process of transforming the number of data items by arithmetic or statistical calculations, standard curves, and concentration factors, and collation into a more useable form. (TNI)

Deficiency: An unauthorized deviation from acceptable procedures or practices, or a defect in an item (ASQC), whether in the laboratory's control or not.

Demonstration of Capability: A procedure to establish the ability of the analyst to generate analytical results of acceptable accuracy and precision. (TNI)

Document Control: The act of ensuring that documents (and revisions thereto) are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly, and controlled to ensure use of the correct version at the location where the prescribed activity if performed. (ASQC)

Duplicate Analyses: The analyses or measurements of the variable of interest performed identically on two subsamples of the same sample. The results from duplicate analyses are used to evaluate analytical or measurement precision but not the precision of sampling, preservation or storage internal to the laboratory. (EPA-QAD)

Equipment Blank: Sample of analyte-free media which has been used to rinse common sampling equipment to check effectiveness of decontamination procedures.

External Standard Calibration: Calibrations for methods that do not utilize internal standards to compensate for changes in instrument conditions.

Field Blank: Blank prepared in the field by filing a clean container with pure de-ionized water and appropriate preservative, if any, for the specific sampling activity being undertaken (EPA OSWER)

Field of Accreditation: Those matrix, technology/method, and analyte combinations for which the accreditation body offers accreditation.

Holding Times: The maximum time that samples may be held prior to analyses and still be considered valid or not compromised. (40 CFR Part 136)

Internal Standard: A known amount of standard added to a test portion of a sample as a reference for evaluating and controlling the precision and bias of the applied analytical test method. (TNI)

Internal Standard Calibration: Calibrations for methods that utilize internal standards to compensate for changes in instrument conditions.

Instrument Blank: A clean sample (e.g., distilled water) processed through the instrumental steps of the measurement process; used to determine instrument contamination. (EPA-QAD)

Instrument Detection Limit (IDL): The minimum amount of a substance that can be measured with a specified degree of confidence that the amount is greater than zero using a specific instrument. The IDL is associated with the instrumental portion of a specific method only, and sample preparation steps are not considered in its derivation. The IDL is a statistical estimation at a specified confidence interval of the concentration at which the relative uncertainty is $\pm$ 100%. The IDL represents a range where qualitative detection occurs on a specific instrument. Quantitative results are not produced in this range.

Laboratory Control Sample (however named, such as laboratory fortified blank, spiked blank, or QC check sample): A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes, taken through all preparation and analysis steps of the procedure unless otherwise noted in a reference method. It is

generally used to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system.

An LCS shall be prepared at a minimum of 1 per batch of 20 or less samples per matrix type per sample extraction or preparation method except for analytes for which spiking solutions are not available such as total suspended solids, total dissolved solids, total volatile solids, total solids, pH, color, odor, temperature, dissolved oxygen or turbidity. The results of these samples shall be used to determine batch acceptance.

Least Squares Regression (1st Order Curve): The least squares regression is a mathematical calculation of a straight line over two axes. The y axis represents the instrument response (or Response ratio) of a standard or sample and the x axis represents the concentration. The regression calculation will generate a correlation coefficient (r) that is a measure of the "goodness of fit" of the regression line to the data. A value of 1.00 indicates a perfect fit. In order to be used for quantitative purposes, r must be greater than or equal to 0.99 for organics and 0.995 for inorganics.

Limit(s) of Detection (LOD) [a.k.a., Method Detection Limit (MDL)]: A laboratory's estimate of the minimum amount of an analyte in a given matrix that an analytical process can reliably detect in their facility. (TNI)

LOD Verification [a.k.a., MDL Verification]: A processed QC sample in the matrix of interest, spiked with the analyte at no more than 3X the LOD for single analyte tests and 4X the LOD for multiple analyte tests and processed through the entire analytical procedure.

Limit(s) of Quantitation (LOQ) [a.k.a., Reporting Limit]: The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. (TNI)

(QS) Matrix: The component or substrate that contains the analyte of interest. For purposes of batch and QC requirement determinations, the following matrix distinctions shall be used:

Aqueous: Any aqueous sample excluded from the definition of Drinking Water or Saline/Estuarine. Includes surface water, groundwater effluents, and TCLP or other extracts.

Drinking Water: Any aqueous sample that has been designated as a potable or potential potable water source.

Saline/Estuarine: Any aqueous sample from an ocean or estuary, or other salt water source such as the Great Salt Lake.

Non-Aqueous Liquid: Any organic liquid with <15% settleable solids.

Biological Tissue: Any sample of a biological origin such as fish tissue, shellfish, or plant material. Such samples shall be grouped according to origin.

Solids: Includes soils, sediments, sludges, and other matrices with >15% settleable solids.

Chemical Waste: A product or by-product of an industrial process that results in a matrix not previously defined.

Air & Emissions: Whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas or vapor that are collected with a sorbant tube, impinger solution, filter, or other device. (TNI)

Matrix Spike (spiked sample or fortified sample): A sample prepared, taken through all sample preparation and analytical steps of the procedure unless otherwise noted in a referenced method, by adding a known amount of target analyte to a specified amount of sample for which an independent test result of target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency.

Matrix Spike Duplicate (spiked sample or fortified sample duplicate): A replicate matrix spike prepared and analyzed to obtain a measure of the precision of the recovery for each analyte.

Method Blank: A sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses.

Method Detection Limit: The minimum concentration of a substance (an analyte) that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. (40 CFR Part 136, Appendix B)

Negative Control: Measures taken to ensure that a test, its components, or the environment do not cause undesired effects, or produce incorrect test results.

Non-conformance: An indication, judgment, or state of not having met the requirements of the relevant specifications, contract, or regulation.

Observation: A record of phenomena that (1) may assist in evaluation of the sample data; (2) may be of importance to the project manager and/or the client, and yet not at the time of the observation have any known effect on quality.

Performance Audit: The routine comparison of independently obtained qualitative and quantitative measurement system data with routinely obtained data in order to evaluate the proficiency of an analyst or laboratory.

Positive Control: Measures taken to ensure that a test and/or its components are working properly and producing correct or expected results from positive test subjects.

Precision: The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms. (TNI)

Preservation: Any conditions under which a sample must be kept in order to maintain chemical and/or biological integrity prior to analysis. (TNI)

Proficiency Testing: A means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source. (TNI)

Proficiency Testing Program: The aggregate of providing rigorously controlled and standardized environmental samples to a laboratory for analysis, reporting of results, statistical evaluation of the results and the collective demographics and results summary of all participating laboratories. (TNI)

Proficiency Test Sample (PT): A sample, the composition of which is unknown to the laboratory and is provided to test whether the laboratory can produce analytical results within specified acceptance criteria. (TNI)

Quality Assurance: An integrated system of management activities involving planning, implementation, assessment, reporting and quality improvement to ensure that a process, item or service is of the type of quality needed and expected by the client. (TNI)

Quality Assurance [Project] Plan (QAPP): A formal document describing the detailed quality control procedures by which the quality requirements defined for the data and decisions pertaining to a specific project are to be achieved. (EAP-QAD)

Quality Control: The overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the customer; operational techniques and activities that are used to fulfill requirements for quality; also the system of activities and checks used to ensure that measurement systems are maintained within prescribed limits, providing protection against “out of control” conditions and ensuring that the results are of acceptable quality. (TNI)

Quality Control Sample: A sample used to assess the performance of all or a portion of the measurement system. One of any number of samples, such as Certified Reference Materials, a quality system matrix fortified by spiking, or actual samples fortified by spiking, intended to demonstrate that a measurement system or activity is in control. (TNI)

Quality Manual: A document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users. (TNI)

Quality System: A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA and QC activities. (TNI)

Raw Data: The documentation generated during sampling and analysis. This documentation includes, but is not limited to, field notes, electronic data, magnetic tapes, untabulated sample results, QC sample results, print outs of chromatograms, instrument outputs, and handwritten records. (TNI)

Record Retention: The systematic collection, indexing and storing of documented information under secure conditions.

Reference Material: Material or substance one or more properties of which are sufficiently homogeneous and well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials. (TNI)

Reference Standard: Standard used for the calibration of working measurement standards in a given organization or a given location. (TNI)

Sampling: Activity related to obtaining a representative sample of the object of conformity assessment, according to a procedure.

Second Order Polynomial Curve (Quadratic): The 2nd order curves are a mathematical calculation of a slightly curved line over two axis. The y axis represents the instrument response (or Response ratio) of a standard or sample and the x axis represents the concentration. The 2nd order regression will generate a coefficient of determination (COD or r^2) that is a measure of the "goodness of fit" of the quadratic curvature the data. A value of 1.00 indicates a perfect fit. In order to be used for quantitative purposes, r^2 must be greater than or equal to 0.99.

Selectivity: The ability to analyze, distinguish, and determine a specific analyte or parameter from another component that may be a potential interferent or that may behave similarly to the target analyte or parameter within the measurement system. (TNI)

Sensitivity: The capability of a method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest. (TNI)

Spike: A known mass of target analyte added to a blank, sample or sub-sample; used to determine recovery efficiency or for other quality control purposes.

Standard: The document describing the elements of laboratory accreditation that has been developed and established within the consensus principles of standard setting and meets the approval requirements of standard adoption organizations procedures and policies. (TNI)

Standard Operating Procedures (SOPs): A written document which details the method for an operation, analysis, or action, with thoroughly prescribed techniques and steps. SOPs are officially approved as the methods for performing certain routine or repetitive tasks. (TNI)

Storage Blank: A blank matrix stored with field samples of a similar matrix (volatiles only) that measures storage contribution to any source of contamination.

Surrogate: A substance with properties that mimic the analyte of interest. It is unlikely to be found in environment samples and is added to them for quality control purposes.

Surrogate compounds must be added to all samples, standards, and blanks, for all organic chromatography methods except when the matrix precludes its use or when a surrogate is not available. Poor surrogate recovery may indicate a problem with sample composition and shall be reported to the client whose sample produced poor recovery. (QAMS)

Systems Audit (also Technical Systems Audit): A thorough, systematic, qualitative on-site assessment of the facilities, equipment, personnel, training, procedures, record keeping, data validation, data management, and reporting aspects of a total measurement system. (EPA-QAD)

Technical Manager: A member of the staff of an environmental laboratory who exercises actual day-to-day supervision of laboratory operations for the appropriate fields of accreditation and reporting of results

Technology: A specific arrangement of analytical instruments, detection systems, and/or preparation techniques.

Traceability: The ability to trace the history, application, or location of an entity by means of recorded identifications. In a calibration sense, traceability relates measuring equipment to national or international standards, primary standards, basic physical constants or properties, or reference materials. In a data collection sense, it relates calculations and data generated throughout the project back to the requirements for the quality of the project. (TNI)

Trip Blank: A blank matrix placed in a sealed container at the laboratory that is shipped, held unopened in the field, and returned to the laboratory in the shipping container with the field samples.

Uncertainty: A parameter associated with the result of a measurement that characterizes the dispersion of the value that could reasonably be attributed to the measured value.

Acronyms:

CAR – Corrective Action Report

CCV – Continuing Calibration Verification
CF – Calibration Factor
CFR – Code of Federal Regulations
COC – Chain of Custody
DOC – Demonstration of Capability
DQO – Data Quality Objectives
DUP - Duplicate
EHS – Environment, Health and Safety
EPA – Environmental Protection Agency
GC - Gas Chromatography
GC/MS - Gas Chromatography/Mass Spectrometry
HPLC - High Performance Liquid Chromatography
ICP - Inductively Coupled Plasma Atomic Emission Spectroscopy
ICP/MS – ICP/Mass Spectrometry
ICV – Initial Calibration Verification
IDL – Instrument Detection Limit
IH – Industrial Hygiene
IS – Internal Standard
LCS – Laboratory Control Sample
LCSD – Laboratory Control Sample Duplicate
LIMS – Laboratory Information Management System
LOD – Limit of Detection
LOQ – Limit of Quantitation
MDL – Method Detection Limit
MDLCK – MDL Check Standard
MDLV – MDL Verification Check Standard
MRL – Method Reporting Limit Check Standard
MS – Matrix Spike
MSD – Matrix Spike Duplicate
SDS - Safety Data Sheet
NELAP - National Environmental Laboratory Accreditation Program
PT – Performance Testing
TNI – The NELAC Institute
QAM – Quality Assurance Manual
QA/QC – Quality Assurance / Quality Control
QAPP – Quality Assurance Project Plan
RF – Response Factor
RPD – Relative Percent Difference
RSD – Relative Standard Deviation
SD – Standard Deviation
SOP – Standard Operating Procedure
TAT – Turn-Around-Time
VOA – Volatiles
VOC – Volatile Organic Compound

Appendix 3. Laboratory Certifications, Accreditations, Validations

TestAmerica Burlington maintains accreditations, certifications, and approvals with numerous state and national entities. Programs vary but may include on-site audits, reciprocal agreements with another entity, performance testing evaluations, review of the QA Manual, Standard Operating Procedures, Method Detection Limits, training records, etc. At the time of this QA Manual revision, the laboratory has accreditation/ certification/licensing with the following organizations:

Laboratory	Program	Authority	Lab ID	Expires
Burlington	DoD ELAP	ANAB	L2336	02/25/2020
Burlington	NELAP	Florida	E87467	6/30/2018
Burlington	NELAP	Minnesota	050-999-436	12/31/2018
Burlington	NELAP	New Hampshire	2006	12/18/2018
Burlington	NELAP	New Jersey	VT972	6/30/2018
Burlington	NELAP	New York	10391	4/1/2018
Burlington	NELAP	Pennsylvania	68-00489	5/1/2018
Burlington	NELAP	Virginia	460209	12/14/2018
Burlington	State Program	Connecticut	PH-0751	9/30/2019
Burlington	State Program	DE Haz. Subst. Cleanup Act (HSCA)	NA	2/1/2019
Burlington	State Program	Maine	VT00008	4/17/2019
Burlington	State Program	Rhode Island	LAO00298	12/30/2018
Burlington	State Program	Vermont	VT-4000	1/1/2018

The certificates and accredited parameter lists are available for each State/Program at www.testamericainc.com under Analytical Services Search – Certifications.

OREGON

Environmental Laboratory Accreditation Program

TestAmerica Laboratories Inc.- Knoxville

NELAP Recognized

TNI 0189

5815 Middlebrook Pike

Knoxville, TN 37921

IS GRANTED APPROVAL BY ORELAP UNDER THE 2009 TNI STANDARDS, TO PERFORM ANALYSES ON ENVIRONMENTAL SAMPLES IN MATRICES AS LISTED BELOW :

Air	*Drinking Water*	*Non Potable Water*	*Solids and Chem. Waste*	*Tissue*
		Chemistry	Chemistry	Chemistry

AND AS RECORDED IN THE LIST OF APPROVED ANALYTES, METHODS, ANALYTICAL TECHNIQUES, AND FIELDS OF TESTING ISSUED CONCURRENTLY WITH THIS CERTIFICATE AND REVISED AS NECESSARY.

ACCREDITED STATUS DEPENDS ON SUCCESSFUL ONGOING PARTICIPATION IN THE PROGRAM AND CONTINUED COMPLIANCE WITH THE STANDARDS.

CUSTOMERS ARE URGED TO VERIFY THE LABORATORY'S CURRENT ACCREDITATION STATUS IN OREGON.

Christopher L. Redman

Christopher L. Redman, BA
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EFFECTIVE DATE : 01/2/2018

EXPIRATION DATE : 01/1/2019

Certificate No : TNI 0189 - 001

OREGON

Environmental Laboratory Accreditation Program

ORELAP Fields of Accreditation

ORELAP ID: TNI 0189

TestAmerica Laboratories Inc.- Knoxville

EPA CODE: TN00009

5815 Middlebrook Pike

Certificate: TNI 0189 - 001

Knoxville, TN 37921 Issue Date: 1/2/2018 Expiration Date: 1/1/2019

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MATRIX	Reference	Code	Analyte	Code	Description
Biological Tissue					
	EPA 1613B			10120602	Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope Dilution GC/HRMS
		9516	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)		
		9519	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)		
		9420	1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)		
		9426	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)		
		9423	1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)		
		9471	1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-Hxcdf)		
		9453	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd)		
		9474	1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf)		
		9456	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,6,7,8-Hxcdd)		
		9477	1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf)		
		9459	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd)		
		9543	1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf)		
		9540	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd)		
		9480	2,3,4,6,7,8-Hexachlorodibenzofuran		
		9549	2,3,4,7,8-Pentachlorodibenzofuran		
		9618	2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD)		
		9612	2,3,7,8-Tetrachlorodibenzofuran		
		9438	Hpcdd, total		
		9444	Hpcdf, total		
		9468	Hxcdd, total		
		9483	Hxcdf, total		
		9555	Pecdd, total		
		9552	Pecdf, total		
		9609	TCDD, total		
		9615	TCDF, total		

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Biological Tissue	EPA 1668A	10262029	Chlorinated Biphenyl Cogeners in Water, Soil, Sediment, and Tissue by GC-HRMS
	9095	2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ-206)	
	9090	2,2',3,3',4,4',5,5'-Octachlorobiphenyl (BZ-194)	
	9101	2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl (BZ-207)	
	9103	2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ-195)	
	9102	2,2',3,3',4,4',5,6'-Octachlorobiphenyl (BZ-196)	
	9065	2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ-170)	
	9104	2,2',3,3',4,4',6,6'-Octachlorobiphenyl (BZ-197)	
	9106	2,2',3,3',4,4',6-Heptachlorobiphenyl (BZ-171)	
	9020	2,2',3,3',4,4'-Hexachlorobiphenyl (BZ-128)	
	9107	2,2',3,3',4,5,5',6,6'-Nonachlorobiphenyl (BZ-208)	
	9109	2,2',3,3',4,5,5',6-Octachlorobiphenyl (BZ-198)	
	9108	2,2',3,3',4,5,5',6'-Octachlorobiphenyl (BZ-199)	
	9110	2,2',3,3',4,5,5'-Heptachlorobiphenyl (BZ-172)	
	9111	2,2',3,3',4,5,6,6'-Octachlorobiphenyl (BZ-200)	
	9112	2,2',3,3',4,5',6,6'-Octachlorobiphenyl (BZ-201)	
	9113	2,2',3,3',4,5,6-Heptachlorobiphenyl (BZ-173)	
	9116	2,2',3,3',4,5,6'-Heptachlorobiphenyl (BZ-174)	
	9115	2,2',3,3',4,5',6-Heptachlorobiphenyl (BZ-175)	
	9114	2,2',3,3',4,5',6'-Heptachlorobiphenyl (BZ-177)	
	9118	2,2',3,3',4,5-Hexachlorobiphenyl (BZ-129)	
	9117	2,2',3,3',4,5'-Hexachlorobiphenyl (BZ-130)	
	9119	2,2',3,3',4,6,6'-Heptachlorobiphenyl (BZ-176)	
	9121	2,2',3,3',4,6-Hexachlorobiphenyl (BZ-131)	
	9120	2,2',3,3',4,6'-Hexachlorobiphenyl (BZ-132)	

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Biological Tissue	EPA 1668A	9122	2,2',3,3',4-Pentachlorobiphenyl (BZ-82)
		9123	2,2',3,3',5,5',6,6'-Octachlorobiphenyl (BZ-202)
		9124	2,2',3,3',5,5',6-Heptachlorobiphenyl (BZ-178)
		9125	2,2',3,3',5,5'-Hexachlorobiphenyl (BZ-133)
		9126	2,2',3,3',5,6,6'-Heptachlorobiphenyl (BZ-179)
		9128	2,2',3,3',5,6-Hexachlorobiphenyl (BZ-134)
		9127	2,2',3,3',5,6'-Hexachlorobiphenyl (BZ-135)
		9129	2,2',3,3',5-Pentachlorobiphenyl (BZ-83)
		9130	2,2',3,3',6,6'-Hexachlorobiphenyl (BZ-136)
		9131	2,2',3,3',6-Pentachlorobiphenyl (BZ-84)
		9132	2,2',3,3'-Tetrachlorobiphenyl (BZ-40)
		9133	2,2',3,4,4',5,5',6-Octachlorobiphenyl (BZ-203)
		9134	2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ-180)
		9135	2,2',3,4,4',5,6,6'-Octachlorobiphenyl (BZ-204)
		9137	2,2',3,4,4',5,6-Heptachlorobiphenyl (BZ-181)
		9136	2,2',3,4,4',5,6'-Heptachlorobiphenyl (BZ-182)
		9075	2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ-183)
		9138	2,2',3,4,4',5-Hexachlorobiphenyl (BZ-137)
		9025	2,2',3,4,4',5'-Hexachlorobiphenyl (BZ-138)
		9139	2,2',3,4,4',6,6'-Heptachlorobiphenyl (BZ-184)
		9141	2,2',3,4,4',6-Hexachlorobiphenyl (BZ-139)
		9140	2,2',3,4,4',6'-Hexachlorobiphenyl (BZ-140)
		9142	2,2',3,4,4'-Pentachlorobiphenyl (BZ-85)
		9143	2,2',3,4,5,5',6-Heptachlorobiphenyl (BZ-185)
		9080	2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ-187)
		9030	2,2',3,4,5,5'-Hexachlorobiphenyl (BZ-141)
		9144	2,2',3,4',5,5'-Hexachlorobiphenyl (BZ-146)

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Biological Tissue	EPA 1668A	9145	2,2',3,4,5,6,6'-Heptachlorobiphenyl (BZ-186)
		9146	2,2',3,4',5,6,6'-Heptachlorobiphenyl (BZ-188)
		9148	2,2',3,4,5,6-Hexachlorobiphenyl (BZ-142)
		9152	2,2',3,4,5,6'-Hexachlorobiphenyl (BZ-143)
		9150	2,2',3,4,5',6-Hexachlorobiphenyl (BZ-144)
		9149	2,2',3,4',5,6-Hexachlorobiphenyl (BZ-147)
		9147	2,2',3,4',5,6'-Hexachlorobiphenyl (BZ-148)
		9151	2,2',3,4',5',6-Hexachlorobiphenyl (BZ-149)
		9153	2,2',3,4,5-Pentachlorobiphenyl (BZ-86)
		8975	2,2',3,4,5'-Pentachlorobiphenyl (BZ-87)
		9155	2,2',3,4',5-Pentachlorobiphenyl (BZ-90)
		9154	2,2',3,4',5'-Pentachlorobiphenyl (BZ-97)
		9156	2,2',3,4,6,6'-Hexachlorobiphenyl (BZ-145)
		9157	2,2',3,4',6,6'-Hexachlorobiphenyl (BZ-150)
		9158	2,2',3,4,6-Pentachlorobiphenyl (BZ-88)
		9161	2,2',3,4,6'-Pentachlorobiphenyl (BZ-89)
		9160	2,2',3,4',6-Pentachlorobiphenyl (BZ-91)
		9159	2,2',3,4',6'-Pentachlorobiphenyl (BZ-98)
		9163	2,2',3,4-Tetrachlorobiphenyl (BZ-41)
		9162	2,2',3,4'-Tetrachlorobiphenyl (BZ-42)
		9035	2,2',3,5,5',6-Hexachlorobiphenyl (BZ-151)
		9164	2,2',3,5,5'-Pentachlorobiphenyl (BZ-92)
		9165	2,2',3,5,6,6'-Hexachlorobiphenyl (BZ-152)
		9168	2,2',3,5,6-Pentachlorobiphenyl (BZ-93)
		9167	2,2',3,5,6'-Pentachlorobiphenyl (BZ-94)
		9166	2,2',3,5',6-Pentachlorobiphenyl (BZ-95)
		9169	2,2',3,5-Tetrachlorobiphenyl (BZ-43)
		8945	2,2',3,5'-Tetrachlorobiphenyl (BZ-44)
		9170	2,2',3,6,6'-Pentachlorobiphenyl (BZ-96)
		9172	2,2',3,6-Tetrachlorobiphenyl (BZ-45)
		9171	2,2',3,6'-Tetrachlorobiphenyl (BZ-46)
		9173	2,2',3-Trichlorobiphenyl (BZ-16)
		9040	2,2',4,4',5,5'-Hexachlorobiphenyl (BZ-153)

Biological Tissue	EPA 1668A	9174	2,2',4,4',5,6'-Hexachlorobiphenyl (BZ-154)
		9175	2,2',4,4',5-Pentachlorobiphenyl (BZ-99)
		9176	2,2',4,4',6,6'-Hexachlorobiphenyl (BZ-155)
		9177	2,2',4,4',6-Pentachlorobiphenyl (BZ-100)
		9178	2,2',4,4'-Tetrachlorobiphenyl (BZ-47)
		8980	2,2',4,5,5'-Pentachlorobiphenyl (BZ-101)
		9180	2,2',4,5,6'-Pentachlorobiphenyl (BZ-102)
		9179	2,2',4,5',6-Pentachlorobiphenyl (BZ-103)
		9181	2,2',4,5-Tetrachlorobiphenyl (BZ-48)
		8950	2,2',4,5'-Tetrachlorobiphenyl (BZ-49)
		9182	2,2',4,6,6'-Pentachlorobiphenyl (BZ-104)
		9184	2,2',4,6-Tetrachlorobiphenyl (BZ-50)
		9183	2,2',4,6'-Tetrachlorobiphenyl (BZ-51)
		9185	2,2',4-Trichlorobiphenyl (BZ-17)
		8955	2,2',5,5'-Tetrachlorobiphenyl (BZ-52)
		9186	2,2',5,6'-Tetrachlorobiphenyl (BZ-53)
		8930	2,2',5-Trichlorobiphenyl (BZ-18)
		9187	2,2',6,6'-Tetrachlorobiphenyl (BZ-54)
		9188	2,2',6-Trichlorobiphenyl (BZ-19)
		9189	2,2'-Dichlorobiphenyl (BZ-4)
		9190	2,3,3',4,4',5,5',6-Octachlorobiphenyl (BZ-205)
		9085	2,3,3',4,4',5,5'-Heptachlorobiphenyl (BZ-189)
		9191	2,3,3',4,4',5,6-Heptachlorobiphenyl (BZ-190)
		9192	2,3,3',4,4',5',6-Heptachlorobiphenyl (BZ-191)
		9050	2,3,3',4,4',5-Hexachlorobiphenyl (BZ-156)
		9045	2,3,3',4,4',5'-Hexachlorobiphenyl (BZ-157)
		9193	2,3,3',4,4',6-Hexachlorobiphenyl (BZ-158)
		8985	2,3,3',4,4'-Pentachlorobiphenyl (BZ-105)
		9194	2,3,3',4,5,5',6-Heptachlorobiphenyl (BZ-192)
		9195	2,3,3',4',5,5',6-Heptachlorobiphenyl (BZ-193)
		9196	2,3,3',4,5,5'-Hexachlorobiphenyl (BZ-159)

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Biological Tissue	EPA 1668A	9197	2,3,3',4',5,5'-Hexachlorobiphenyl (BZ-162)
		9198	2,3,3',4,5,6-Hexachlorobiphenyl (BZ-160)
		9199	2,3,3',4',5,6-Hexachlorobiphenyl (BZ-163)
		9201	2,3,3',4',5',6-Hexachlorobiphenyl (BZ-164)
		9200	2,3,3',4,5',6-Hexachlorobiphenyl (BZ-161)
		9204	2,3,3',4,5-Pentachlorobiphenyl (BZ-106)
		9205	2,3,3',4',5-Pentachlorobiphenyl (BZ-107)
		9203	2,3,3',4,5'-Pentachlorobiphenyl (BZ-108)
		9202	2,3,3',4',5'-Pentachlorobiphenyl (BZ-122)
		9206	2,3,3',4,6-Pentachlorobiphenyl (BZ-109)
		8990	2,3,3',4',6-Pentachlorobiphenyl (BZ-110)
		9208	2,3,3',4-Tetrachlorobiphenyl (BZ-55)
		9207	2,3,3',4'-Tetrachlorobiphenyl (BZ-56)
		9209	2,3,3',5,5',6-Hexachlorobiphenyl (BZ-165)
		9210	2,3,3',5,5'-Pentachlorobiphenyl (BZ-111)
		9211	2,3,3',5,6-Pentachlorobiphenyl (BZ-112)
		9212	2,3,3',5',6-Pentachlorobiphenyl (BZ-113)
		9214	2,3,3',5-Tetrachlorobiphenyl (BZ-57)
		9213	2,3,3',5'-Tetrachlorobiphenyl (BZ-58)
		9215	2,3,3',6-Tetrachlorobiphenyl (BZ-59)
		9216	2,3,3'-Trichlorobiphenyl (BZ-20)
		9055	2,3',4,4',5,5'-Hexachlorobiphenyl (BZ-167)
		9217	2,3,4,4',5,6-Hexachlorobiphenyl (BZ-166)
		9218	2,3',4,4',5',6-Hexachlorobiphenyl (BZ-168)
		9005	2,3,4,4',5-Pentachlorobiphenyl (BZ-114)
		8995	2,3',4,4',5-Pentachlorobiphenyl (BZ-118)
		9011	2,3',4,4',5'-Pentachlorobiphenyl (BZ-123)
		9219	2,3,4,4',6-Pentachlorobiphenyl (BZ-115)

Biological Tissue	EPA 1668A	9220	2,3',4,4',6-Pentachlorobiphenyl (BZ-119)
		9221	2,3,4,4'-Tetrachlorobiphenyl (BZ-60)
		8960	2,3',4,4'-Tetrachlorobiphenyl (BZ-66)
		9223	2,3',4,5,5'-Pentachlorobiphenyl (BZ-120)
		9222	2,3',4',5,5'-Pentachlorobiphenyl (BZ-124)
		9225	2,3,4,5,6-Pentachlorobiphenyl (BZ-116)
		9227	2,3,4',5,6-Pentachlorobiphenyl (BZ-117)
		9226	2,3',4,5',6-Pentachlorobiphenyl (BZ-121)
		9224	2,3',4',5',6-Pentachlorobiphenyl (BZ-125)
		9228	2,3,4,5-Tetrachlorobiphenyl (BZ-61)
		9233	2,3,4',5-Tetrachlorobiphenyl (BZ-63)
		9231	2,3',4,5'-Tetrachlorobiphenyl (BZ-68)
		9230	2,3',4',5-Tetrachlorobiphenyl (BZ-70)
		9229	2,3',4',5'-Tetrachlorobiphenyl (BZ-76)
		9232	2,3',4,5-Tetrachlorobiphenyl (BZ-67)
		9234	2,3,4,6-Tetrachlorobiphenyl (BZ-62)
		9236	2,3,4',6-Tetrachlorobiphenyl (BZ-64)
		9235	2,3',4,6-Tetrachlorobiphenyl (BZ-69)
		9237	2,3',4',6-Tetrachlorobiphenyl (BZ-71)
		9238	2,3,4-Trichlorobiphenyl (BZ-21)
		9241	2,3,4'-Trichlorobiphenyl (BZ-22)
		9240	2,3',4-Trichlorobiphenyl (BZ-25)
		9239	2,3',4'-Trichlorobiphenyl (BZ-33)
		9242	2,3',5,5'-Tetrachlorobiphenyl (BZ-72)
		9243	2,3,5,6-Tetrachlorobiphenyl (BZ-65)
		9244	2,3',5',6-Tetrachlorobiphenyl (BZ-73)
		9245	2,3,5-Trichlorobiphenyl (BZ-23)
		8935	2,3',5-Trichlorobiphenyl (BZ-26)
		9246	2,3',5'-Trichlorobiphenyl (BZ-34)
		9247	2,3,6-Trichlorobiphenyl (BZ-24)
		9248	2,3',6-Trichlorobiphenyl (BZ-27)
		8920	2,3-Dichlorobiphenyl (BZ-5)
		9249	2,3'-Dichlorobiphenyl (BZ-6)
		9250	2,4,4',5-Tetrachlorobiphenyl (BZ-74)
		9251	2,4,4',6-Tetrachlorobiphenyl (BZ-75)
		9252	2,4,4'-Trichlorobiphenyl (BZ-28)
		9253	2,4,5-Trichlorobiphenyl (BZ-29)
		8940	2,4',5-Trichlorobiphenyl (BZ-31)
		9254	2,4,6-Trichlorobiphenyl (BZ-30)

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Biological Tissue

EPA 1668A	9255	2,4',6-Trichlorobiphenyl (BZ-32)		
	9257	2,4-Dichlorobiphenyl (BZ-7)		
	9256	2,4'-Dichlorobiphenyl (BZ-8)		
	9258	2,5-Dichlorobiphenyl (BZ-9)		
	9259	2,6-Dichlorobiphenyl (BZ-10)		
	8915	2-Chlorobiphenyl (BZ-1)		
	9060	3,3',4,4',5,5'-Hexachlorobiphenyl (BZ-169)		
	9015	3,3',4,4',5-Pentachlorobiphenyl (BZ-126)		
	8965	3,3',4,4'-Tetrachlorobiphenyl (BZ-77)		
	9260	3,3',4,5,5'-Pentachlorobiphenyl (BZ-127)		
	9262	3,3',4,5-Tetrachlorobiphenyl (BZ-78)		
	9261	3,3',4,5'-Tetrachlorobiphenyl (BZ-79)		
	9263	3,3',4-Trichlorobiphenyl (BZ-35)		
	9264	3,3',5,5'-Tetrachlorobiphenyl (BZ-80)		
	9265	3,3',5-Trichlorobiphenyl (BZ-36)		
	8925	3,3'-Dichlorobiphenyl (BZ-11)		
	8970	3,4,4',5-Tetrachlorobiphenyl (BZ-81)		
	9266	3,4,4'-Trichlorobiphenyl (BZ-37)		
	9267	3,4,5-Trichlorobiphenyl (BZ-38)		
	9268	3,4',5-Trichlorobiphenyl (BZ-39)		
	9270	3,4-Dichlorobiphenyl (BZ-12)		
	9269	3,4'-Dichlorobiphenyl (BZ-13)		
	9271	3,5-Dichlorobiphenyl (BZ-14)		
	9272	3-Chlorobiphenyl (BZ-2)		
	9273	4,4'-Dichlorobiphenyl (BZ-15)		
	9274	4-Chlorobiphenyl (BZ-3)		
	9105	Decachlorobiphenyl (BZ-209)		
	8876	Total Dichlorobiphenyls		
	8877	Total Heptachlorobiphenyls		
	8888	Total Hexachlorobiphenyls		
	8889	Total Monochlorobiphenyls		
	8891	Total Nonachlorobiphenyls		
	8892	Total Octachlorobiphenyls		
	8896	Total Pentachlorobiphenyls		
	8893	Total Tetrachlorobiphenyls		
	8894	Total Trichlorobiphenyls		
EPA 1668C			10262109	Chlorinated Biphenyl Cogeners in Water, Soil, Sediment, and Tissue by GC-HRMS
	9095	2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ-206)		
	9090	2,2',3,3',4,4',5,5'-Octachlorobiphenyl (BZ-194)		

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ORELAP Fields of Accreditation

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TestAmerica Laboratories Inc.- Knoxville

EPA CODE: TN00009

5815 Middlebrook Pike

Certificate: TNI 0189 - 001

Knoxville, TN 37921

Issue Date: 1/2/2018 Expiration Date: 1/1/2019

As of 1/2/2018 this list supersedes all previous lists for this certificate number.

Biological Tissue	EPA 1668C	9101	2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl (BZ-207)
		9103	2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ-195)
		9102	2,2',3,3',4,4',5,6'-Octachlorobiphenyl (BZ-196)
		9065	2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ-170)
		9104	2,2',3,3',4,4',6,6'-Octachlorobiphenyl (BZ-197)
		9106	2,2',3,3',4,4',6-Heptachlorobiphenyl (BZ-171)
		9020	2,2',3,3',4,4'-Hexachlorobiphenyl (BZ-128)
		9107	2,2',3,3',4,5,5',6,6'-Nonachlorobiphenyl (BZ-208)
		9109	2,2',3,3',4,5,5',6-Octachlorobiphenyl (BZ-198)
		9108	2,2',3,3',4,5,5',6'-Octachlorobiphenyl (BZ-199)
		9110	2,2',3,3',4,5,5'-Heptachlorobiphenyl (BZ-172)
		9111	2,2',3,3',4,5,6,6'-Octachlorobiphenyl (BZ-200)
		9112	2,2',3,3',4,5',6,6'-Octachlorobiphenyl (BZ-201)
		9113	2,2',3,3',4,5,6-Heptachlorobiphenyl (BZ-173)
		9116	2,2',3,3',4,5,6'-Heptachlorobiphenyl (BZ-174)
		9115	2,2',3,3',4,5',6-Heptachlorobiphenyl (BZ-175)
		9114	2,2',3,3',4,5',6'-Heptachlorobiphenyl (BZ-177)
		9118	2,2',3,3',4,5-Hexachlorobiphenyl (BZ-129)
		9117	2,2',3,3',4,5'-Hexachlorobiphenyl (BZ-130)
		9119	2,2',3,3',4,6,6'-Heptachlorobiphenyl (BZ-176)
		9121	2,2',3,3',4,6-Hexachlorobiphenyl (BZ-131)
		9120	2,2',3,3',4,6'-Hexachlorobiphenyl (BZ-132)
		9122	2,2',3,3',4-Pentachlorobiphenyl (BZ-82)
		9123	2,2',3,3',5,5',6,6'-Octachlorobiphenyl (BZ-202)
		9124	2,2',3,3',5,5',6-Heptachlorobiphenyl (BZ-178)
		9125	2,2',3,3',5,5'-Hexachlorobiphenyl (BZ-133)

Biological Tissue	EPA 1668C	9126	2,2',3,3',5,6,6'-Heptachlorobiphenyl (BZ-179)
		9128	2,2',3,3',5,6-Hexachlorobiphenyl (BZ-134)
		9127	2,2',3,3',5,6'-Hexachlorobiphenyl (BZ-135)
		9129	2,2',3,3',5-Pentachlorobiphenyl (BZ-83)
		9130	2,2',3,3',6,6'-Hexachlorobiphenyl (BZ-136)
		9131	2,2',3,3',6-Pentachlorobiphenyl (BZ-84)
		9132	2,2',3,3'-Tetrachlorobiphenyl (BZ-40)
		9133	2,2',3,4,4',5,5',6-Octachlorobiphenyl (BZ-203)
		9134	2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ-180)
		9135	2,2',3,4,4',5,6,6'-Octachlorobiphenyl (BZ-204)
		9137	2,2',3,4,4',5,6-Heptachlorobiphenyl (BZ-181)
		9136	2,2',3,4,4',5,6'-Heptachlorobiphenyl (BZ-182)
		9075	2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ-183)
		9138	2,2',3,4,4',5-Hexachlorobiphenyl (BZ-137)
		9025	2,2',3,4,4',5'-Hexachlorobiphenyl (BZ-138)
		9139	2,2',3,4,4',6,6'-Heptachlorobiphenyl (BZ-184)
		9141	2,2',3,4,4',6-Hexachlorobiphenyl (BZ-139)
		9140	2,2',3,4,4',6'-Hexachlorobiphenyl (BZ-140)
		9142	2,2',3,4,4'-Pentachlorobiphenyl (BZ-85)
		9143	2,2',3,4,5,5',6-Heptachlorobiphenyl (BZ-185)
		9080	2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ-187)
		9030	2,2',3,4,5,5'-Hexachlorobiphenyl (BZ-141)
		9144	2,2',3,4',5,5'-Hexachlorobiphenyl (BZ-146)
		9145	2,2',3,4,5,6,6'-Heptachlorobiphenyl (BZ-186)
		9146	2,2',3,4',5,6,6'-Heptachlorobiphenyl (BZ-188)
		9148	2,2',3,4,5,6-Hexachlorobiphenyl (BZ-142)
		9152	2,2',3,4,5,6'-Hexachlorobiphenyl (BZ-143)

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Biological Tissue	EPA 1668C	9150	2,2',3,4,5',6-Hexachlorobiphenyl (BZ-144)
		9149	2,2',3,4',5,6-Hexachlorobiphenyl (BZ-147)
		9147	2,2',3,4',5,6'-Hexachlorobiphenyl (BZ-148)
		9151	2,2',3,4',5',6-Hexachlorobiphenyl (BZ-149)
		9153	2,2',3,4,5-Pentachlorobiphenyl (BZ-86)
		8975	2,2',3,4,5'-Pentachlorobiphenyl (BZ-87)
		9155	2,2',3,4',5-Pentachlorobiphenyl (BZ-90)
		9154	2,2',3,4',5'-Pentachlorobiphenyl (BZ-97)
		9156	2,2',3,4,6,6'-Hexachlorobiphenyl (BZ-145)
		9157	2,2',3,4',6,6'-Hexachlorobiphenyl (BZ-150)
		9158	2,2',3,4,6-Pentachlorobiphenyl (BZ-88)
		9161	2,2',3,4,6'-Pentachlorobiphenyl (BZ-89)
		9160	2,2',3,4',6-Pentachlorobiphenyl (BZ-91)
		9159	2,2',3,4',6'-Pentachlorobiphenyl (BZ-98)
		9163	2,2',3,4-Tetrachlorobiphenyl (BZ-41)
		9162	2,2',3,4'-Tetrachlorobiphenyl (BZ-42)
		9035	2,2',3,5,5',6-Hexachlorobiphenyl (BZ-151)
		9164	2,2',3,5,5'-Pentachlorobiphenyl (BZ-92)
		9165	2,2',3,5,6,6'-Hexachlorobiphenyl (BZ-152)
		9168	2,2',3,5,6-Pentachlorobiphenyl (BZ-93)
		9167	2,2',3,5,6'-Pentachlorobiphenyl (BZ-94)
		9166	2,2',3,5',6-Pentachlorobiphenyl (BZ-95)
		9169	2,2',3,5-Tetrachlorobiphenyl (BZ-43)
		8945	2,2',3,5'-Tetrachlorobiphenyl (BZ-44)
		9170	2,2',3,6,6'-Pentachlorobiphenyl (BZ-96)
		9172	2,2',3,6-Tetrachlorobiphenyl (BZ-45)
		9171	2,2',3,6'-Tetrachlorobiphenyl (BZ-46)
		9173	2,2',3-Trichlorobiphenyl (BZ-16)
		9040	2,2',4,4',5,5'-Hexachlorobiphenyl (BZ-153)
		9174	2,2',4,4',5,6'-Hexachlorobiphenyl (BZ-154)
		9175	2,2',4,4',5-Pentachlorobiphenyl (BZ-99)
		9176	2,2',4,4',6,6'-Hexachlorobiphenyl (BZ-155)
		9177	2,2',4,4',6-Pentachlorobiphenyl (BZ-100)
		9178	2,2',4,4'-Tetrachlorobiphenyl (BZ-47)

Biological Tissue	EPA 1668C	8980	2,2',4,5,5'-Pentachlorobiphenyl (BZ-101)
		9180	2,2',4,5,6'-Pentachlorobiphenyl (BZ-102)
		9179	2,2',4,5',6-Pentachlorobiphenyl (BZ-103)
		9181	2,2',4,5-Tetrachlorobiphenyl (BZ-48)
		8950	2,2',4,5'-Tetrachlorobiphenyl (BZ-49)
		9182	2,2',4,6,6'-Pentachlorobiphenyl (BZ-104)
		9184	2,2',4,6-Tetrachlorobiphenyl (BZ-50)
		9183	2,2',4,6'-Tetrachlorobiphenyl (BZ-51)
		9185	2,2',4-Trichlorobiphenyl (BZ-17)
		8955	2,2',5,5'-Tetrachlorobiphenyl (BZ-52)
		9186	2,2',5,6'-Tetrachlorobiphenyl (BZ-53)
		8930	2,2',5-Trichlorobiphenyl (BZ-18)
		9187	2,2',6,6'-Tetrachlorobiphenyl (BZ-54)
		9188	2,2',6-Trichlorobiphenyl (BZ-19)
		9189	2,2'-Dichlorobiphenyl (BZ-4)
		9190	2,3,3',4,4',5,5',6-Octachlorobiphenyl (BZ-205)
		9085	2,3,3',4,4',5,5'-Heptachlorobiphenyl (BZ-189)
		9191	2,3,3',4,4',5,6-Heptachlorobiphenyl (BZ-190)
		9192	2,3,3',4,4',5',6-Heptachlorobiphenyl (BZ-191)
		9050	2,3,3',4,4',5-Hexachlorobiphenyl (BZ-156)
		9045	2,3,3',4,4',5'-Hexachlorobiphenyl (BZ-157)
		9193	2,3,3',4,4',6-Hexachlorobiphenyl (BZ-158)
		8985	2,3,3',4,4'-Pentachlorobiphenyl (BZ-105)
		9194	2,3,3',4,5,5',6-Heptachlorobiphenyl (BZ-192)
		9195	2,3,3',4',5,5',6-Heptachlorobiphenyl (BZ-193)
		9196	2,3,3',4,5,5'-Hexachlorobiphenyl (BZ-159)
		9197	2,3,3',4',5,5'-Hexachlorobiphenyl (BZ-162)
		9198	2,3,3',4,5,6-Hexachlorobiphenyl (BZ-160)
		9199	2,3,3',4',5,6-Hexachlorobiphenyl (BZ-163)
		9201	2,3,3',4',5',6-Hexachlorobiphenyl (BZ-164)

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Biological Tissue	EPA 1668C	9200	2,3,3',4,5',6-Hexachlorobiphenyl (BZ-161)
		9204	2,3,3',4,5-Pentachlorobiphenyl (BZ-106)
		9205	2,3,3',4',5-Pentachlorobiphenyl (BZ-107)
		9203	2,3,3',4,5'-Pentachlorobiphenyl (BZ-108)
		9202	2,3,3',4',5'-Pentachlorobiphenyl (BZ-122)
		9206	2,3,3',4,6-Pentachlorobiphenyl (BZ-109)
		8990	2,3,3',4',6-Pentachlorobiphenyl (BZ-110)
		9208	2,3,3',4-Tetrachlorobiphenyl (BZ-55)
		9207	2,3,3',4'-Tetrachlorobiphenyl (BZ-56)
		9209	2,3,3',5,5',6-Hexachlorobiphenyl (BZ-165)
		9210	2,3,3',5,5'-Pentachlorobiphenyl (BZ-111)
		9211	2,3,3',5,6-Pentachlorobiphenyl (BZ-112)
		9212	2,3,3',5',6-Pentachlorobiphenyl (BZ-113)
		9214	2,3,3',5-Tetrachlorobiphenyl (BZ-57)
		9213	2,3,3',5'-Tetrachlorobiphenyl (BZ-58)
		9215	2,3,3',6-Tetrachlorobiphenyl (BZ-59)
		9216	2,3,3'-Trichlorobiphenyl (BZ-20)
		9055	2,3',4,4',5,5'-Hexachlorobiphenyl (BZ-167)
		9217	2,3,4,4',5,6-Hexachlorobiphenyl (BZ-166)
		9218	2,3',4,4',5',6-Hexachlorobiphenyl (BZ-168)
		9005	2,3,4,4',5-Pentachlorobiphenyl (BZ-114)
		8995	2,3',4,4',5-Pentachlorobiphenyl (BZ-118)
		9011	2,3',4,4',5'-Pentachlorobiphenyl (BZ-123)
		9219	2,3,4,4',6-Pentachlorobiphenyl (BZ-115)
		9220	2,3',4,4',6-Pentachlorobiphenyl (BZ-119)
		9221	2,3,4,4'-Tetrachlorobiphenyl (BZ-60)
		8960	2,3',4,4'-Tetrachlorobiphenyl (BZ-66)
		9223	2,3',4,5,5'-Pentachlorobiphenyl (BZ-120)
		9222	2,3',4',5,5'-Pentachlorobiphenyl (BZ-124)

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Biological Tissue	EPA 1668C	9225	2,3,4,5,6-Pentachlorobiphenyl (BZ-116)
		9227	2,3,4',5,6-Pentachlorobiphenyl (BZ-117)
		9226	2,3',4,5',6-Pentachlorobiphenyl (BZ-121)
		9224	2,3',4',5',6-Pentachlorobiphenyl (BZ-125)
		9228	2,3,4,5-Tetrachlorobiphenyl (BZ-61)
		9233	2,3,4',5-Tetrachlorobiphenyl (BZ-63)
		9231	2,3',4,5'-Tetrachlorobiphenyl (BZ-68)
		9230	2,3',4',5-Tetrachlorobiphenyl (BZ-70)
		9229	2,3',4',5'-Tetrachlorobiphenyl (BZ-76)
		9232	2,3',4,5-Tetrachlorobiphenyl (BZ-67)
		9234	2,3,4,6-Tetrachlorobiphenyl (BZ-62)
		9236	2,3,4',6-Tetrachlorobiphenyl (BZ-64)
		9235	2,3',4,6-Tetrachlorobiphenyl (BZ-69)
		9237	2,3',4',6-Tetrachlorobiphenyl (BZ-71)
		9238	2,3,4-Trichlorobiphenyl (BZ-21)
		9241	2,3,4'-Trichlorobiphenyl (BZ-22)
		9240	2,3',4-Trichlorobiphenyl (BZ-25)
		9239	2,3',4'-Trichlorobiphenyl (BZ-33)
		9242	2,3',5,5'-Tetrachlorobiphenyl (BZ-72)
		9243	2,3,5,6-Tetrachlorobiphenyl (BZ-65)
		9244	2,3',5',6-Tetrachlorobiphenyl (BZ-73)
		9245	2,3,5-Trichlorobiphenyl (BZ-23)
		8935	2,3',5-Trichlorobiphenyl (BZ-26)
		9246	2,3',5'-Trichlorobiphenyl (BZ-34)
		9247	2,3,6-Trichlorobiphenyl (BZ-24)
		9248	2,3',6-Trichlorobiphenyl (BZ-27)
		8920	2,3-Dichlorobiphenyl (BZ-5)
		9249	2,3'-Dichlorobiphenyl (BZ-6)
		9250	2,4,4',5-Tetrachlorobiphenyl (BZ-74)
		9251	2,4,4',6-Tetrachlorobiphenyl (BZ-75)
		9252	2,4,4'-Trichlorobiphenyl (BZ-28)
		9253	2,4,5-Trichlorobiphenyl (BZ-29)
		8940	2,4',5-Trichlorobiphenyl (BZ-31)
		9254	2,4,6-Trichlorobiphenyl (BZ-30)
		9255	2,4',6-Trichlorobiphenyl (BZ-32)
		9257	2,4-Dichlorobiphenyl (BZ-7)
		9256	2,4'-Dichlorobiphenyl (BZ-8)
		9258	2,5-Dichlorobiphenyl (BZ-9)
		9259	2,6-Dichlorobiphenyl (BZ-10)
		8915	2-Chlorobiphenyl (BZ-1)

Biological Tissue

	EPA 1668C	9060	3,3',4,4',5,5'-Hexachlorobiphenyl (BZ-169)		
		9015	3,3',4,4',5-Pentachlorobiphenyl (BZ-126)		
		8965	3,3',4,4'-Tetrachlorobiphenyl (BZ-77)		
		9260	3,3',4,5,5'-Pentachlorobiphenyl (BZ-127)		
		9262	3,3',4,5-Tetrachlorobiphenyl (BZ-78)		
		9261	3,3',4,5'-Tetrachlorobiphenyl (BZ-79)		
		9263	3,3',4-Trichlorobiphenyl (BZ-35)		
		9264	3,3',5,5'-Tetrachlorobiphenyl (BZ-80)		
		9265	3,3',5-Trichlorobiphenyl (BZ-36)		
		8925	3,3'-Dichlorobiphenyl (BZ-11)		
		8970	3,4,4',5-Tetrachlorobiphenyl (BZ-81)		
		9266	3,4,4'-Trichlorobiphenyl (BZ-37)		
		9267	3,4,5-Trichlorobiphenyl (BZ-38)		
		9268	3,4',5-Trichlorobiphenyl (BZ-39)		
		9270	3,4-Dichlorobiphenyl (BZ-12)		
		9269	3,4'-Dichlorobiphenyl (BZ-13)		
		9271	3,5-Dichlorobiphenyl (BZ-14)		
		9272	3-Chlorobiphenyl (BZ-2)		
		9273	4,4'-Dichlorobiphenyl (BZ-15)		
		9274	4-Chlorobiphenyl (BZ-3)		
		9105	Decachlorobiphenyl (BZ-209)		
		8876	Total Dichlorobiphenyls		
		8877	Total Heptachlorobiphenyls		
		8888	Total Hexachlorobiphenyls		
		8889	Total Monochlorobiphenyls		
		8891	Total Nonachlorobiphenyls		
		8892	Total Octachlorobiphenyls		
		8896	Total Pentachlorobiphenyls		
		8893	Total Tetrachlorobiphenyls		
		8894	Total Trichlorobiphenyls		
	EPA 8290			10187209	Polychlorinated Dibenzodioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) by GC/HRMS
		9516	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)		
		9519	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)		
		9420	1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)		
		9426	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)		
		9423	1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)		

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EPA 8290	9471	1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-Hxcdf)	
	9453	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd)	
	9474	1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf)	
	9456	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,6,7,8-Hxcdd)	
	9477	1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf)	
	9459	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd)	
	9543	1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf)	
	9540	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd)	
	9480	2,3,4,6,7,8-Hexachlorodibenzofuran	
	9549	2,3,4,7,8-Pentachlorodibenzofuran	
	9618	2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD)	
	9612	2,3,7,8-Tetrachlorodibenzofuran	
	9438	Hpcdd, total	
	9444	Hpcdf, total	
	9468	Hxcdd, total	
	9483	Hxcdf, total	
	9555	Pecdd, total	
	9552	Pecdf, total	
	9609	TCDD, total	
	9615	TCDF, total	
EPA 8290A			10187403 Polychlorinated Dibenzodioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) by GC/HRMS
	9516	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	
	9519	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	
	9420	1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)	
	9426	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)	
	9423	1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)	
	9471	1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-Hxcdf)	
	9453	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd)	
	9474	1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf)	
	9456	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,6,7,8-Hxcdd)	

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Biological Tissue	EPA 8290A	9477	1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf)		
		9459	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd)		
		9543	1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf)		
		9540	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd)		
		9480	2,3,4,6,7,8-Hexachlorodibenzofuran		
		9549	2,3,4,7,8-Pentachlorodibenzofuran		
		9618	2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD)		
		9612	2,3,7,8-Tetrachlorodibenzofuran		
		9438	Hpcdd, total		
		9444	Hpcdf, total		
		9468	Hxcdd, total		
		9483	Hxcdf, total		
		9555	Pecdd, total		
		9552	Pecdf, total		
		9609	TCDD, total		
		9615	TCDF, total		
Non-Potable Water	EPA 1613B			10120602	Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope Dilution GC/HRMS
		9516	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)		
		9519	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)		
		9420	1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)		
		9426	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)		
		9423	1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)		
		9471	1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-Hxcdf)		
		9453	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd)		
		9474	1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf)		
		9456	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,6,7,8-Hxcdd)		
		9477	1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf)		
		9459	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd)		
		9543	1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf)		

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EPA 1613B	9540	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd)		
	9480	2,3,4,6,7,8-Hexachlorodibenzofuran		
	9549	2,3,4,7,8-Pentachlorodibenzofuran		
	9618	2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD)		
	9612	2,3,7,8-Tetrachlorodibenzofuran		
	9438	Hpcdd, total		
	9444	Hpcdf, total		
	9468	Hxcdd, total		
	9483	Hxcdf, total		
	9555	Pecdd, total		
	9552	Pecdf, total		
	9609	TCDD, total		
	9615	TCDF, total		
EPA 1668A			10262029	Chlorinated Biphenyl Cogeners in Water, Soil, Sediment, and Tissue by GC-HRMS
	9095	2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ-206)		
	9090	2,2',3,3',4,4',5,5'-Octachlorobiphenyl (BZ-194)		
	9101	2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl (BZ-207)		
	9103	2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ-195)		
	9102	2,2',3,3',4,4',5,6'-Octachlorobiphenyl (BZ-196)		
	9065	2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ-170)		
	9104	2,2',3,3',4,4',6,6'-Octachlorobiphenyl (BZ-197)		
	9106	2,2',3,3',4,4',6-Heptachlorobiphenyl (BZ-171)		
	9020	2,2',3,3',4,4'-Hexachlorobiphenyl (BZ-128)		
	9107	2,2',3,3',4,5,5',6,6'-Nonachlorobiphenyl (BZ-208)		
	9109	2,2',3,3',4,5,5',6-Octachlorobiphenyl (BZ-198)		
	9108	2,2',3,3',4,5,5',6'-Octachlorobiphenyl (BZ-199)		
	9110	2,2',3,3',4,5,5'-Heptachlorobiphenyl (BZ-172)		
	9111	2,2',3,3',4,5,6,6'-Octachlorobiphenyl (BZ-200)		
	9112	2,2',3,3',4,5',6,6'-Octachlorobiphenyl (BZ-201)		
	9113	2,2',3,3',4,5,6-Heptachlorobiphenyl (BZ-173)		

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EPA 1668A	9116	2,2',3,3',4,5,6'-Heptachlorobiphenyl (BZ-174)
	9115	2,2',3,3',4,5',6-Heptachlorobiphenyl (BZ-175)
	9114	2,2',3,3',4,5',6'-Heptachlorobiphenyl (BZ-177)
	9118	2,2',3,3',4,5-Hexachlorobiphenyl (BZ-129)
	9117	2,2',3,3',4,5'-Hexachlorobiphenyl (BZ-130)
	9119	2,2',3,3',4,6,6'-Heptachlorobiphenyl (BZ-176)
	9121	2,2',3,3',4,6-Hexachlorobiphenyl (BZ-131)
	9120	2,2',3,3',4,6'-Hexachlorobiphenyl (BZ-132)
	9122	2,2',3,3',4-Pentachlorobiphenyl (BZ-82)
	9123	2,2',3,3',5,5',6,6'-Octachlorobiphenyl (BZ-202)
	9124	2,2',3,3',5,5',6-Heptachlorobiphenyl (BZ-178)
	9125	2,2',3,3',5,5'-Hexachlorobiphenyl (BZ-133)
	9126	2,2',3,3',5,6,6'-Heptachlorobiphenyl (BZ-179)
	9128	2,2',3,3',5,6-Hexachlorobiphenyl (BZ-134)
	9127	2,2',3,3',5,6'-Hexachlorobiphenyl (BZ-135)
	9129	2,2',3,3',5-Pentachlorobiphenyl (BZ-83)
	9130	2,2',3,3',6,6'-Hexachlorobiphenyl (BZ-136)
	9131	2,2',3,3',6-Pentachlorobiphenyl (BZ-84)
	9132	2,2',3,3'-Tetrachlorobiphenyl (BZ-40)
	9133	2,2',3,4,4',5,5',6-Octachlorobiphenyl (BZ-203)
	9134	2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ-180)
	9135	2,2',3,4,4',5,6,6'-Octachlorobiphenyl (BZ-204)
	9137	2,2',3,4,4',5,6-Heptachlorobiphenyl (BZ-181)
	9136	2,2',3,4,4',5,6'-Heptachlorobiphenyl (BZ-182)
	9075	2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ-183)
	9138	2,2',3,4,4',5-Hexachlorobiphenyl (BZ-137)
	9025	2,2',3,4,4',5'-Hexachlorobiphenyl (BZ-138)

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EPA 1668A	9139	2,2',3,4,4',6,6'-Heptachlorobiphenyl (BZ-184)
	9141	2,2',3,4,4',6-Hexachlorobiphenyl (BZ-139)
	9140	2,2',3,4,4',6'-Hexachlorobiphenyl (BZ-140)
	9142	2,2',3,4,4'-Pentachlorobiphenyl (BZ-85)
	9143	2,2',3,4,5,5',6-Heptachlorobiphenyl (BZ-185)
	9080	2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ-187)
	9030	2,2',3,4,5,5'-Hexachlorobiphenyl (BZ-141)
	9144	2,2',3,4',5,5'-Hexachlorobiphenyl (BZ-146)
	9145	2,2',3,4,5,6,6'-Heptachlorobiphenyl (BZ-186)
	9146	2,2',3,4',5,6,6'-Heptachlorobiphenyl (BZ-188)
	9148	2,2',3,4,5,6-Hexachlorobiphenyl (BZ-142)
	9152	2,2',3,4,5,6'-Hexachlorobiphenyl (BZ-143)
	9150	2,2',3,4,5',6-Hexachlorobiphenyl (BZ-144)
	9149	2,2',3,4',5,6-Hexachlorobiphenyl (BZ-147)
	9147	2,2',3,4',5,6'-Hexachlorobiphenyl (BZ-148)
	9151	2,2',3,4',5',6-Hexachlorobiphenyl (BZ-149)
	9153	2,2',3,4,5-Pentachlorobiphenyl (BZ-86)
	8975	2,2',3,4,5'-Pentachlorobiphenyl (BZ-87)
	9155	2,2',3,4',5-Pentachlorobiphenyl (BZ-90)
	9154	2,2',3,4',5'-Pentachlorobiphenyl (BZ-97)
	9156	2,2',3,4,6,6'-Hexachlorobiphenyl (BZ-145)
	9157	2,2',3,4',6,6'-Hexachlorobiphenyl (BZ-150)
	9158	2,2',3,4,6-Pentachlorobiphenyl (BZ-88)
	9161	2,2',3,4,6'-Pentachlorobiphenyl (BZ-89)
	9160	2,2',3,4',6-Pentachlorobiphenyl (BZ-91)
	9159	2,2',3,4',6'-Pentachlorobiphenyl (BZ-98)
	9163	2,2',3,4-Tetrachlorobiphenyl (BZ-41)
	9162	2,2',3,4'-Tetrachlorobiphenyl (BZ-42)
	9035	2,2',3,5,5',6-Hexachlorobiphenyl (BZ-151)
	9164	2,2',3,5,5'-Pentachlorobiphenyl (BZ-92)

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EPA 1668A	9165	2,2',3,5,6,6'-Hexachlorobiphenyl (BZ-152)
	9168	2,2',3,5,6-Pentachlorobiphenyl (BZ-93)
	9167	2,2',3,5,6'-Pentachlorobiphenyl (BZ-94)
	9166	2,2',3,5',6-Pentachlorobiphenyl (BZ-95)
	9169	2,2',3,5-Tetrachlorobiphenyl (BZ-43)
	8945	2,2',3,5'-Tetrachlorobiphenyl (BZ-44)
	9170	2,2',3,6,6'-Pentachlorobiphenyl (BZ-96)
	9172	2,2',3,6-Tetrachlorobiphenyl (BZ-45)
	9171	2,2',3,6'-Tetrachlorobiphenyl (BZ-46)
	9173	2,2',3-Trichlorobiphenyl (BZ-16)
	9040	2,2',4,4',5,5'-Hexachlorobiphenyl (BZ-153)
	9174	2,2',4,4',5,6'-Hexachlorobiphenyl (BZ-154)
	9175	2,2',4,4',5-Pentachlorobiphenyl (BZ-99)
	9176	2,2',4,4',6,6'-Hexachlorobiphenyl (BZ-155)
	9177	2,2',4,4',6-Pentachlorobiphenyl (BZ-100)
	9178	2,2',4,4'-Tetrachlorobiphenyl (BZ-47)
	8980	2,2',4,5,5'-Pentachlorobiphenyl (BZ-101)
	9180	2,2',4,5,6'-Pentachlorobiphenyl (BZ-102)
	9179	2,2',4,5',6-Pentachlorobiphenyl (BZ-103)
	9181	2,2',4,5-Tetrachlorobiphenyl (BZ-48)
	8950	2,2',4,5'-Tetrachlorobiphenyl (BZ-49)
	9182	2,2',4,6,6'-Pentachlorobiphenyl (BZ-104)
	9184	2,2',4,6-Tetrachlorobiphenyl (BZ-50)
	9183	2,2',4,6'-Tetrachlorobiphenyl (BZ-51)
	9185	2,2',4-Trichlorobiphenyl (BZ-17)
	8955	2,2',5,5'-Tetrachlorobiphenyl (BZ-52)
	9186	2,2',5,6'-Tetrachlorobiphenyl (BZ-53)
	8930	2,2',5-Trichlorobiphenyl (BZ-18)
	9187	2,2',6,6'-Tetrachlorobiphenyl (BZ-54)
	9188	2,2',6-Trichlorobiphenyl (BZ-19)
	9189	2,2'-Dichlorobiphenyl (BZ-4)
	9190	2,3,3',4,4',5,5',6-Octachlorobiphenyl (BZ-205)
	9085	2,3,3',4,4',5,5'-Heptachlorobiphenyl (BZ-189)
	9191	2,3,3',4,4',5,6-Heptachlorobiphenyl (BZ-190)

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EPA 1668A	9192	2,3,3',4,4',5',6-Heptachlorobiphenyl (BZ-191)
	9050	2,3,3',4,4',5-Hexachlorobiphenyl (BZ-156)
	9045	2,3,3',4,4',5'-Hexachlorobiphenyl (BZ-157)
	9193	2,3,3',4,4',6-Hexachlorobiphenyl (BZ-158)
	8985	2,3,3',4,4'-Pentachlorobiphenyl (BZ-105)
	9194	2,3,3',4,5,5',6-Heptachlorobiphenyl (BZ-192)
	9195	2,3,3',4',5,5',6-Heptachlorobiphenyl (BZ-193)
	9196	2,3,3',4,5,5'-Hexachlorobiphenyl (BZ-159)
	9197	2,3,3',4',5,5'-Hexachlorobiphenyl (BZ-162)
	9198	2,3,3',4,5,6-Hexachlorobiphenyl (BZ-160)
	9199	2,3,3',4',5,6-Hexachlorobiphenyl (BZ-163)
	9201	2,3,3',4',5',6-Hexachlorobiphenyl (BZ-164)
	9200	2,3,3',4,5',6-Hexachlorobiphenyl (BZ-161)
	9204	2,3,3',4,5-Pentachlorobiphenyl (BZ-106)
	9205	2,3,3',4',5-Pentachlorobiphenyl (BZ-107)
	9203	2,3,3',4,5'-Pentachlorobiphenyl (BZ-108)
	9202	2,3,3',4',5'-Pentachlorobiphenyl (BZ-122)
	9206	2,3,3',4,6-Pentachlorobiphenyl (BZ-109)
	8990	2,3,3',4',6-Pentachlorobiphenyl (BZ-110)
	9208	2,3,3',4-Tetrachlorobiphenyl (BZ-55)
	9207	2,3,3',4'-Tetrachlorobiphenyl (BZ-56)
	9209	2,3,3',5,5',6-Hexachlorobiphenyl (BZ-165)
	9210	2,3,3',5,5'-Pentachlorobiphenyl (BZ-111)
	9211	2,3,3',5,6-Pentachlorobiphenyl (BZ-112)
	9212	2,3,3',5',6-Pentachlorobiphenyl (BZ-113)
	9214	2,3,3',5-Tetrachlorobiphenyl (BZ-57)
	9213	2,3,3',5'-Tetrachlorobiphenyl (BZ-58)

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		9216	2,3,3'-Trichlorobiphenyl (BZ-20)
		9055	2,3',4,4',5,5'-Hexachlorobiphenyl (BZ-167)
		9217	2,3,4,4',5,6-Hexachlorobiphenyl (BZ-166)
		9218	2,3',4,4',5',6-Hexachlorobiphenyl (BZ-168)
		9005	2,3,4,4',5-Pentachlorobiphenyl (BZ-114)
		8995	2,3',4,4',5-Pentachlorobiphenyl (BZ-118)
		9011	2,3',4,4',5'-Pentachlorobiphenyl (BZ-123)
		9219	2,3,4,4',6-Pentachlorobiphenyl (BZ-115)
		9220	2,3',4,4',6-Pentachlorobiphenyl (BZ-119)
		9221	2,3,4,4'-Tetrachlorobiphenyl (BZ-60)
		8960	2,3',4,4'-Tetrachlorobiphenyl (BZ-66)
		9223	2,3',4,5,5'-Pentachlorobiphenyl (BZ-120)
		9222	2,3',4',5,5'-Pentachlorobiphenyl (BZ-124)
		9225	2,3,4,5,6-Pentachlorobiphenyl (BZ-116)
		9227	2,3,4',5,6-Pentachlorobiphenyl (BZ-117)
		9226	2,3',4,5',6-Pentachlorobiphenyl (BZ-121)
		9224	2,3',4',5',6-Pentachlorobiphenyl (BZ-125)
		9228	2,3,4,5-Tetrachlorobiphenyl (BZ-61)
		9233	2,3,4',5-Tetrachlorobiphenyl (BZ-63)
		9231	2,3',4,5'-Tetrachlorobiphenyl (BZ-68)
		9230	2,3',4',5-Tetrachlorobiphenyl (BZ-70)
		9229	2,3',4',5'-Tetrachlorobiphenyl (BZ-76)
		9232	2,3',4,5-Tetrachlorobiphenyl (BZ-67)
		9234	2,3,4,6-Tetrachlorobiphenyl (BZ-62)
		9236	2,3,4',6-Tetrachlorobiphenyl (BZ-64)
		9235	2,3',4,6-Tetrachlorobiphenyl (BZ-69)
		9237	2,3',4',6-Tetrachlorobiphenyl (BZ-71)
		9238	2,3,4-Trichlorobiphenyl (BZ-21)
		9241	2,3,4'-Trichlorobiphenyl (BZ-22)
		9240	2,3',4-Trichlorobiphenyl (BZ-25)
		9239	2,3',4'-Trichlorobiphenyl (BZ-33)
		9242	2,3',5,5'-Tetrachlorobiphenyl (BZ-72)
		9243	2,3,5,6-Tetrachlorobiphenyl (BZ-65)

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EPA 1668A	9244	2,3',5',6-Tetrachlorobiphenyl (BZ-73)
	9245	2,3,5-Trichlorobiphenyl (BZ-23)
	8935	2,3',5-Trichlorobiphenyl (BZ-26)
	9246	2,3',5'-Trichlorobiphenyl (BZ-34)
	9247	2,3,6-Trichlorobiphenyl (BZ-24)
	9248	2,3',6-Trichlorobiphenyl (BZ-27)
	8920	2,3-Dichlorobiphenyl (BZ-5)
	9249	2,3'-Dichlorobiphenyl (BZ-6)
	9250	2,4,4',5-Tetrachlorobiphenyl (BZ-74)
	9251	2,4,4',6-Tetrachlorobiphenyl (BZ-75)
	9252	2,4,4'-Trichlorobiphenyl (BZ-28)
	9253	2,4,5-Trichlorobiphenyl (BZ-29)
	8940	2,4',5-Trichlorobiphenyl (BZ-31)
	9254	2,4,6-Trichlorobiphenyl (BZ-30)
	9255	2,4',6-Trichlorobiphenyl (BZ-32)
	9257	2,4-Dichlorobiphenyl (BZ-7)
	9256	2,4'-Dichlorobiphenyl (BZ-8)
	9258	2,5-Dichlorobiphenyl (BZ-9)
	9259	2,6-Dichlorobiphenyl (BZ-10)
	8915	2-Chlorobiphenyl (BZ-1)
	9060	3,3',4,4',5,5'-Hexachlorobiphenyl (BZ-169)
	9015	3,3',4,4',5-Pentachlorobiphenyl (BZ-126)
	8965	3,3',4,4'-Tetrachlorobiphenyl (BZ-77)
	9260	3,3',4,5,5'-Pentachlorobiphenyl (BZ-127)
	9262	3,3',4,5-Tetrachlorobiphenyl (BZ-78)
	9261	3,3',4,5'-Tetrachlorobiphenyl (BZ-79)
	9263	3,3',4-Trichlorobiphenyl (BZ-35)
	9264	3,3',5,5'-Tetrachlorobiphenyl (BZ-80)
	9265	3,3',5-Trichlorobiphenyl (BZ-36)
	8925	3,3'-Dichlorobiphenyl (BZ-11)
	8970	3,4,4',5-Tetrachlorobiphenyl (BZ-81)
	9266	3,4,4'-Trichlorobiphenyl (BZ-37)
	9267	3,4,5-Trichlorobiphenyl (BZ-38)
	9268	3,4',5-Trichlorobiphenyl (BZ-39)
	9270	3,4-Dichlorobiphenyl (BZ-12)
	9269	3,4'-Dichlorobiphenyl (BZ-13)
	9271	3,5-Dichlorobiphenyl (BZ-14)
	9272	3-Chlorobiphenyl (BZ-2)
	9273	4,4'-Dichlorobiphenyl (BZ-15)
	9274	4-Chlorobiphenyl (BZ-3)
	9105	Decachlorobiphenyl (BZ-209)

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Non-Potable Water

EPA 1668A	8876	Total Dichlorobiphenyls		
	8877	Total Heptachlorobiphenyls		
	8888	Total Hexachlorobiphenyls		
	8889	Total Monochlorobiphenyls		
	8891	Total Nonachlorobiphenyls		
	8892	Total Octachlorobiphenyls		
	8896	Total Pentachlorobiphenyls		
	8893	Total Tetrachlorobiphenyls		
	8894	Total Trichlorobiphenyls		
EPA 1668C			10262109	Chlorinated Biphenyl Cogeners in Water, Soil, Sediment, and Tissue by GC-HRMS
	9095	2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ-206)		
	9090	2,2',3,3',4,4',5,5'-Octachlorobiphenyl (BZ-194)		
	9101	2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl (BZ-207)		
	9103	2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ-195)		
	9102	2,2',3,3',4,4',5,6'-Octachlorobiphenyl (BZ-196)		
	9065	2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ-170)		
	9104	2,2',3,3',4,4',6,6'-Octachlorobiphenyl (BZ-197)		
	9106	2,2',3,3',4,4',6-Heptachlorobiphenyl (BZ-171)		
	9020	2,2',3,3',4,4'-Hexachlorobiphenyl (BZ-128)		
	9107	2,2',3,3',4,5,5',6,6'-Nonachlorobiphenyl (BZ-208)		
	9109	2,2',3,3',4,5,5',6-Octachlorobiphenyl (BZ-198)		
	9108	2,2',3,3',4,5,5',6'-Octachlorobiphenyl (BZ-199)		
	9110	2,2',3,3',4,5,5'-Heptachlorobiphenyl (BZ-172)		
	9111	2,2',3,3',4,5,6,6'-Octachlorobiphenyl (BZ-200)		
	9112	2,2',3,3',4,5',6,6'-Octachlorobiphenyl (BZ-201)		
	9113	2,2',3,3',4,5,6-Heptachlorobiphenyl (BZ-173)		
	9116	2,2',3,3',4,5,6'-Heptachlorobiphenyl (BZ-174)		
	9115	2,2',3,3',4,5',6-Heptachlorobiphenyl (BZ-175)		
	9114	2,2',3,3',4,5',6'-Heptachlorobiphenyl (BZ-177)		

Non-Potable Water

EPA 1668C	9118	2,2',3,3',4,5-Hexachlorobiphenyl (BZ-129)
	9117	2,2',3,3',4,5'-Hexachlorobiphenyl (BZ-130)
	9119	2,2',3,3',4,6,6'-Heptachlorobiphenyl (BZ-176)
	9121	2,2',3,3',4,6-Hexachlorobiphenyl (BZ-131)
	9120	2,2',3,3',4,6'-Hexachlorobiphenyl (BZ-132)
	9122	2,2',3,3',4-Pentachlorobiphenyl (BZ-82)
	9123	2,2',3,3',5,5',6,6'-Octachlorobiphenyl (BZ-202)
	9124	2,2',3,3',5,5',6-Heptachlorobiphenyl (BZ-178)
	9125	2,2',3,3',5,5'-Hexachlorobiphenyl (BZ-133)
	9126	2,2',3,3',5,6,6'-Heptachlorobiphenyl (BZ-179)
	9128	2,2',3,3',5,6-Hexachlorobiphenyl (BZ-134)
	9127	2,2',3,3',5,6'-Hexachlorobiphenyl (BZ-135)
	9129	2,2',3,3',5-Pentachlorobiphenyl (BZ-83)
	9130	2,2',3,3',6,6'-Hexachlorobiphenyl (BZ-136)
	9131	2,2',3,3',6-Pentachlorobiphenyl (BZ-84)
	9132	2,2',3,3'-Tetrachlorobiphenyl (BZ-40)
	9133	2,2',3,4,4',5,5',6-Octachlorobiphenyl (BZ-203)
	9134	2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ-180)
	9135	2,2',3,4,4',5,6,6'-Octachlorobiphenyl (BZ-204)
	9137	2,2',3,4,4',5,6-Heptachlorobiphenyl (BZ-181)
	9136	2,2',3,4,4',5,6'-Heptachlorobiphenyl (BZ-182)
	9075	2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ-183)
	9138	2,2',3,4,4',5-Hexachlorobiphenyl (BZ-137)
	9025	2,2',3,4,4',5'-Hexachlorobiphenyl (BZ-138)
	9139	2,2',3,4,4',6,6'-Heptachlorobiphenyl (BZ-184)
	9141	2,2',3,4,4',6-Hexachlorobiphenyl (BZ-139)
	9140	2,2',3,4,4',6'-Hexachlorobiphenyl (BZ-140)

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EPA 1668C	9142	2,2',3,4,4'-Pentachlorobiphenyl (BZ-85)
	9143	2,2',3,4,5,5',6-Heptachlorobiphenyl (BZ-185)
	9080	2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ-187)
	9030	2,2',3,4,5,5'-Hexachlorobiphenyl (BZ-141)
	9144	2,2',3,4',5,5'-Hexachlorobiphenyl (BZ-146)
	9145	2,2',3,4,5,6,6'-Heptachlorobiphenyl (BZ-186)
	9146	2,2',3,4',5,6,6'-Heptachlorobiphenyl (BZ-188)
	9148	2,2',3,4,5,6-Hexachlorobiphenyl (BZ-142)
	9152	2,2',3,4,5,6'-Hexachlorobiphenyl (BZ-143)
	9150	2,2',3,4,5',6-Hexachlorobiphenyl (BZ-144)
	9149	2,2',3,4',5,6-Hexachlorobiphenyl (BZ-147)
	9147	2,2',3,4',5,6'-Hexachlorobiphenyl (BZ-148)
	9151	2,2',3,4',5',6-Hexachlorobiphenyl (BZ-149)
	9153	2,2',3,4,5-Pentachlorobiphenyl (BZ-86)
	8975	2,2',3,4,5'-Pentachlorobiphenyl (BZ-87)
	9155	2,2',3,4',5-Pentachlorobiphenyl (BZ-90)
	9154	2,2',3,4',5'-Pentachlorobiphenyl (BZ-97)
	9156	2,2',3,4,6,6'-Hexachlorobiphenyl (BZ-145)
	9157	2,2',3,4',6,6'-Hexachlorobiphenyl (BZ-150)
	9158	2,2',3,4,6-Pentachlorobiphenyl (BZ-88)
	9161	2,2',3,4,6'-Pentachlorobiphenyl (BZ-89)
	9160	2,2',3,4',6-Pentachlorobiphenyl (BZ-91)
	9159	2,2',3,4',6'-Pentachlorobiphenyl (BZ-98)
	9163	2,2',3,4-Tetrachlorobiphenyl (BZ-41)
	9162	2,2',3,4'-Tetrachlorobiphenyl (BZ-42)
	9035	2,2',3,5,5',6-Hexachlorobiphenyl (BZ-151)
	9164	2,2',3,5,5'-Pentachlorobiphenyl (BZ-92)
	9165	2,2',3,5,6,6'-Hexachlorobiphenyl (BZ-152)
	9168	2,2',3,5,6-Pentachlorobiphenyl (BZ-93)
	9167	2,2',3,5,6'-Pentachlorobiphenyl (BZ-94)
	9166	2,2',3,5',6-Pentachlorobiphenyl (BZ-95)

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EPA 1668C	9169	2,2',3,5-Tetrachlorobiphenyl (BZ-43)
	8945	2,2',3,5'-Tetrachlorobiphenyl (BZ-44)
	9170	2,2',3,6,6'-Pentachlorobiphenyl (BZ-96)
	9172	2,2',3,6-Tetrachlorobiphenyl (BZ-45)
	9171	2,2',3,6'-Tetrachlorobiphenyl (BZ-46)
	9173	2,2',3-Trichlorobiphenyl (BZ-16)
	9040	2,2',4,4',5,5'-Hexachlorobiphenyl (BZ-153)
	9174	2,2',4,4',5,6'-Hexachlorobiphenyl (BZ-154)
	9175	2,2',4,4',5-Pentachlorobiphenyl (BZ-99)
	9176	2,2',4,4',6,6'-Hexachlorobiphenyl (BZ-155)
	9177	2,2',4,4',6-Pentachlorobiphenyl (BZ-100)
	9178	2,2',4,4'-Tetrachlorobiphenyl (BZ-47)
	8980	2,2',4,5,5'-Pentachlorobiphenyl (BZ-101)
	9180	2,2',4,5,6'-Pentachlorobiphenyl (BZ-102)
	9179	2,2',4,5',6-Pentachlorobiphenyl (BZ-103)
	9181	2,2',4,5-Tetrachlorobiphenyl (BZ-48)
	8950	2,2',4,5'-Tetrachlorobiphenyl (BZ-49)
	9182	2,2',4,6,6'-Pentachlorobiphenyl (BZ-104)
	9184	2,2',4,6-Tetrachlorobiphenyl (BZ-50)
	9183	2,2',4,6'-Tetrachlorobiphenyl (BZ-51)
	9185	2,2',4-Trichlorobiphenyl (BZ-17)
	8955	2,2',5,5'-Tetrachlorobiphenyl (BZ-52)
	9186	2,2',5,6'-Tetrachlorobiphenyl (BZ-53)
	8930	2,2',5-Trichlorobiphenyl (BZ-18)
	9187	2,2',6,6'-Tetrachlorobiphenyl (BZ-54)
	9188	2,2',6-Trichlorobiphenyl (BZ-19)
	9189	2,2'-Dichlorobiphenyl (BZ-4)
	9190	2,3,3',4,4',5,5',6-Octachlorobiphenyl (BZ-205)
	9085	2,3,3',4,4',5,5'-Heptachlorobiphenyl (BZ-189)
	9191	2,3,3',4,4',5,6-Heptachlorobiphenyl (BZ-190)
	9192	2,3,3',4,4',5',6-Heptachlorobiphenyl (BZ-191)
	9050	2,3,3',4,4',5-Hexachlorobiphenyl (BZ-156)
	9045	2,3,3',4,4',5'-Hexachlorobiphenyl (BZ-157)

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Non-Potable Water	EPA 1668C	9193	2,3,3',4,4',6-Hexachlorobiphenyl (BZ-158)
		8985	2,3,3',4,4'-Pentachlorobiphenyl (BZ-105)
		9194	2,3,3',4,5,5',6-Heptachlorobiphenyl (BZ-192)
		9195	2,3,3',4',5,5',6-Heptachlorobiphenyl (BZ-193)
		9196	2,3,3',4,5,5'-Hexachlorobiphenyl (BZ-159)
		9197	2,3,3',4',5,5'-Hexachlorobiphenyl (BZ-162)
		9198	2,3,3',4,5,6-Hexachlorobiphenyl (BZ-160)
		9199	2,3,3',4',5,6-Hexachlorobiphenyl (BZ-163)
		9201	2,3,3',4',5',6-Hexachlorobiphenyl (BZ-164)
		9200	2,3,3',4,5',6-Hexachlorobiphenyl (BZ-161)
		9204	2,3,3',4,5-Pentachlorobiphenyl (BZ-106)
		9205	2,3,3',4',5-Pentachlorobiphenyl (BZ-107)
		9203	2,3,3',4,5'-Pentachlorobiphenyl (BZ-108)
		9202	2,3,3',4',5'-Pentachlorobiphenyl (BZ-122)
		9206	2,3,3',4,6-Pentachlorobiphenyl (BZ-109)
		8990	2,3,3',4',6-Pentachlorobiphenyl (BZ-110)
		9208	2,3,3',4-Tetrachlorobiphenyl (BZ-55)
		9207	2,3,3',4'-Tetrachlorobiphenyl (BZ-56)
		9209	2,3,3',5,5',6-Hexachlorobiphenyl (BZ-165)
		9210	2,3,3',5,5'-Pentachlorobiphenyl (BZ-111)
		9211	2,3,3',5,6-Pentachlorobiphenyl (BZ-112)
		9212	2,3,3',5',6-Pentachlorobiphenyl (BZ-113)
		9214	2,3,3',5-Tetrachlorobiphenyl (BZ-57)
		9213	2,3,3',5'-Tetrachlorobiphenyl (BZ-58)
		9215	2,3,3',6-Tetrachlorobiphenyl (BZ-59)
		9216	2,3,3'-Trichlorobiphenyl (BZ-20)
		9055	2,3',4,4',5,5'-Hexachlorobiphenyl (BZ-167)
		9217	2,3,4,4',5,6-Hexachlorobiphenyl (BZ-166)

Non-Potable Water

EPA 1668C	9218	2,3',4,4',5',6-Hexachlorobiphenyl (BZ-168)
	9005	2,3,4,4',5-Pentachlorobiphenyl (BZ-114)
	8995	2,3',4,4',5-Pentachlorobiphenyl (BZ-118)
	9011	2,3',4,4',5'-Pentachlorobiphenyl (BZ-123)
	9219	2,3,4,4',6-Pentachlorobiphenyl (BZ-115)
	9220	2,3',4,4',6-Pentachlorobiphenyl (BZ-119)
	9221	2,3,4,4'-Tetrachlorobiphenyl (BZ-60)
	8960	2,3',4,4'-Tetrachlorobiphenyl (BZ-66)
	9223	2,3',4,5,5'-Pentachlorobiphenyl (BZ-120)
	9222	2,3',4',5,5'-Pentachlorobiphenyl (BZ-124)
	9225	2,3,4,5,6-Pentachlorobiphenyl (BZ-116)
	9227	2,3,4',5,6-Pentachlorobiphenyl (BZ-117)
	9226	2,3',4,5',6-Pentachlorobiphenyl (BZ-121)
	9224	2,3',4',5',6-Pentachlorobiphenyl (BZ-125)
	9228	2,3,4,5-Tetrachlorobiphenyl (BZ-61)
	9233	2,3,4',5-Tetrachlorobiphenyl (BZ-63)
	9231	2,3',4,5'-Tetrachlorobiphenyl (BZ-68)
	9230	2,3',4',5-Tetrachlorobiphenyl (BZ-70)
	9229	2,3',4',5'-Tetrachlorobiphenyl (BZ-76)
	9232	2,3',4,5-Tetrachlorobiphenyl (BZ-67)
	9234	2,3,4,6-Tetrachlorobiphenyl (BZ-62)
	9236	2,3,4',6-Tetrachlorobiphenyl (BZ-64)
	9235	2,3',4,6-Tetrachlorobiphenyl (BZ-69)
	9237	2,3',4',6-Tetrachlorobiphenyl (BZ-71)
	9238	2,3,4-Trichlorobiphenyl (BZ-21)
	9241	2,3,4'-Trichlorobiphenyl (BZ-22)
	9240	2,3',4-Trichlorobiphenyl (BZ-25)
	9239	2,3',4'-Trichlorobiphenyl (BZ-33)
	9242	2,3',5,5'-Tetrachlorobiphenyl (BZ-72)
	9243	2,3,5,6-Tetrachlorobiphenyl (BZ-65)
	9244	2,3',5',6-Tetrachlorobiphenyl (BZ-73)
	9245	2,3,5-Trichlorobiphenyl (BZ-23)
	8935	2,3',5-Trichlorobiphenyl (BZ-26)
	9246	2,3',5'-Trichlorobiphenyl (BZ-34)
	9247	2,3,6-Trichlorobiphenyl (BZ-24)

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EPA 1668C

9248	2,3',6-Trichlorobiphenyl (BZ-27)
8920	2,3-Dichlorobiphenyl (BZ-5)
9249	2,3'-Dichlorobiphenyl (BZ-6)
9250	2,4,4',5-Tetrachlorobiphenyl (BZ-74)
9251	2,4,4',6-Tetrachlorobiphenyl (BZ-75)
9252	2,4,4'-Trichlorobiphenyl (BZ-28)
9253	2,4,5-Trichlorobiphenyl (BZ-29)
8940	2,4',5-Trichlorobiphenyl (BZ-31)
9254	2,4,6-Trichlorobiphenyl (BZ-30)
9255	2,4',6-Trichlorobiphenyl (BZ-32)
9257	2,4-Dichlorobiphenyl (BZ-7)
9256	2,4'-Dichlorobiphenyl (BZ-8)
9258	2,5-Dichlorobiphenyl (BZ-9)
9259	2,6-Dichlorobiphenyl (BZ-10)
8915	2-Chlorobiphenyl (BZ-1)
9060	3,3',4,4',5,5'-Hexachlorobiphenyl (BZ-169)
9015	3,3',4,4',5-Pentachlorobiphenyl (BZ-126)
8965	3,3',4,4'-Tetrachlorobiphenyl (BZ-77)
9260	3,3',4,5,5'-Pentachlorobiphenyl (BZ-127)
9262	3,3',4,5-Tetrachlorobiphenyl (BZ-78)
9261	3,3',4,5'-Tetrachlorobiphenyl (BZ-79)
9263	3,3',4-Trichlorobiphenyl (BZ-35)
9264	3,3',5,5'-Tetrachlorobiphenyl (BZ-80)
9265	3,3',5-Trichlorobiphenyl (BZ-36)
8925	3,3'-Dichlorobiphenyl (BZ-11)
8970	3,4,4',5-Tetrachlorobiphenyl (BZ-81)
9266	3,4,4'-Trichlorobiphenyl (BZ-37)
9267	3,4,5-Trichlorobiphenyl (BZ-38)
9268	3,4',5-Trichlorobiphenyl (BZ-39)
9270	3,4-Dichlorobiphenyl (BZ-12)
9269	3,4'-Dichlorobiphenyl (BZ-13)
9271	3,5-Dichlorobiphenyl (BZ-14)
9272	3-Chlorobiphenyl (BZ-2)
9273	4,4'-Dichlorobiphenyl (BZ-15)
9274	4-Chlorobiphenyl (BZ-3)
9105	Decachlorobiphenyl (BZ-209)
8876	Total Dichlorobiphenyls
8877	Total Heptachlorobiphenyls
8888	Total Hexachlorobiphenyls
8889	Total Monochlorobiphenyls
8891	Total Nonachlorobiphenyls

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EPA 1668C	8892	Total Octachlorobiphenyls	
	8896	Total Pentachlorobiphenyls	
	8893	Total Tetrachlorobiphenyls	
	8894	Total Trichlorobiphenyls	
EPA 8290			10187209 Polychlorinated Dibenzodioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) by GC/HRMS
	9516	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	
	9519	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	
	9420	1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)	
	9426	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)	
	9423	1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)	
	9471	1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-Hxcdf)	
	9453	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd)	
	9474	1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf)	
	9456	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,6,7,8-Hxcdd)	
	9477	1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf)	
	9459	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd)	
	9543	1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf)	
	9540	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd)	
	9480	2,3,4,6,7,8-Hexachlorodibenzofuran	
	9549	2,3,4,7,8-Pentachlorodibenzofuran	
	9618	2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD)	
	9612	2,3,7,8-Tetrachlorodibenzofuran	
	9438	Hpcdd, total	
	9444	Hpcdf, total	
	9468	Hxcdd, total	
	9483	Hxcdf, total	
	9555	Pecdd, total	
	9552	Pecdf, total	
	9609	TCDD, total	
	9615	TCDF, total	

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EPA 8290A			10187403	Polychlorinated Dibenzodioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) by GC/HRMS
	9516	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)		
	9519	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)		
	9420	1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)		
	9426	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)		
	9423	1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)		
	9471	1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-Hxcdf)		
	9453	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd)		
	9474	1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf)		
	9456	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,6,7,8-Hxcdd)		
	9477	1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf)		
	9459	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd)		
	9543	1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf)		
	9540	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd)		
	9480	2,3,4,6,7,8-Hexachlorodibenzofuran		
	9549	2,3,4,7,8-Pentachlorodibenzofuran		
	9618	2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD)		
	9612	2,3,7,8-Tetrachlorodibenzofuran		
	9438	Hpcdd, total		
	9444	Hpcdf, total		
	9468	Hxcdd, total		
	9483	Hxcdf, total		
	9555	Pecdd, total		
	9552	Pecdf, total		
	9609	TCDD, total		
	9615	TCDF, total		

Solids

EPA 1613B			10120602	Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope Dilution GC/HRMS
	9516	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)		

Solids

	EPA 1613B	9519	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)		
		9420	1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)		
		9426	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)		
		9423	1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)		
		9471	1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-Hxcdf)		
		9453	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd)		
		9474	1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf)		
		9456	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,6,7,8-Hxcdd)		
		9477	1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf)		
		9459	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd)		
		9543	1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf)		
		9540	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd)		
		9480	2,3,4,6,7,8-Hexachlorodibenzofuran		
		9549	2,3,4,7,8-Pentachlorodibenzofuran		
		9618	2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD)		
		9612	2,3,7,8-Tetrachlorodibenzofuran		
		9438	Hpcdd, total		
		9444	Hpcdf, total		
		9468	Hxcdd, total		
		9483	Hxcdf, total		
		9555	Pecdd, total		
		9552	Pecdf, total		
		9609	TCDD, total		
		9615	TCDF, total		
	EPA 1668A			10262029	Chlorinated Biphenyl Cogeners in Water, Soil, Sediment, and Tissue by GC-HRMS
		9095	2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ-206)		
		9090	2,2',3,3',4,4',5,5'-Octachlorobiphenyl (BZ-194)		
		9101	2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl (BZ-207)		
		9103	2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ-195)		
		9102	2,2',3,3',4,4',5,6'-Octachlorobiphenyl (BZ-196)		

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Solids	EPA 1668A	9065	2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ-170)
		9104	2,2',3,3',4,4',6,6'-Octachlorobiphenyl (BZ-197)
		9106	2,2',3,3',4,4',6-Heptachlorobiphenyl (BZ-171)
		9020	2,2',3,3',4,4'-Hexachlorobiphenyl (BZ-128)
		9107	2,2',3,3',4,5,5',6,6'-Nonachlorobiphenyl (BZ-208)
		9109	2,2',3,3',4,5,5',6-Octachlorobiphenyl (BZ-198)
		9108	2,2',3,3',4,5,5',6'-Octachlorobiphenyl (BZ-199)
		9110	2,2',3,3',4,5,5'-Heptachlorobiphenyl (BZ-172)
		9111	2,2',3,3',4,5,6,6'-Octachlorobiphenyl (BZ-200)
		9112	2,2',3,3',4,5',6,6'-Octachlorobiphenyl (BZ-201)
		9113	2,2',3,3',4,5,6-Heptachlorobiphenyl (BZ-173)
		9116	2,2',3,3',4,5,6'-Heptachlorobiphenyl (BZ-174)
		9115	2,2',3,3',4,5',6-Heptachlorobiphenyl (BZ-175)
		9114	2,2',3,3',4,5',6'-Heptachlorobiphenyl (BZ-177)
		9118	2,2',3,3',4,5-Hexachlorobiphenyl (BZ-129)
		9117	2,2',3,3',4,5'-Hexachlorobiphenyl (BZ-130)
		9119	2,2',3,3',4,6,6'-Heptachlorobiphenyl (BZ-176)
		9121	2,2',3,3',4,6-Hexachlorobiphenyl (BZ-131)
		9120	2,2',3,3',4,6'-Hexachlorobiphenyl (BZ-132)
		9122	2,2',3,3',4-Pentachlorobiphenyl (BZ-82)
		9123	2,2',3,3',5,5',6,6'-Octachlorobiphenyl (BZ-202)
		9124	2,2',3,3',5,5',6-Heptachlorobiphenyl (BZ-178)
		9125	2,2',3,3',5,5'-Hexachlorobiphenyl (BZ-133)
		9126	2,2',3,3',5,6,6'-Heptachlorobiphenyl (BZ-179)
		9128	2,2',3,3',5,6-Hexachlorobiphenyl (BZ-134)
		9127	2,2',3,3',5,6'-Hexachlorobiphenyl (BZ-135)

Solids	EPA 1668A	9129	2,2',3,3',5-Pentachlorobiphenyl (BZ-83)
		9130	2,2',3,3',6,6'-Hexachlorobiphenyl (BZ-136)
		9131	2,2',3,3',6-Pentachlorobiphenyl (BZ-84)
		9132	2,2',3,3'-Tetrachlorobiphenyl (BZ-40)
		9133	2,2',3,4,4',5,5',6-Octachlorobiphenyl (BZ-203)
		9134	2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ-180)
		9135	2,2',3,4,4',5,6,6'-Octachlorobiphenyl (BZ-204)
		9137	2,2',3,4,4',5,6-Heptachlorobiphenyl (BZ-181)
		9136	2,2',3,4,4',5,6'-Heptachlorobiphenyl (BZ-182)
		9075	2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ-183)
		9138	2,2',3,4,4',5-Hexachlorobiphenyl (BZ-137)
		9025	2,2',3,4,4',5'-Hexachlorobiphenyl (BZ-138)
		9139	2,2',3,4,4',6,6'-Heptachlorobiphenyl (BZ-184)
		9141	2,2',3,4,4',6-Hexachlorobiphenyl (BZ-139)
		9140	2,2',3,4,4',6'-Hexachlorobiphenyl (BZ-140)
		9142	2,2',3,4,4'-Pentachlorobiphenyl (BZ-85)
		9143	2,2',3,4,5,5',6-Heptachlorobiphenyl (BZ-185)
		9080	2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ-187)
		9030	2,2',3,4,5,5'-Hexachlorobiphenyl (BZ-141)
		9144	2,2',3,4',5,5'-Hexachlorobiphenyl (BZ-146)
		9145	2,2',3,4,5,6,6'-Heptachlorobiphenyl (BZ-186)
		9146	2,2',3,4',5,6,6'-Heptachlorobiphenyl (BZ-188)
		9148	2,2',3,4,5,6-Hexachlorobiphenyl (BZ-142)
		9152	2,2',3,4,5,6'-Hexachlorobiphenyl (BZ-143)
		9150	2,2',3,4,5',6-Hexachlorobiphenyl (BZ-144)
		9149	2,2',3,4',5,6-Hexachlorobiphenyl (BZ-147)
		9147	2,2',3,4',5,6'-Hexachlorobiphenyl (BZ-148)

Solids	EPA 1668A	9151	2,2',3,4',5',6-Hexachlorobiphenyl (BZ-149)
		9153	2,2',3,4,5-Pentachlorobiphenyl (BZ-86)
		8975	2,2',3,4,5'-Pentachlorobiphenyl (BZ-87)
		9155	2,2',3,4',5-Pentachlorobiphenyl (BZ-90)
		9154	2,2',3,4',5'-Pentachlorobiphenyl (BZ-97)
		9156	2,2',3,4,6,6'-Hexachlorobiphenyl (BZ-145)
		9157	2,2',3,4',6,6'-Hexachlorobiphenyl (BZ-150)
		9158	2,2',3,4,6-Pentachlorobiphenyl (BZ-88)
		9161	2,2',3,4,6'-Pentachlorobiphenyl (BZ-89)
		9160	2,2',3,4',6-Pentachlorobiphenyl (BZ-91)
		9159	2,2',3,4',6'-Pentachlorobiphenyl (BZ-98)
		9163	2,2',3,4-Tetrachlorobiphenyl (BZ-41)
		9162	2,2',3,4'-Tetrachlorobiphenyl (BZ-42)
		9035	2,2',3,5,5',6-Hexachlorobiphenyl (BZ-151)
		9164	2,2',3,5,5'-Pentachlorobiphenyl (BZ-92)
		9165	2,2',3,5,6,6'-Hexachlorobiphenyl (BZ-152)
		9168	2,2',3,5,6-Pentachlorobiphenyl (BZ-93)
		9167	2,2',3,5,6'-Pentachlorobiphenyl (BZ-94)
		9166	2,2',3,5',6-Pentachlorobiphenyl (BZ-95)
		9169	2,2',3,5-Tetrachlorobiphenyl (BZ-43)
		8945	2,2',3,5'-Tetrachlorobiphenyl (BZ-44)
		9170	2,2',3,6,6'-Pentachlorobiphenyl (BZ-96)
		9172	2,2',3,6-Tetrachlorobiphenyl (BZ-45)
		9171	2,2',3,6'-Tetrachlorobiphenyl (BZ-46)
		9173	2,2',3-Trichlorobiphenyl (BZ-16)
		9040	2,2',4,4',5,5'-Hexachlorobiphenyl (BZ-153)
		9174	2,2',4,4',5,6'-Hexachlorobiphenyl (BZ-154)
		9175	2,2',4,4',5-Pentachlorobiphenyl (BZ-99)
		9176	2,2',4,4',6,6'-Hexachlorobiphenyl (BZ-155)
		9177	2,2',4,4',6-Pentachlorobiphenyl (BZ-100)
		9178	2,2',4,4'-Tetrachlorobiphenyl (BZ-47)
		8980	2,2',4,5,5'-Pentachlorobiphenyl (BZ-101)
		9180	2,2',4,5,6'-Pentachlorobiphenyl (BZ-102)
		9179	2,2',4,5',6-Pentachlorobiphenyl (BZ-103)

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Solids	EPA 1668A	9181	2,2',4,5-Tetrachlorobiphenyl (BZ-48)
		8950	2,2',4,5'-Tetrachlorobiphenyl (BZ-49)
		9182	2,2',4,6,6'-Pentachlorobiphenyl (BZ-104)
		9184	2,2',4,6-Tetrachlorobiphenyl (BZ-50)
		9183	2,2',4,6'-Tetrachlorobiphenyl (BZ-51)
		9185	2,2',4-Trichlorobiphenyl (BZ-17)
		8955	2,2',5,5'-Tetrachlorobiphenyl (BZ-52)
		9186	2,2',5,6'-Tetrachlorobiphenyl (BZ-53)
		8930	2,2',5-Trichlorobiphenyl (BZ-18)
		9187	2,2',6,6'-Tetrachlorobiphenyl (BZ-54)
		9188	2,2',6-Trichlorobiphenyl (BZ-19)
		9189	2,2'-Dichlorobiphenyl (BZ-4)
		9190	2,3,3',4,4',5,5',6-Octachlorobiphenyl (BZ-205)
		9085	2,3,3',4,4',5,5'-Heptachlorobiphenyl (BZ-189)
		9191	2,3,3',4,4',5,6-Heptachlorobiphenyl (BZ-190)
		9192	2,3,3',4,4',5',6-Heptachlorobiphenyl (BZ-191)
		9050	2,3,3',4,4',5-Hexachlorobiphenyl (BZ-156)
		9045	2,3,3',4,4',5'-Hexachlorobiphenyl (BZ-157)
		9193	2,3,3',4,4',6-Hexachlorobiphenyl (BZ-158)
		8985	2,3,3',4,4'-Pentachlorobiphenyl (BZ-105)
		9194	2,3,3',4,5,5',6-Heptachlorobiphenyl (BZ-192)
		9195	2,3,3',4',5,5',6-Heptachlorobiphenyl (BZ-193)
		9196	2,3,3',4,5,5'-Hexachlorobiphenyl (BZ-159)
		9197	2,3,3',4',5,5'-Hexachlorobiphenyl (BZ-162)
		9198	2,3,3',4,5,6-Hexachlorobiphenyl (BZ-160)
		9199	2,3,3',4',5,6-Hexachlorobiphenyl (BZ-163)
		9201	2,3,3',4',5',6-Hexachlorobiphenyl (BZ-164)
		9200	2,3,3',4,5',6-Hexachlorobiphenyl (BZ-161)
		9204	2,3,3',4,5-Pentachlorobiphenyl (BZ-106)
		9205	2,3,3',4',5-Pentachlorobiphenyl (BZ-107)

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Solids	EPA 1668A	9203	2,3,3',4,5'-Pentachlorobiphenyl (BZ-108)
		9202	2,3,3',4',5'-Pentachlorobiphenyl (BZ-122)
		9206	2,3,3',4,6-Pentachlorobiphenyl (BZ-109)
		8990	2,3,3',4',6-Pentachlorobiphenyl (BZ-110)
		9208	2,3,3',4-Tetrachlorobiphenyl (BZ-55)
		9207	2,3,3',4'-Tetrachlorobiphenyl (BZ-56)
		9209	2,3,3',5,5',6-Hexachlorobiphenyl (BZ-165)
		9210	2,3,3',5,5'-Pentachlorobiphenyl (BZ-111)
		9211	2,3,3',5,6-Pentachlorobiphenyl (BZ-112)
		9212	2,3,3',5',6-Pentachlorobiphenyl (BZ-113)
		9214	2,3,3',5-Tetrachlorobiphenyl (BZ-57)
		9213	2,3,3',5'-Tetrachlorobiphenyl (BZ-58)
		9215	2,3,3',6-Tetrachlorobiphenyl (BZ-59)
		9216	2,3,3'-Trichlorobiphenyl (BZ-20)
		9055	2,3',4,4',5,5'-Hexachlorobiphenyl (BZ-167)
		9217	2,3,4,4',5,6-Hexachlorobiphenyl (BZ-166)
		9218	2,3',4,4',5',6-Hexachlorobiphenyl (BZ-168)
		9005	2,3,4,4',5-Pentachlorobiphenyl (BZ-114)
		8995	2,3',4,4',5-Pentachlorobiphenyl (BZ-118)
		9011	2,3',4,4',5'-Pentachlorobiphenyl (BZ-123)
		9219	2,3,4,4',6-Pentachlorobiphenyl (BZ-115)
		9220	2,3',4,4',6-Pentachlorobiphenyl (BZ-119)
		9221	2,3,4,4'-Tetrachlorobiphenyl (BZ-60)
		8960	2,3',4,4'-Tetrachlorobiphenyl (BZ-66)
		9223	2,3',4,5,5'-Pentachlorobiphenyl (BZ-120)
		9222	2,3',4',5,5'-Pentachlorobiphenyl (BZ-124)
		9225	2,3,4,5,6-Pentachlorobiphenyl (BZ-116)
		9227	2,3,4',5,6-Pentachlorobiphenyl (BZ-117)
		9226	2,3',4,5',6-Pentachlorobiphenyl (BZ-121)

Solids	EPA 1668A	9224	2,3',4',5',6-Pentachlorobiphenyl (BZ-125)
		9228	2,3,4,5-Tetrachlorobiphenyl (BZ-61)
		9233	2,3,4',5-Tetrachlorobiphenyl (BZ-63)
		9231	2,3',4,5'-Tetrachlorobiphenyl (BZ-68)
		9230	2,3',4',5-Tetrachlorobiphenyl (BZ-70)
		9229	2,3',4',5'-Tetrachlorobiphenyl (BZ-76)
		9232	2,3',4,5-Tetrachlorobiphenyl (BZ-67)
		9234	2,3,4,6-Tetrachlorobiphenyl (BZ-62)
		9236	2,3,4',6-Tetrachlorobiphenyl (BZ-64)
		9235	2,3',4,6-Tetrachlorobiphenyl (BZ-69)
		9237	2,3',4',6-Tetrachlorobiphenyl (BZ-71)
		9238	2,3,4-Trichlorobiphenyl (BZ-21)
		9241	2,3,4'-Trichlorobiphenyl (BZ-22)
		9240	2,3',4-Trichlorobiphenyl (BZ-25)
		9239	2,3',4'-Trichlorobiphenyl (BZ-33)
		9242	2,3',5,5'-Tetrachlorobiphenyl (BZ-72)
		9243	2,3,5,6-Tetrachlorobiphenyl (BZ-65)
		9244	2,3',5',6-Tetrachlorobiphenyl (BZ-73)
		9245	2,3,5-Trichlorobiphenyl (BZ-23)
		8935	2,3',5-Trichlorobiphenyl (BZ-26)
		9246	2,3',5'-Trichlorobiphenyl (BZ-34)
		9247	2,3,6-Trichlorobiphenyl (BZ-24)
		9248	2,3',6-Trichlorobiphenyl (BZ-27)
		8920	2,3-Dichlorobiphenyl (BZ-5)
		9249	2,3'-Dichlorobiphenyl (BZ-6)
		9250	2,4,4',5-Tetrachlorobiphenyl (BZ-74)
		9251	2,4,4',6-Tetrachlorobiphenyl (BZ-75)
		9252	2,4,4'-Trichlorobiphenyl (BZ-28)
		9253	2,4,5-Trichlorobiphenyl (BZ-29)
		8940	2,4',5-Trichlorobiphenyl (BZ-31)
		9254	2,4,6-Trichlorobiphenyl (BZ-30)
		9255	2,4',6-Trichlorobiphenyl (BZ-32)
		9257	2,4-Dichlorobiphenyl (BZ-7)
		9256	2,4'-Dichlorobiphenyl (BZ-8)
		9258	2,5-Dichlorobiphenyl (BZ-9)
		9259	2,6-Dichlorobiphenyl (BZ-10)
		8915	2-Chlorobiphenyl (BZ-1)
		9060	3,3',4,4',5,5'-Hexachlorobiphenyl (BZ-169)
		9015	3,3',4,4',5-Pentachlorobiphenyl (BZ-126)
		8965	3,3',4,4'-Tetrachlorobiphenyl (BZ-77)
		9260	3,3',4,5,5'-Pentachlorobiphenyl (BZ-127)

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EPA 1668A	9262	3,3',4,5-Tetrachlorobiphenyl (BZ-78)	
	9261	3,3',4,5'-Tetrachlorobiphenyl (BZ-79)	
	9263	3,3',4-Trichlorobiphenyl (BZ-35)	
	9264	3,3',5,5'-Tetrachlorobiphenyl (BZ-80)	
	9265	3,3',5-Trichlorobiphenyl (BZ-36)	
	8925	3,3'-Dichlorobiphenyl (BZ-11)	
	8970	3,4,4',5-Tetrachlorobiphenyl (BZ-81)	
	9266	3,4,4'-Trichlorobiphenyl (BZ-37)	
	9267	3,4,5-Trichlorobiphenyl (BZ-38)	
	9268	3,4',5-Trichlorobiphenyl (BZ-39)	
	9270	3,4-Dichlorobiphenyl (BZ-12)	
	9269	3,4'-Dichlorobiphenyl (BZ-13)	
	9271	3,5-Dichlorobiphenyl (BZ-14)	
	9272	3-Chlorobiphenyl (BZ-2)	
	9273	4,4'-Dichlorobiphenyl (BZ-15)	
	9274	4-Chlorobiphenyl (BZ-3)	
	9105	Decachlorobiphenyl (BZ-209)	
	8876	Total Dichlorobiphenyls	
	8877	Total Heptachlorobiphenyls	
	8888	Total Hexachlorobiphenyls	
	8889	Total Monochlorobiphenyls	
	8891	Total Nonachlorobiphenyls	
	8892	Total Octachlorobiphenyls	
	8896	Total Pentachlorobiphenyls	
	8893	Total Tetrachlorobiphenyls	
	8894	Total Trichlorobiphenyls	
EPA 1668C			10262109 Chlorinated Biphenyl Cogeners in Water, Soil, Sediment, and Tissue by GC-HRMS
	9095	2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ-206)	
	9090	2,2',3,3',4,4',5,5'-Octachlorobiphenyl (BZ-194)	
	9101	2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl (BZ-207)	
	9103	2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ-195)	
	9102	2,2',3,3',4,4',5,6'-Octachlorobiphenyl (BZ-196)	
	9065	2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ-170)	
	9104	2,2',3,3',4,4',6,6'-Octachlorobiphenyl (BZ-197)	
	9106	2,2',3,3',4,4',6-Heptachlorobiphenyl (BZ-171)	
	9020	2,2',3,3',4,4'-Hexachlorobiphenyl (BZ-128)	

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Solids	EPA 1668C	9107	2,2',3,3',4,5,5',6,6'-Nonachlorobiphenyl (BZ-208)
		9109	2,2',3,3',4,5,5',6-Octachlorobiphenyl (BZ-198)
		9108	2,2',3,3',4,5,5',6'-Octachlorobiphenyl (BZ-199)
		9110	2,2',3,3',4,5,5'-Heptachlorobiphenyl (BZ-172)
		9111	2,2',3,3',4,5,6,6'-Octachlorobiphenyl (BZ-200)
		9112	2,2',3,3',4,5',6,6'-Octachlorobiphenyl (BZ-201)
		9113	2,2',3,3',4,5,6-Heptachlorobiphenyl (BZ-173)
		9116	2,2',3,3',4,5,6'-Heptachlorobiphenyl (BZ-174)
		9115	2,2',3,3',4,5',6-Heptachlorobiphenyl (BZ-175)
		9114	2,2',3,3',4,5',6'-Heptachlorobiphenyl (BZ-177)
		9118	2,2',3,3',4,5-Hexachlorobiphenyl (BZ-129)
		9117	2,2',3,3',4,5'-Hexachlorobiphenyl (BZ-130)
		9119	2,2',3,3',4,6,6'-Heptachlorobiphenyl (BZ-176)
		9121	2,2',3,3',4,6-Hexachlorobiphenyl (BZ-131)
		9120	2,2',3,3',4,6'-Hexachlorobiphenyl (BZ-132)
		9122	2,2',3,3',4-Pentachlorobiphenyl (BZ-82)
		9123	2,2',3,3',5,5',6,6'-Octachlorobiphenyl (BZ-202)
		9124	2,2',3,3',5,5',6-Heptachlorobiphenyl (BZ-178)
		9125	2,2',3,3',5,5'-Hexachlorobiphenyl (BZ-133)
		9126	2,2',3,3',5,6,6'-Heptachlorobiphenyl (BZ-179)
		9128	2,2',3,3',5,6-Hexachlorobiphenyl (BZ-134)
		9127	2,2',3,3',5,6'-Hexachlorobiphenyl (BZ-135)
		9129	2,2',3,3',5-Pentachlorobiphenyl (BZ-83)
		9130	2,2',3,3',6,6'-Hexachlorobiphenyl (BZ-136)
		9131	2,2',3,3',6-Pentachlorobiphenyl (BZ-84)
		9132	2,2',3,3'-Tetrachlorobiphenyl (BZ-40)
		9133	2,2',3,4,4',5,5',6-Octachlorobiphenyl (BZ-203)

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Solids	EPA 1668C	9134	2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ-180)
		9135	2,2',3,4,4',5,6,6'-Octachlorobiphenyl (BZ-204)
		9137	2,2',3,4,4',5,6-Heptachlorobiphenyl (BZ-181)
		9136	2,2',3,4,4',5,6'-Heptachlorobiphenyl (BZ-182)
		9075	2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ-183)
		9138	2,2',3,4,4',5-Hexachlorobiphenyl (BZ-137)
		9025	2,2',3,4,4',5'-Hexachlorobiphenyl (BZ-138)
		9139	2,2',3,4,4',6,6'-Heptachlorobiphenyl (BZ-184)
		9141	2,2',3,4,4',6-Hexachlorobiphenyl (BZ-139)
		9140	2,2',3,4,4',6'-Hexachlorobiphenyl (BZ-140)
		9142	2,2',3,4,4'-Pentachlorobiphenyl (BZ-85)
		9143	2,2',3,4,5,5',6-Heptachlorobiphenyl (BZ-185)
		9080	2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ-187)
		9030	2,2',3,4,5,5'-Hexachlorobiphenyl (BZ-141)
		9144	2,2',3,4',5,5'-Hexachlorobiphenyl (BZ-146)
		9145	2,2',3,4,5,6,6'-Heptachlorobiphenyl (BZ-186)
		9146	2,2',3,4',5,6,6'-Heptachlorobiphenyl (BZ-188)
		9148	2,2',3,4,5,6-Hexachlorobiphenyl (BZ-142)
		9152	2,2',3,4,5,6'-Hexachlorobiphenyl (BZ-143)
		9150	2,2',3,4,5',6-Hexachlorobiphenyl (BZ-144)
		9149	2,2',3,4',5,6-Hexachlorobiphenyl (BZ-147)
		9147	2,2',3,4',5,6'-Hexachlorobiphenyl (BZ-148)
		9151	2,2',3,4',5',6-Hexachlorobiphenyl (BZ-149)
		9153	2,2',3,4,5-Pentachlorobiphenyl (BZ-86)
		8975	2,2',3,4,5'-Pentachlorobiphenyl (BZ-87)
		9155	2,2',3,4',5-Pentachlorobiphenyl (BZ-90)
		9154	2,2',3,4',5'-Pentachlorobiphenyl (BZ-97)

Solids	EPA 1668C	9156	2,2',3,4,6,6'-Hexachlorobiphenyl (BZ-145)
		9157	2,2',3,4',6,6'-Hexachlorobiphenyl (BZ-150)
		9158	2,2',3,4,6-Pentachlorobiphenyl (BZ-88)
		9161	2,2',3,4,6'-Pentachlorobiphenyl (BZ-89)
		9160	2,2',3,4',6-Pentachlorobiphenyl (BZ-91)
		9159	2,2',3,4',6'-Pentachlorobiphenyl (BZ-98)
		9163	2,2',3,4-Tetrachlorobiphenyl (BZ-41)
		9162	2,2',3,4'-Tetrachlorobiphenyl (BZ-42)
		9035	2,2',3,5,5',6-Hexachlorobiphenyl (BZ-151)
		9164	2,2',3,5,5'-Pentachlorobiphenyl (BZ-92)
		9165	2,2',3,5,6,6'-Hexachlorobiphenyl (BZ-152)
		9168	2,2',3,5,6-Pentachlorobiphenyl (BZ-93)
		9167	2,2',3,5,6'-Pentachlorobiphenyl (BZ-94)
		9166	2,2',3,5',6-Pentachlorobiphenyl (BZ-95)
		9169	2,2',3,5-Tetrachlorobiphenyl (BZ-43)
		8945	2,2',3,5'-Tetrachlorobiphenyl (BZ-44)
		9170	2,2',3,6,6'-Pentachlorobiphenyl (BZ-96)
		9172	2,2',3,6-Tetrachlorobiphenyl (BZ-45)
		9171	2,2',3,6'-Tetrachlorobiphenyl (BZ-46)
		9173	2,2',3-Trichlorobiphenyl (BZ-16)
		9040	2,2',4,4',5,5'-Hexachlorobiphenyl (BZ-153)
		9174	2,2',4,4',5,6'-Hexachlorobiphenyl (BZ-154)
		9175	2,2',4,4',5-Pentachlorobiphenyl (BZ-99)
		9176	2,2',4,4',6,6'-Hexachlorobiphenyl (BZ-155)
		9177	2,2',4,4',6-Pentachlorobiphenyl (BZ-100)
		9178	2,2',4,4'-Tetrachlorobiphenyl (BZ-47)
		8980	2,2',4,5,5'-Pentachlorobiphenyl (BZ-101)
		9180	2,2',4,5,6'-Pentachlorobiphenyl (BZ-102)
		9179	2,2',4,5',6-Pentachlorobiphenyl (BZ-103)
		9181	2,2',4,5-Tetrachlorobiphenyl (BZ-48)
		8950	2,2',4,5'-Tetrachlorobiphenyl (BZ-49)
		9182	2,2',4,6,6'-Pentachlorobiphenyl (BZ-104)
		9184	2,2',4,6-Tetrachlorobiphenyl (BZ-50)
		9183	2,2',4,6'-Tetrachlorobiphenyl (BZ-51)

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EPA 1668C	9185	2,2',4-Trichlorobiphenyl (BZ-17)
	8955	2,2',5,5'-Tetrachlorobiphenyl (BZ-52)
	9186	2,2',5,6'-Tetrachlorobiphenyl (BZ-53)
	8930	2,2',5-Trichlorobiphenyl (BZ-18)
	9187	2,2',6,6'-Tetrachlorobiphenyl (BZ-54)
	9188	2,2',6-Trichlorobiphenyl (BZ-19)
	9189	2,2'-Dichlorobiphenyl (BZ-4)
	9190	2,3,3',4,4',5,5',6-Octachlorobiphenyl (BZ-205)
	9085	2,3,3',4,4',5,5'-Heptachlorobiphenyl (BZ-189)
	9191	2,3,3',4,4',5,6-Heptachlorobiphenyl (BZ-190)
	9192	2,3,3',4,4',5',6-Heptachlorobiphenyl (BZ-191)
	9050	2,3,3',4,4',5-Hexachlorobiphenyl (BZ-156)
	9045	2,3,3',4,4',5'-Hexachlorobiphenyl (BZ-157)
	9193	2,3,3',4,4',6-Hexachlorobiphenyl (BZ-158)
	8985	2,3,3',4,4'-Pentachlorobiphenyl (BZ-105)
	9194	2,3,3',4,5,5',6-Heptachlorobiphenyl (BZ-192)
	9195	2,3,3',4',5,5',6-Heptachlorobiphenyl (BZ-193)
	9196	2,3,3',4,5,5'-Hexachlorobiphenyl (BZ-159)
	9197	2,3,3',4',5,5'-Hexachlorobiphenyl (BZ-162)
	9198	2,3,3',4,5,6-Hexachlorobiphenyl (BZ-160)
	9199	2,3,3',4',5,6-Hexachlorobiphenyl (BZ-163)
	9201	2,3,3',4',5',6-Hexachlorobiphenyl (BZ-164)
	9200	2,3,3',4,5',6-Hexachlorobiphenyl (BZ-161)
	9204	2,3,3',4,5-Pentachlorobiphenyl (BZ-106)
	9205	2,3,3',4',5-Pentachlorobiphenyl (BZ-107)
	9203	2,3,3',4,5'-Pentachlorobiphenyl (BZ-108)
	9202	2,3,3',4',5'-Pentachlorobiphenyl (BZ-122)
	9206	2,3,3',4,6-Pentachlorobiphenyl (BZ-109)

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Solids	EPA 1668C	8990	2,3,3',4',6-Pentachlorobiphenyl (BZ-110)
		9208	2,3,3',4-Tetrachlorobiphenyl (BZ-55)
		9207	2,3,3',4'-Tetrachlorobiphenyl (BZ-56)
		9209	2,3,3',5,5',6-Hexachlorobiphenyl (BZ-165)
		9210	2,3,3',5,5'-Pentachlorobiphenyl (BZ-111)
		9211	2,3,3',5,6-Pentachlorobiphenyl (BZ-112)
		9212	2,3,3',5',6-Pentachlorobiphenyl (BZ-113)
		9214	2,3,3',5-Tetrachlorobiphenyl (BZ-57)
		9213	2,3,3',5'-Tetrachlorobiphenyl (BZ-58)
		9215	2,3,3',6-Tetrachlorobiphenyl (BZ-59)
		9216	2,3,3'-Trichlorobiphenyl (BZ-20)
		9055	2,3',4,4',5,5'-Hexachlorobiphenyl (BZ-167)
		9217	2,3,4,4',5,6-Hexachlorobiphenyl (BZ-166)
		9218	2,3',4,4',5',6-Hexachlorobiphenyl (BZ-168)
		9005	2,3,4,4',5-Pentachlorobiphenyl (BZ-114)
		8995	2,3',4,4',5-Pentachlorobiphenyl (BZ-118)
		9011	2,3',4,4',5'-Pentachlorobiphenyl (BZ-123)
		9219	2,3,4,4',6-Pentachlorobiphenyl (BZ-115)
		9220	2,3',4,4',6-Pentachlorobiphenyl (BZ-119)
		9221	2,3,4,4'-Tetrachlorobiphenyl (BZ-60)
		8960	2,3',4,4'-Tetrachlorobiphenyl (BZ-66)
		9223	2,3',4,5,5'-Pentachlorobiphenyl (BZ-120)
		9222	2,3',4',5,5'-Pentachlorobiphenyl (BZ-124)
		9225	2,3,4,5,6-Pentachlorobiphenyl (BZ-116)
		9227	2,3,4',5,6-Pentachlorobiphenyl (BZ-117)
		9226	2,3',4,5',6-Pentachlorobiphenyl (BZ-121)
		9224	2,3',4',5',6-Pentachlorobiphenyl (BZ-125)
		9228	2,3,4,5-Tetrachlorobiphenyl (BZ-61)
		9233	2,3,4',5-Tetrachlorobiphenyl (BZ-63)
		9231	2,3',4,5'-Tetrachlorobiphenyl (BZ-68)

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Solids	EPA 1668C	9230	2,3',4',5-Tetrachlorobiphenyl (BZ-70)
		9229	2,3',4',5'-Tetrachlorobiphenyl (BZ-76)
		9232	2,3',4,5-Tetrachlorobiphenyl (BZ-67)
		9234	2,3,4,6-Tetrachlorobiphenyl (BZ-62)
		9236	2,3,4',6-Tetrachlorobiphenyl (BZ-64)
		9235	2,3',4,6-Tetrachlorobiphenyl (BZ-69)
		9237	2,3',4',6-Tetrachlorobiphenyl (BZ-71)
		9238	2,3,4-Trichlorobiphenyl (BZ-21)
		9241	2,3,4'-Trichlorobiphenyl (BZ-22)
		9240	2,3',4-Trichlorobiphenyl (BZ-25)
		9239	2,3',4'-Trichlorobiphenyl (BZ-33)
		9242	2,3',5,5'-Tetrachlorobiphenyl (BZ-72)
		9243	2,3,5,6-Tetrachlorobiphenyl (BZ-65)
		9244	2,3',5',6-Tetrachlorobiphenyl (BZ-73)
		9245	2,3,5-Trichlorobiphenyl (BZ-23)
		8935	2,3',5-Trichlorobiphenyl (BZ-26)
		9246	2,3',5'-Trichlorobiphenyl (BZ-34)
		9247	2,3,6-Trichlorobiphenyl (BZ-24)
		9248	2,3',6-Trichlorobiphenyl (BZ-27)
		8920	2,3-Dichlorobiphenyl (BZ-5)
		9249	2,3'-Dichlorobiphenyl (BZ-6)
		9250	2,4,4',5-Tetrachlorobiphenyl (BZ-74)
		9251	2,4,4',6-Tetrachlorobiphenyl (BZ-75)
		9252	2,4,4'-Trichlorobiphenyl (BZ-28)
		9253	2,4,5-Trichlorobiphenyl (BZ-29)
		8940	2,4',5-Trichlorobiphenyl (BZ-31)
		9254	2,4,6-Trichlorobiphenyl (BZ-30)
		9255	2,4',6-Trichlorobiphenyl (BZ-32)
		9257	2,4-Dichlorobiphenyl (BZ-7)
		9256	2,4'-Dichlorobiphenyl (BZ-8)
		9258	2,5-Dichlorobiphenyl (BZ-9)
		9259	2,6-Dichlorobiphenyl (BZ-10)
		8915	2-Chlorobiphenyl (BZ-1)
		9060	3,3',4,4',5,5'-Hexachlorobiphenyl (BZ-169)
		9015	3,3',4,4',5-Pentachlorobiphenyl (BZ-126)
		8965	3,3',4,4'-Tetrachlorobiphenyl (BZ-77)
		9260	3,3',4,5,5'-Pentachlorobiphenyl (BZ-127)
		9262	3,3',4,5-Tetrachlorobiphenyl (BZ-78)
		9261	3,3',4,5'-Tetrachlorobiphenyl (BZ-79)
		9263	3,3',4-Trichlorobiphenyl (BZ-35)
		9264	3,3',5,5'-Tetrachlorobiphenyl (BZ-80)

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EPA 1668C	9265	3,3',5-Trichlorobiphenyl (BZ-36)		
	8925	3,3'-Dichlorobiphenyl (BZ-11)		
	8970	3,4,4',5-Tetrachlorobiphenyl (BZ-81)		
	9266	3,4,4'-Trichlorobiphenyl (BZ-37)		
	9267	3,4,5-Trichlorobiphenyl (BZ-38)		
	9268	3,4',5-Trichlorobiphenyl (BZ-39)		
	9270	3,4-Dichlorobiphenyl (BZ-12)		
	9269	3,4'-Dichlorobiphenyl (BZ-13)		
	9271	3,5-Dichlorobiphenyl (BZ-14)		
	9272	3-Chlorobiphenyl (BZ-2)		
	9273	4,4'-Dichlorobiphenyl (BZ-15)		
	9274	4-Chlorobiphenyl (BZ-3)		
	9105	Decachlorobiphenyl (BZ-209)		
	8876	Total Dichlorobiphenyls		
	8877	Total Heptachlorobiphenyls		
	8888	Total Hexachlorobiphenyls		
	8889	Total Monochlorobiphenyls		
	8891	Total Nonachlorobiphenyls		
	8892	Total Octachlorobiphenyls		
	8896	Total Pentachlorobiphenyls		
	8893	Total Tetrachlorobiphenyls		
	8894	Total Trichlorobiphenyls		
EPA 8290			10187209	Polychlorinated Dibenzodioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) by GC/HRMS
	9516	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)		
	9519	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)		
	9420	1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)		
	9426	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)		
	9423	1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)		
	9471	1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-Hxcdf)		
	9453	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd)		
	9474	1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf)		
	9456	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,6,7,8-Hxcdd)		
	9477	1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf)		
	9459	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd)		

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Solids

EPA 8290	9543	1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf)	
	9540	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd)	
	9480	2,3,4,6,7,8-Hexachlorodibenzofuran	
	9549	2,3,4,7,8-Pentachlorodibenzofuran	
	9618	2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD)	
	9612	2,3,7,8-Tetrachlorodibenzofuran	
	9438	Hpcdd, total	
	9444	Hpcdf, total	
	9468	Hxcdd, total	
	9483	Hxcdf, total	
	9555	Pecdd, total	
	9552	Pecdf, total	
	9609	TCDD, total	
	9615	TCDF, total	
EPA 8290A			10187403 Polychlorinated Dibenzodioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) by GC/HRMS
	9516	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	
	9519	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	
	9420	1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)	
	9426	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)	
	9423	1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)	
	9471	1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-Hxcdf)	
	9453	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd)	
	9474	1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf)	
	9456	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,6,7,8-Hxcdd)	
	9477	1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf)	
	9459	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd)	
	9543	1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf)	
	9540	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd)	
	9480	2,3,4,6,7,8-Hexachlorodibenzofuran	
	9549	2,3,4,7,8-Pentachlorodibenzofuran	

Solids	EPA 8290A	9618	2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD)
		9612	2,3,7,8-Tetrachlorodibenzofuran
		9438	Hpcdd, total
		9444	Hpcdf, total
		9468	Hxcdd, total
		9483	Hxcdf, total
		9555	Pecdd, total
		9552	Pecdf, total
		9609	TCDD, total
		9615	TCDF, total

Quality Assurance Manual

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SECTION 2

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SOPs AND POLICIES REFERRED TO IN THE QA MANUAL

SOP/Policy Reference	Title
CA-I-P-002	Electronic Reporting and Signature Policy
CA-L-P-002	Contract Compliance Policy
CW-L-S-004	Subcontracting Procedures
CA-Q-M-002	Corporate Quality Management Plan
CA-Q-S-001	Acid and Solvent Lot Testing and Approval
CA-Q-S-002	Acceptable Manual Integration Practices
CA-Q-S-006	Detection Limits
CA-Q-S-009	Root Cause Analysis
CA-T-P-001	Qualified Products List
CW-E-M-001	Corporate Environmental Health and Safety Manual
CW-F-P-002	Company Wide Authorization Matrix
CW-F-P-004	Procurement and Contracts Policy
CW-F-S-007	Capital Expenditure Controlled Purchases
CW-L-P-001	Record Retention
CW-L-P-004	Company Wide Ethics Policy
CW-L-S-002	Internal Investigations
CW-Q-S-001	Corporate Document Control and Archiving
CW-Q-S-002	Writing a Standard Operating Procedure (SOPs)
CW-Q-S-003	Internal Auditing
CW-Q-S-004	Management Systems Review
CW-Q-S-005	Data Recall Process
CA-C-S-001	Work Sharing Process

REFERENCED LABORATORY SOPs

SOP Reference	Title
KNOX-QA-0001	Standard/Reagent Labeling and Documentation (Sec. 9.3.2, 9.3.3, 21.4, 21.4.3)
KNOX-QA-0004	Control Limits and Control Charting (Sec. 5.5, 5.6.1, 24.6.4.1)
KNOX-QA-0005	Balance Calibration and Weight Verification (Sec. 9.5, 20.3.1)
KNOX-QA-0006	Subsampling (Sec. 22.5)
KNOX-QA-0008	Nonconformance and Corrective Action System (Sec. 10.1)
KNOX-QA-0009	Personnel Orientation and Training (Sec. 17.3, 19.4.2, 19.4.3.8)
KNOX-QA-0010	Temperature Monitoring and Thermometer Calibration (Sec. 20.3.3.)
KNOX-QA-0011	Document Control & Distribution (Sec. 3.4.1, 6.1, 19.2)
KNOX-QA-0012	Pipette and Volumetric Labware Calibration Verification (Sec. 20.3.5)
KNOX-QA-0018	Preparation and Management of Standard Operating Procedures (Sec. 6.3, 19.2)
KNOX-QA-0019	Estimation of Measurement Uncertainty (Sec. 19.12.4)
KNOX-QA-0021	Department of Defense Quality Systems Manual Program Requirements (Sec 24.6.5.3.1, 24.6.5.3.2, 25.2.8)
KNOX-QA0023	Detection Limits (Sec. 19.7.1)
KNOX-AD-0003	Documenting Project Requirements (Sec. 7.3.1)
KNOX-AD-0004	Data Reporting (Sec. 14.1.1, 25.3)
KNOX-IT-0001	Good Automated Laboratory Practices (Sec. 9.4, 19.13.1)
KNOX-IT-0002	Electronic Data And Software Backup (Sec. 19.13.1)
KNOX-MS-0014	Tentatively Identified Compounds (TICS) (Sec. 20.5)
KNOX-SC-0003	Sample Receipt and Login (Sec. 23.2.1)
KNOX-SC-0005	Sample Disposal, Return and Archive (Sec. 23.7)

SECTION 3

INTRODUCTION, SCOPE AND APPLICABILITY

3.1 INTRODUCTION AND COMPLIANCE REFERENCES

TestAmerica Knoxville's Quality Assurance Manual (QAM) is a document prepared to define the overall policies, organization objectives and functional responsibilities for achieving TestAmerica's data quality goals. The laboratory maintains a local perspective in its scope of services and client relations and maintains a national perspective in terms of quality.

The QAM has been prepared to assure compliance the NELAC Institute (TNI) Standard dated 2009, Volume 1 Modules 2 and 4, and ISO/IEC Guide 17025:2005(E). In addition, the policies and procedures outlined in this manual are compliant with TestAmerica's Corporate Quality Management Plan (CA-Q-M-002; CQMP) and the various accreditation and certification programs listed in Appendix 3. The CQMP provides a summary of TestAmerica's quality and data integrity system. It contains requirements and general guidelines under which all TestAmerica facilities conduct their operations.

The QAM has been prepared to be consistent with the requirements of the following documents:

- ANSI/ASQC, E4-1994, "Specifications and Guidelines for Quality Management Systems for Environmental Data Collection and Environmental Technology Programs" (American National Standard, January 5, 1995, or most recent version)
- "EPA Requirements for Quality Management Programs" (QA/R-2) (EPA/240/B-01/002, May 31, 2006).
- EPA 600/4-79-019, *Handbook for Analytical Quality Control in Water and Wastewater Laboratories,* EPA, March 1979.
- Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846), Third Edition, September 1986, Final Update I, July 1992, Final Update IIA, August 1993, Final Update II, September 1994; Final Update IIB, January 1995; Final Update III, December 1996; Final Update IV, January 2008. Final Update V, August 2015.
- Federal Register, 40 CFR Parts 136, 141, and 261.
- Manual for the Certification of Laboratories Analyzing Drinking Water (EPA 815-R-05-004, January 2005).
- APHA, *Standard Methods for the Examination of Water and Wastewater,* 18th Edition, 19th, 20th , 21st , and on-line Editions.
- *U.S. Department of Energy* Order 414.1B, *Quality Assurance*, Approved April 29, 2004, and/or 414.1C, *Quality Assurance*, Approved June 17, 2005; and/or *U.S. Department of Energy* Order 414.1D, *Quality Assurance,* Approved April 25, 2011.
- U.S. Department of Defense, Quality Systems Manual for Environmental Laboratories, Version 4.2, October 2010.
- U.S. Department of Defense (DoD)/Department of Energy (DOE) Consolidated Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.0, July 2013.

3.2 TERMS AND DEFINITIONS

A Quality Assurance Program is a company-wide system designed to ensure that data produced by the laboratory conforms to the standards set by state and/or federal regulations. The program functions at the management level through company goals and management policies, and at the analytical level through Standard Operating Procedures (SOPs) and quality control. The TestAmerica program is designed to minimize systematic error, encourage constructive, documented problem solving, and provide a framework for continuous improvement within the organization.

Refer to Appendix 2 for the Glossary/Acronyms.

3.3 SCOPE / FIELDS OF TESTING

The laboratory analyzes a broad range of environmental and industrial samples every month. Sample matrices vary among air (source and ambient), drinking water, effluent water, groundwater, soils, sediment, biological, hazardous waste, and sludge. The Quality Assurance Program contains specific procedures and methods to test samples of differing matrices for chemical and physical parameters. The Program also contains guidelines on maintaining documentation of analytical processes, reviewing results, servicing clients and tracking samples through the laboratory. The technical and service requirements of all analytical requests are thoroughly evaluated before commitments are made to accept the work. Measurements are made using published reference methods or methods developed and validated by the laboratory.

The methods covered by this manual include the most frequently requested methodologies needed to provide analytical services in the United States and its territories. The specific list of test methods used by the laboratory can be found in Table 19-1. The approach of this QAM is to define the minimum level of quality assurance and quality control necessary to meet these requirements. All methods performed by the laboratory meet these criteria as appropriate. In some instances, quality assurance project plans (QAPPs), project specific data quality objectives (DQOs) or local regulations may require criteria other than those contained in this QAM. In these cases, the laboratory abides by the requested criteria following review and acceptance of the requirements by the Laboratory Director and the Quality Assurance (QA) Manager. In some cases, QAPPs and DQOs may specify less stringent requirements. The Laboratory Director and the QA Manager must determine if it is in the lab's best interest to follow the less stringent requirements.
Note: TestAmerica Knoxville must comply with the information provided in its VAP approved QA Manual and SOPs.

3.4 MANAGEMENT OF THE MANUAL

3.4.1 Review Process

The template on which this manual is based is reviewed annually by Corporate Quality Management Personnel to assure that it remains in compliance with Section3.1. This QAM itself is reviewed annually by the senior laboratory management to assure that it reflects current practices and meets the requirements of the laboratory's clients and regulators as well as the CQMP. Occasionally, the manual may need changes in order to meet new or changing regulations and operations. The QA Manager reviews the changes in the normal course of

business and incorporates changes into revised sections of the document. All updates are reviewed by the senior laboratory management staff. The laboratory updates and approves such changes according to our document control and distribution procedures (refer to SOP No. KNOX-QA-0011).

Laboratory-specific QAM changes are initiated through the TestAmerica Knoxville Quality Assurance Manager. Each revision to the QAM is approved by the same authorized signatories as shown on the cover page of the QAM. Changes to the Laboratory Specific QAM must also be reviewed and approved by Ohio EPA VAP prior to implementation.

SECTION 4

MANAGEMENT REQUIREMENTS

4.1 OVERVIEW

TestAmerica Knoxville is a local operating unit of TestAmerica Laboratories, Inc. The organizational structure, responsibilities and authorities of the corporate staff of TestAmerica Laboratories, Inc. are presented in the CQMP. The laboratory has day-to-day independent operational authority overseen by corporate officers (e.g., President and Chief Executive Officer, Chief Operating Officer (COO), Executive VP Operations, Corporate Quality Assurance, etc.). The TestAmerica Knoxville laboratory operational and support staff work under the direction of the Laboratory Director. The organizational structure for both Corporate & TestAmerica Knoxville is presented in Figure 4-1.

4.2 ROLES AND RESPONSIBILITIES

In order for the Quality Assurance Program to function properly, all members of the staff must clearly understand and meet their individual responsibilities as they relate to the quality program. The following descriptions briefly define each role in its relationship to the Quality Assurance Program. More detailed laboratory job descriptions are maintained by management and human resources on the company intranet.

4.2.1 Additional Requirements for Laboratories

The responsibility for quality resides with every employee of the laboratory. All employees have access to the QAM, are trained to this QAM, and are responsible for upholding the standards therein. Each person carries out his/her daily tasks in a manner consistent with the goals and in accordance with the procedures in this manual and the laboratory's SOPs. Role descriptions for Corporate personnel are defined in the CQMP. This manual is specific to the operations of TestAmerica's Knoxville laboratory.

4.2.2 Laboratory Director

TestAmerica Knoxville's Laboratory Director is responsible for the overall quality, safety, financial, technical, human resource and service performance of the laboratory and reports directly to the General Manager. The Laboratory Director provides the resources necessary to implement and maintain an effective and comprehensive Quality Assurance and Data Integrity Program.

Specific responsibilities include, but are not limited to:

- Implementing and ensuring adherence to the Quality System as described in this QAM and in the supporting laboratory policies and procedures.
- Providing one or more technical managers for the appropriate fields of testing. If the Technical Manager is absent for a period of time exceeding 15 consecutive calendar days, the Laboratory Director must designate another full time staff member meeting the qualifications of the Technical Manager to temporarily perform this function. If the absence

exceeds 65 consecutive calendar days, the primary accrediting authority must be notified in writing.

- Ensuring that all laboratory analysts and group leaders have the appropriate education and training to properly carry out the duties assigned to them and ensuring that this training has been documented.
- Ensuring that personnel are free from any undue pressures, including inappropriate commercial or financial concerns which may adversely affect the quality of their work.
- Annually assessing the effectiveness of the Quality System within the operation.
- Maintaining adequate trained staff to supervise and perform the work of the laboratory.
- Ensuring that appropriate corrective actions are taken to address analyses identified as requiring such actions by internal and external performance or procedural audits. Procedures that do not meet the standards set forth in the QAM or laboratory SOPs may be temporarily suspended by the Laboratory Director.
- Having signature authority for the QAM, laboratory policies, SOPs, and contracts.
- Having the authority and responsibility to halt work, withhold final reports, or suspend an analysis for due cause as well as authorize the resumption of work

4.2.3 Quality Assurance (QA) Manager or Designee

The QA Manager is able to evaluate data objectively and perform assessments without outside (i.e., managerial) influence. Authorities and responsibilities include:

- Reporting directly to the Laboratory Director and to the Quality Director to maintain independence of QA oversight.
- Maintaining, approving, communicating and implementing the QAM.
- Having joint signature authority, with the Laboratory Director and Technical Manager for approval of quality documents.
- Directing controlled distribution of laboratory quality documents.
- Monitoring and communicating regulatory changes that may affect the laboratory to management.
- Having documented training and/or experience in QA/QC procedures and the laboratory's Quality System.
- Training and advising the laboratory staff on quality assurance/quality control procedures that are pertinent to their daily activities.
- Conducting Ethics and Data Integrity Training and conducting new employee Ethics and QA orientation.
- Ensuring that all personnel understand their contribution to the quality system.
- Evaluating the thoroughness and effectiveness of training.
- Reviewing and approving documentation of analyst training records.
- Serving as a focal point for QA and QC issues, reviewing corrective actions and recommending resolution for recurring nonconformances within the laboratory.

- Notifying laboratory management of deficiencies in the quality system and ensuring corrective actions are implemented and effective. Procedures that do not meet the standards set forth in the QAM or laboratory SOPs shall be investigated following the procedures outlined in Section 12 and if deemed necessary may be temporarily suspended during the investigation.
- Assisting the laboratory in maintaining regulatory analytical compliance, including maintaining certifications.
- Having a general knowledge of the analytical test methods for which data audit/review is performed.
- Monitoring data quality measures via statistical methods to verify that the laboratory routinely meets stated quality goals.
- Using available tools, such as audit results, control charts, proficiency testing results, data analysis, corrective and preventive actions, customer feedback, and management reviews in efforts to monitor trends and continually improve the quality system.
- Scheduling proficiency test samples.
- Performing annual quality systems audits, and periodic data audits.
- Hosting external audits conducted by outside agencies.
- Approving quality control reference data changes in the LIMS.
- Preparing monthly QA Reports to management providing Quality System Metrics.
- Having the final authority to accept or reject data and to stop work in progress in the event that procedures or practices compromise the validity and integrity of analytical data. The QA Manager also has the responsibility to authorize the resumption of work if a stop work order was issued.
- Having responsibility and authority to ensure the continuous implementation of the quality system based on ISO 17025.
- Ensuring communication & monitoring standards of performance to ensure that systems are in place to produce the level of quality as defined in this document.
- Ensuring compliance with ISO 17025.
- Ensuring compliance with the DoD/ DOE Consolidated Quality Systems Manual (QSM).

4.2.4 Technical Manager or Designee

The Technical Manager is responsible for the technical operation of the laboratory and reports directly to the Laboratory Director. The Technical Manager is responsible for compliance with the ISO 17025 Standard. Specific responsibilities include, but are not limited to:

- Monitoring standards of performance in quality control and quality assurance.
- Monitoring the validity of the analyses performed and the data generated in the laboratory to assure reliable data.
- Exercising day to day supervision of laboratory operations and data reporting.
- Coordinating the development and implementation of SOPs.

- Having joint signature authority for QAM, SOPs, and training records.
- Performing technical training in area(s) of expertise.
- Interfacing with management on technical needs and solving day-to-day technical issues.
- Determining qualifications required for technical positions and evaluating job candidates against those requirements.
- Investigating technical issues related to projects as directed by QA.
- Evaluating new methods, technical proposals, and statements of work.
- Certifying technical laboratory personnel based on education and background to ensure that staff has demonstrated capability in the activities for which they are responsible.
- Meeting the requirements specified in the Section 4.1.1.1 of the NELAC standards.
- Ensuring compliance with ISO 17025.
- Ensuring compliance with the DoD/DOE QSM.

4.2.5 Operations Manager

The Operations Manager reports directly to the Laboratory Director and supervises the daily activities of the analytical groups. Responsibilities include, but are not limited to:

- Scheduling analytical operations.
- Supervising QC activities performed as a part of routine analytical operations.
- Implementing data review procedures.
- Supervising the preparation and maintenance of laboratory records.
- Supervising maintenance of instruments and scheduling of repairs.
- Supervising the daily activities of the Report Production Group.
- Working with the Project Managers and Group Leaders to assure the requirements of projects are met in a timely manner.
- Ensuring that corrective actions are implemented and effective.

4.2.6 Report Production Staff

The Report Production Staff reports to the Operations Manager. Responsibilities include, but are not limited to:

- Accurately generating and compiling analytical reports and associated deliverables for delivery to the client.
- Producing deliverables that meet NELAC requirements, as required.

4.2.7 Environmental Health and Safety Coordinator and Radiation Safety Officer

The Environmental Health and Safety Coordinator reports directly to the Laboratory Director. Responsibilities include, but are not limited to:

- Staying current with the hazardous waste regulations.
- Continuing training on hazardous waste issues.
- Reviewing and updating annually the Hazardous Waste Contingency Plan.
- Auditing the staff with regard to compliance with the TestAmerica Knoxville Specific Emergency Contingency Plan and the Corporate Environmental Health and Safety Manual (CW-E-M-001).
- Contacting the hazardous waste subcontractors for review of procedures and opportunities for minimization of waste.
- Conducting ongoing, necessary safety training and conduct new employee safety orientation.
- Assisting in developing and maintaining the Chemical Hygiene/Safety Manual.
- Administering dispersal of all Material Safety Data Sheet (MSDS) information.
- Performing regular chemical hygiene and housekeeping instruction.
- Giving instruction on proper labeling and practice; Serving as chairman of the laboratory safety committee.
- Overseeing the inspection and maintenance of general safety equipment – fire extinguishers, safety showers, eyewash fountains, etc. and ensure prompt repairs as needed.
- Supervising and scheduling fire drills and emergency evacuation drills.

As Radiation Safety Officer (RSO), responsibilities include but are not limited to:

- Ensuring that all uses of radioactive materials and radiation sources are conducted safely, in accordance with the conditions of the license and applicable regulations, and result in exposures to personnel which are as low as reasonably achievable (ALARA).

- Apprising and informing management of the radiation safety status of the facility and for keeping them aware of their responsibility in maintaining an adequate radiation protection program.

4.2.8 Group (Area) Leader, Team Leader or Laboratory Supervisor

Laboratory Supervisors report directly to the Operations Manager or the Laboratory Director. Responsibilities include, but are not limited to:

- Supervising daily activities of analyses within the group ensuring that the laboratory analysts adhere to the appropriate SOPs and the QAM.
- Supervising QC activities performed as a part of routine analytical operations.
- Implementing data review procedures.
- Supervising the preparation and maintenance of laboratory records.
- Evaluating instrument performance and supervising the calibration, preventive maintenance, and scheduling of repairs.

- Overseeing or performing review and approval of all analytical data.
- Reporting nonconformances to the appropriate managers.
- Ensuring that corrective actions are implemented and effective
- Providing written corrective action responses to audit findings
- Generating and reviewing SOPs for their section.

4.2.9 Laboratory Analysts

Laboratory analysts are responsible for conducting analysis and performing all tasks assigned to them by the group leader. Responsibilities include, but are not limited to:

- Performing analytical methods and data recording in accordance with documented procedures.
- Performing and documenting calibration and preventive maintenance.
- Performing data processing and data review procedures.
- Reporting nonconformances to the Group Leader, Technical Manager and QA Manager.
- Ensuring sample and data integrity by adhering to internal chain-of-custody procedures.

4.2.10 Data Reviewer

Laboratory Data Reviewers are responsible for review of analytical data. Laboratory Analysts also perform data reviews as noted above. Responsibilities include, but are not limited to:

- Performing data review procedures.
- Reporting nonconformances to the Group Leader, Technical Manager and QA Manager.

4.2.11 Sample Receiving Group Leader

The Sample Receiving Group Leader reports to the Customer Service Manager. Responsibilities include, but are not limited to:

- Ensuring implementation of proper sample receipt procedures, including maintenance of chain-of-custody.
- Reporting variances associated with condition-upon-receipt of samples.
- Logging samples into the LIMS.
- Ensuring that all samples are stored in the proper environment.
- Assisting Environmental Health and Safety staff with sample disposal.

4.2.12 Laboratory Client Relations Manager

The Client Relations Manager reports directly to the Laboratory Director and serves as the interface between the laboratory's technical departments and the laboratory's clients. The staff consists of the Project Management team. Responsibilities include, but are not limited to:

- Supervising the daily activities of the Project Management and Sample Control groups.
- Working with the Operations Manager and/or Group Leaders to ensure the requirements of projects are met in a timely manner.
- Having signature authority for laboratory reports.
- Defining customer requirements through project definition.
- Assessing and assuring customer satisfaction.
- Providing feedback to management on changing customer needs.
- Bringing together resources necessary to ensure customer satisfaction.

4.2.13 Project Manager

The Project Manager reports directly to the Customer Service Manager. Responsibilities include, but are not limited to:

- Monitoring analytical and quality assurance project requirements for a specified project.
- Acting as a liaison between the client and the laboratory staff.
- Preparing Quality Assurance Summary (QAS) or equivalent summary form and communicates project-specific requirements to all parties involved.
- Assisting the laboratory staff with interpretation of work plans, contracts, and QAPP requirements.
- Reviewing project data packages for completeness and compliance to client needs.
- Having signature authority for final report.
- Keeping the laboratory and client informed of project status.
- Together with the QA Manager, approving customer requested variances to methods and to standard laboratory protocols.
- Monitoring, reviewing, and evaluating the progress and performance of projects.
- Reporting client inquiries involving data quality issues or data acceptability to the facility QA Manager and to the operations staff.
- Preparing reissue requests for project data.

4.3 DEPUTIES

The following table defines who assumes the responsibilities of key personnel in their absence:

Key Personnel	Deputy
Laboratory Director: Christopher Rigell	Robyn Wagner
QA Manager: Kevin McGee	Annette Ribet
Technical Manager: Robyn Wagner	David Wiles
Technical Manager: Bruce Wagner	Melissa Davidson
Client Relations Manager: John Reynolds	Jamie McKinney

Key Personnel	Deputy
EHS Coordinator: Lewis Osborne	Mike Patty
Radiation Safety Officer (RSO): Lewis Osborne	James Cochran

The laboratory operational and support staff work under the direction of the Laboratory Director. The organizational structure for both Corporate & TestAmerica Knoxville is presented in Figure 4-1. Employee names are provided to demonstrate range and size of departments however the actual staff members may vary over time. The most current Organization Chart may be obtained from Quality Assurance Manager or Laboratory Director.

Figure 4-1.

Corporate and Laboratory Organization Charts

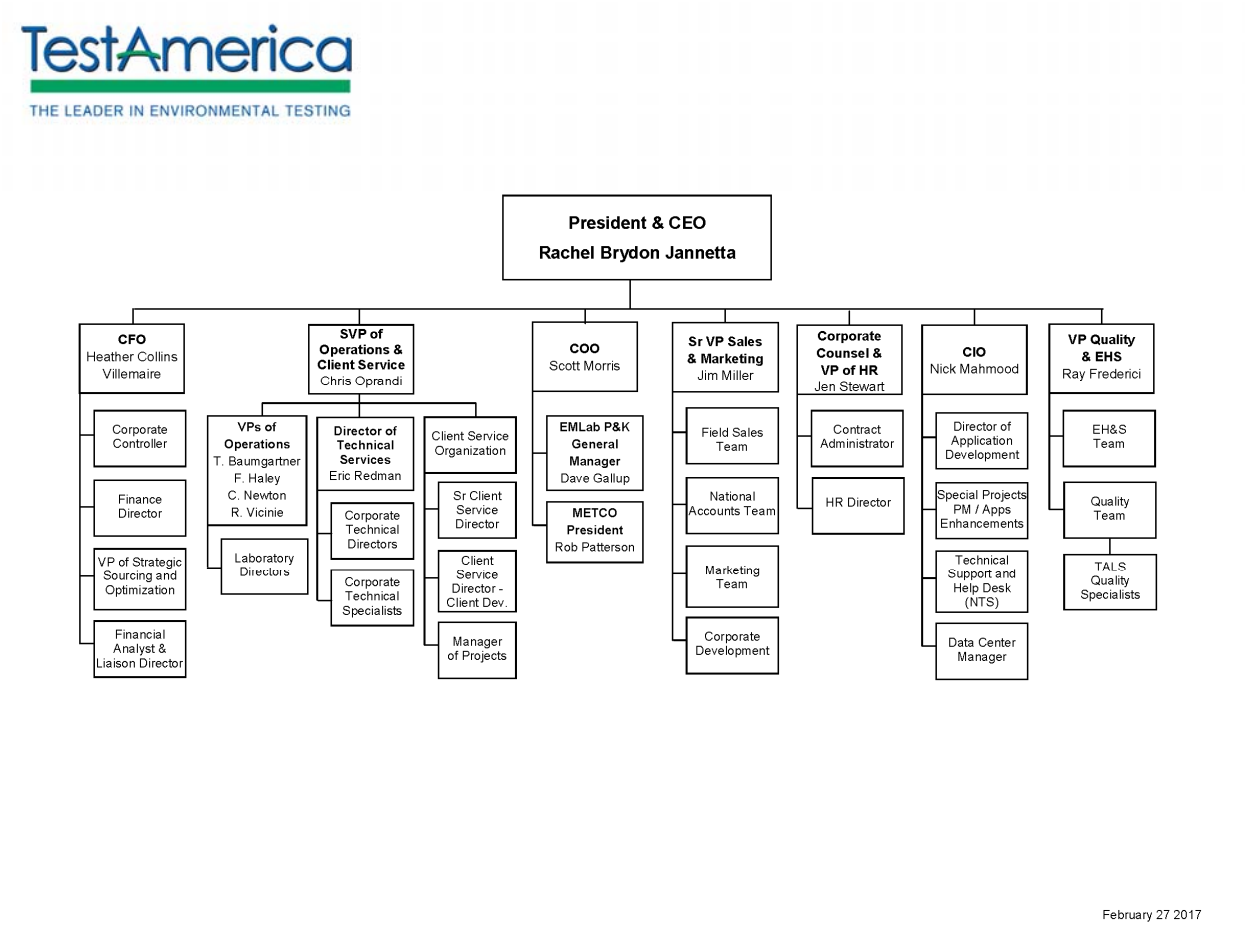


Figure 4-1.

Corporate and Laboratory Organization Charts (continued)

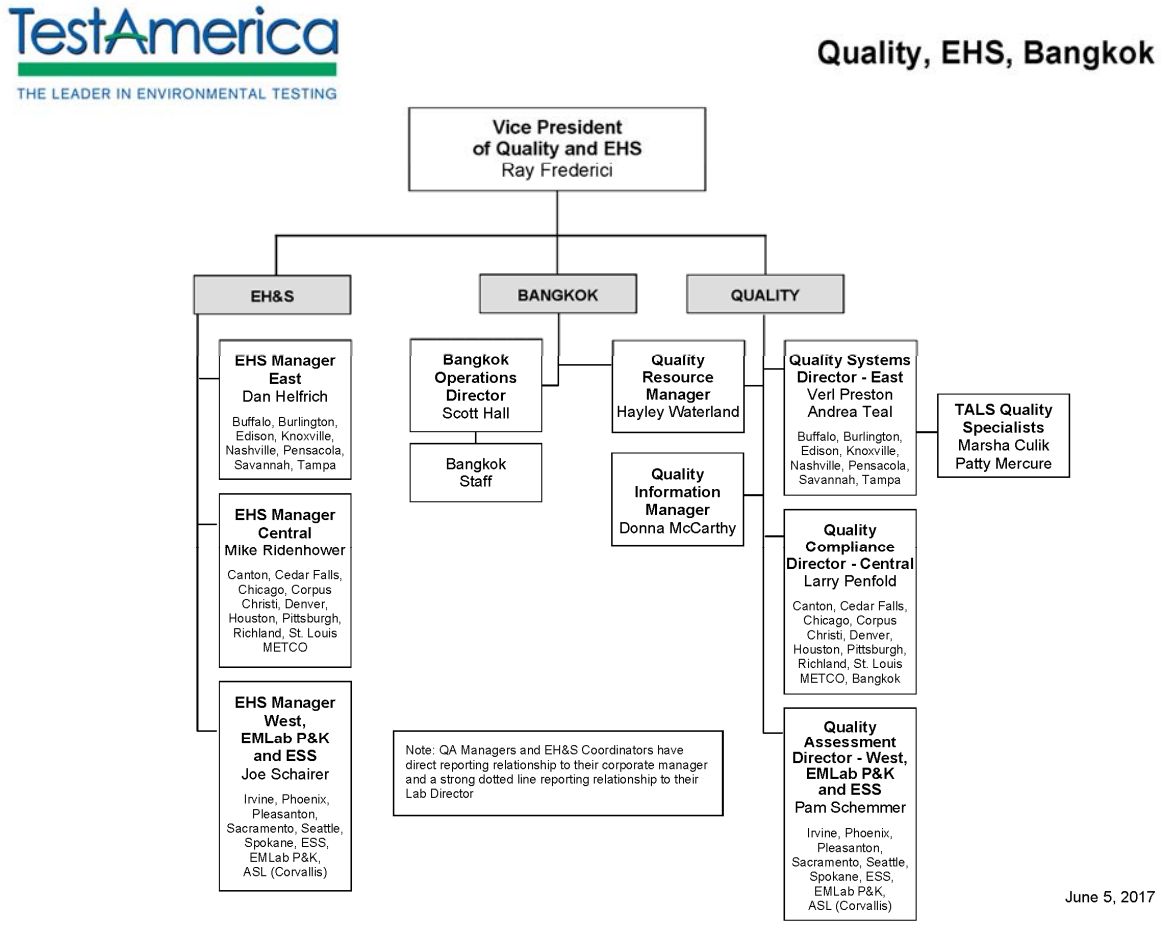
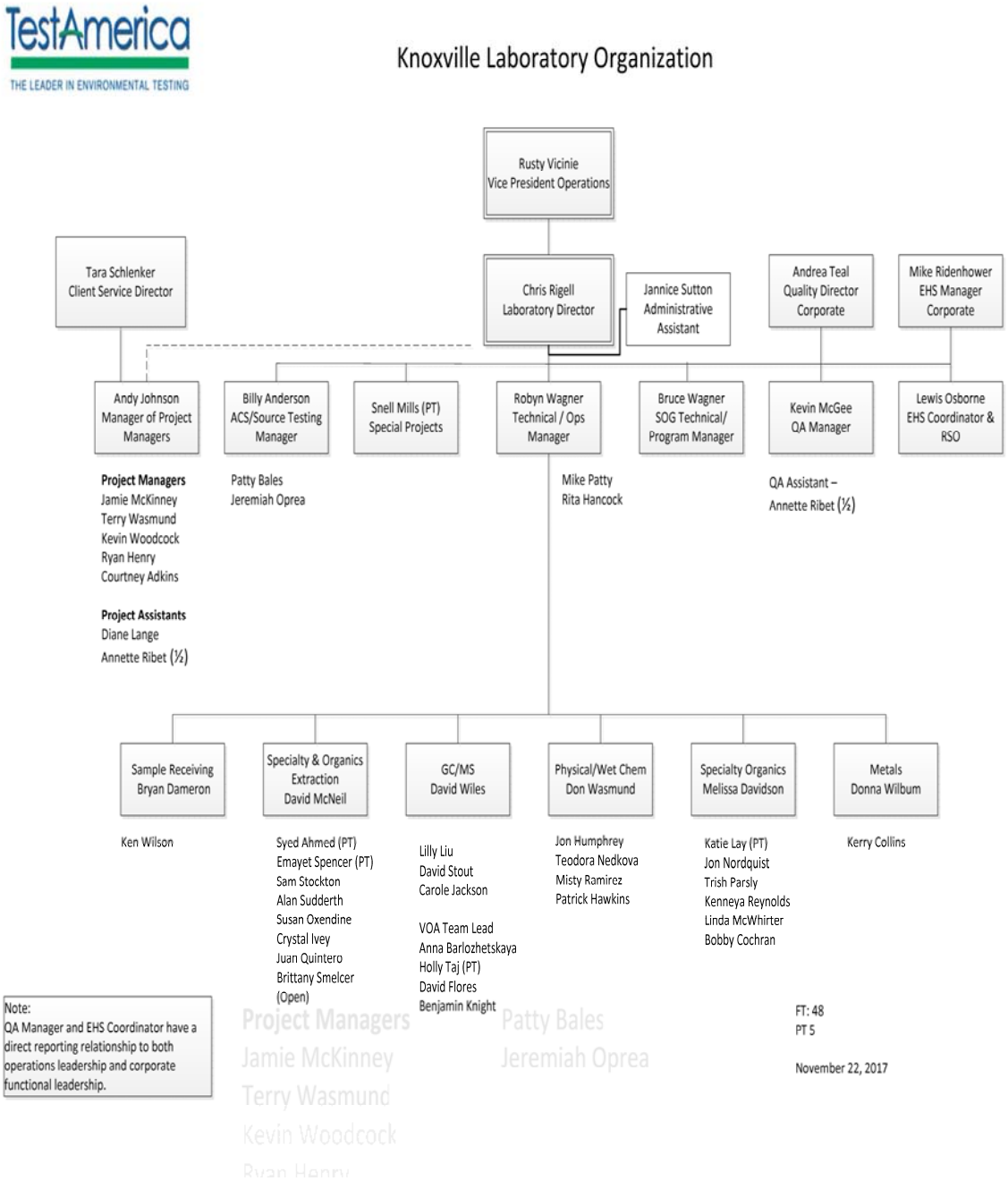


Figure 4-1.

Corporate and Laboratory Organization Charts (continued)



SECTION 5

QUALITY SYSTEM

5.1 QUALITY POLICY STATEMENT

It is TestAmerica's Policy to:

- Provide data of known quality to its clients by adhering to approved methodologies, regulatory requirements and the QA/QC protocols.
- Effectively manage all aspects of the laboratory and business operations by the highest ethical standards.
- Continually improve systems and provide support to quality improvement efforts in laboratory, administrative and managerial activities. TestAmerica recognizes that the implementation of a quality assurance program requires management's commitment and support as well as the involvement of the entire staff.
- Provide clients with the highest level of professionalism and the best service practices in the industry.
- To comply with the NELAC Standards (2003), ISO/IEC 17025:2005(E) International Standard, the 2009 TNI Standard and to continually improve the effectiveness of the management system.

Every staff member at the laboratory plays an integral part in quality assurance and is held responsible and accountable for the quality of their work. It is, therefore, required that all laboratory personnel are trained and agree to comply with applicable procedures and requirements established by this document.

5.2 ETHICS AND DATA INTEGRITY

TestAmerica is committed to ensuring the integrity of its data and meeting the quality needs of its clients. The elements of TestAmerica's Ethics and Data Integrity Program include:

- An Ethics Policy (Company-Wide Ethics Policy No. CW-L-P-004) and Employee Ethics Statements.
- Ethics and Compliance Officers (ECOs).
- A Training program.
- Self-governance through disciplinary action for violations.
- A Confidential mechanism for anonymously reporting alleged misconduct and a means for conducting internal investigations of all alleged misconduct (Corporate SOP No. CW-L-S-002).
- Procedures and guidance for recalling data if necessary (Corporate SOP No. CA-Q-S-005).
- Effective external and internal monitoring system that includes procedures for internal audits (Section 15).

Produce results which are accurate and include QA/QC information that meets client pre-defined Data Quality Objectives (DQOs).

- Present services in a confidential, honest and forthright manner.
- Provide employees with guidelines and an understanding of the Ethical and Quality Standards of our Industry.
- Operate our facilities in a manner that protects the environment and the health and safety of employees and the public.
- Obey all pertinent federal, state and local laws and regulations and encourage other members of our industry to do the same.
- Educate clients as to the extent and kinds of services available.
- Assert competency only for work for which adequate personnel and equipment are available and for which adequate preparation has been made.
- Promote the status of environmental laboratories, their employees, and the value of services rendered by them.

5.3 QUALITY SYSTEM SUPPORTING DOCUMENTATION

The laboratory's Quality System is communicated through a variety of documents.

- Quality Assurance Manual – Each laboratory has a lab specific quality assurance manual.
- Corporate SOPs and Policies - Corporate SOPs and Policies are developed for use by all relevant laboratories. They are incorporated into the laboratory's normal SOP distribution, training and tracking system. Corporate SOPs may be general or technical.
- Work Instructions - A subset of procedural steps, tasks or forms associated with an operation of a management system (e.g., checklists, preformatted bench sheets, forms).
- Laboratory SOPs – General and Technical.

5.3.1 Order of Precedence

In the event of a conflict or discrepancy between policies, the order of precedence is as follows:

- Corporate Quality Management Plan (CQMP)
- Corporate SOPs and Policies
- Laboratory QA/QC Policy Memorandum
- Laboratory Quality Assurance Manual (QAM)
- Laboratory SOPs and Policies
- Other (Work Instructions (WI), memos, flow charts, etc.)

Note: The laboratory has the responsibility and authority to operate in compliance with regulatory requirements of the jurisdiction in which the work is performed. Where the CQMP conflicts with those regulatory requirements, the regulatory requirements of the jurisdiction hold primacy. The laboratory's QAM takes precedence over the CQMP in those cases. Any regulatory requirements (e.g.; Ohio EPA VAP, CT RCP, etc) provided in the laboratory specific

documents (i.e., QAM and SOPs) take precedence over any policies provided in corporate documents.

5.4 QA/QC OBJECTIVES FOR THE MEASUREMENT OF DATA

Quality Assurance (QA) and Quality Control (QC) are activities undertaken to achieve the goal of producing data that accurately characterize the sites or materials that have been sampled. Quality Assurance is generally understood to be more comprehensive than Quality Control. Quality Assurance can be defined as the integrated system of activities that ensures that a product or service meets defined standards.

Quality Control is generally understood to be limited to the analyses of samples and to be synonymous with the term *"analytical quality control"*. QC refers to the routine application of statistically based procedures to evaluate and control the accuracy of results from analytical measurements. The QC program includes procedures for estimating and controlling precision and bias and for determining reporting limits.

Request for Proposals (RFPs) and Quality Assurance Project Plans (QAPP) provide a mechanism for the client and the laboratory to discuss the data quality objectives in order to ensure that analytical services closely correspond to client needs. The client is responsible for developing the QAPP. In order to ensure the ability of the laboratory to meet the Data Quality Objectives (DQOs) specified in the QAPP, clients are advised to allow time for the laboratory to review the QAPP before being finalized. Additionally, the laboratory provides support to the client for developing the sections of the QAPP that concern laboratory activities.

Note: TestAmerica Knoxville must comply with the information provided in its VAP approved QAM and SOPs.

Historically, laboratories have described their QC objectives in terms of precision, accuracy, representativeness, comparability, completeness, selectivity and sensitivity (PARCCSS). Equations to derive relevant QC objectives can be found in the method specific SOPs.

5.4.1 Precision

The laboratory objective for precision is to meet the performance for precision demonstrated for the methods on similar samples and to meet data quality objectives of the EPA and/or other regulatory programs. Precision is defined as the degree of reproducibility of measurements under a given set of analytical conditions (exclusive of field sampling variability). Precision is documented on the basis of replicate analysis, usually duplicate or matrix spike (MS) duplicate samples.

5.4.2 Accuracy

The laboratory objective for accuracy is to meet the performance for accuracy demonstrated for the methods on similar samples and to meet data quality objectives of the EPA and/or other regulatory programs. Accuracy is defined as the degree of bias in a measurement system. Accuracy may be documented through the use of laboratory control samples (LCS) and/or MS. A statement of accuracy is expressed as an interval of acceptance recovery about the mean recovery.

5.4.3 Representativeness

The laboratory objective for representativeness is to provide data which is representative of the sampled medium. Representativeness is defined as the degree to which data represent a characteristic of a population or set of samples and is a measurement of both analytical and field sampling precision. The representativeness of the analytical data is a function of the procedures used in procuring and processing the samples. The representativeness can be documented by the relative percent difference between separately procured, but otherwise identical samples or sample aliquots.

The representativeness of the data from the sampling sites depends on both the sampling procedures and the analytical procedures. The laboratory may provide guidance to the client regarding proper sampling and handling methods in order to assure the integrity of the samples.

5.4.4 Comparability

The comparability objective is to provide analytical data for which the accuracy, precision, representativeness and reporting limit statistics are similar to these quality indicators generated by other laboratories for similar samples, and data generated by the laboratory over time.

The comparability objective is documented by inter-laboratory studies carried out by regulatory agencies or carried out for specific projects or contracts, by comparison of periodically generated statements of accuracy, precision and reporting limits with those of other laboratories.

5.4.5 Completeness

The completeness objective for data is 90% (or as specified by a particular project), expressed as the ratio of the valid data to the total data over the course of the project. Data will be considered valid if they are adequate for their intended use. Data usability is defined in a QAPP, project scope or regulatory requirement. Data validation is the process for reviewing data to determine its usability and completeness. If the completeness objective is not met, actions will be taken internally and with the data user to improve performance. This may take the form of an audit to evaluate the methodology and procedures as possible sources for the difficulty or may result in a recommendation to use a different method.

5.4.6 Selectivity

Selectivity is defined as the capability of a test method or instrument to respond to a target substance or constituent in the presence of non-target substances. Target analytes are separated from non-target constituents and subsequently identified/detected through one or more of the following, depending on the analytical method: extractions (separation), digestions (separation), interelement corrections (separation), use of matrix modifiers (separation), specific retention times (separation and identification), confirmations with different columns or detectors (separation and identification), specific wavelengths (identification), specific mass spectra (identification), specific electrodes (separation and identification), etc..

5.4.7 Sensitivity

Sensitivity refers to the amount of analyte necessary to produce a detector response that can be reliably detected (Method Detection Limit, Estimated Detection Limit, or Limit of Detection) or quantified (Reporting Limit, Minimum Level, or Limit of Quantitation).

5.5 CRITERIA FOR QUALITY INDICATORS

The laboratory can prepare upon request a Quality Control Limit Summary from the Laboratory Information Management System (LIMS) that summarize the precision and accuracy acceptability limits for performed analyses. This summary includes an effective date, is updated each time new limits are generated and is located in the LIMS. Current limits are controlled through the LIMS. The limits in effect for a given date are archived in the LIMS with the associated sample data. Unless otherwise noted, limits within these tables are laboratory generated. Some acceptability limits are derived from US EPA methods when they are required. Where US EPA method limits are not required, the laboratory has developed limits from evaluation of data from similar matrices. Criteria for development of control limits is contained in SOP KNOX-QA-0004.

5.6 STATISTICAL QUALITY CONTROL

Statistically-derived precision and accuracy limits are required by selected methods (such as SW-846). The laboratory routinely utilizes statistically-derived limits to evaluate method performance and determine when corrective action is appropriate. The laboratory analysts are instructed to use the current limits in the laboratory (dated and approved by the Technical Manager/Group Leader and QA Manager) and entered into the LIMS. The Quality Assurance department maintains an archive of all limits used within the laboratory. These limits are maintained in the LIMS as part of the analytical historical record. If a method defines the QC limits, the method limits are used.

If a method requires the generation of historical limits, the lab develops such limits from recent data in the QC database of the LIMS following the guidelines described in Section 25. All calculations and limits are documented and dated when approved and effective. On occasion, a client requests contract-specified limits for a specific project.

Current QC limits are entered and maintained in the LIMS analyte database. As sample results and the related QC are entered into LIMS, the sample QC values are compared with the limits in LIMS to determine if they are within the acceptable range. The laboratory analyst then evaluates if the sample needs to be rerun or re-extracted/rerun or if a comment should be added to the report explaining the reason for the QC outlier.

5.6.1 QC Charts

The generation and use of QC Charts (Control Charts) are described in the laboratory SOP KNOX-QA-0004.

5.7 QUALITY SYSTEM METRICS

In addition to the QC parameters discussed above, the entire Quality System is evaluated on a monthly basis through the use of specific metrics (refer to Section 16). These metrics are used to drive continuous improvement in the laboratory's Quality System.

SECTION 6

DOCUMENT CONTROL

6.1 OVERVIEW

The QA Department is responsible for the control of documents used in the laboratory to ensure that approved, up-to-date documents are in circulation and out-of-date (obsolete) documents are archived or destroyed. The following documents, at a minimum, must be controlled at each laboratory Facility:

- Laboratory Quality Assurance Manual
- Laboratory Standard Operating Procedures (SOP)
- Laboratory Policies
- Work Instructions and Forms
- Corporate Policies and Procedures distributed outside the intranet

The Corporate Quality staff posts Corporate Manuals, SOPs, Policies, Work Instructions, White Papers and Training Materials on the company intranet site. These Corporate documents are only considered controlled when they are read on the intranet site. Printed copies are considered uncontrolled unless the laboratory physically distributes them as controlled documents. A detailed description of the procedure for issuing, authorizing, controlling, distributing, and archiving Corporate documents is found in Corporate SOP No. CW-Q-S-001, Corporate Document Control and Archiving. The laboratory's internal document control procedure is defined in KNOX-QA-0011, Document Control and Distribution.

The laboratory QA Department also maintains access to various references and document sources integral to the operation of the laboratory. This includes reference methods and regulations. Instrument manuals (hard or electronic copies) are also maintained by the laboratory.

The laboratory maintains control of records for raw analytical data and supporting records such as audit reports and responses, logbooks, standard logs, training files, MDL studies, Proficiency Testing (PT) studies, certifications and related correspondence, and nonconformance memos (NCMs). Raw analytical data consists of bound logbooks, instrument printouts, any other notes, magnetic media, electronic data and final reports.

6.2 DOCUMENT APPROVAL AND ISSUE

The pertinent elements of a document control system for each document include a unique document title and number, pagination, the total number of pages of the item or an 'end of document' page, the effective date, revision number and the laboratory's name. The QA personnel are responsible for the maintenance of this system.

Controlled documents are authorized by the QA Department and other laboratory management. In order to develop a new document, an employee submits a draft to the QA Department by way of the group leader/Technical Manager. Upon approval, QA personnel add the identifying version information to the document and retains that document as the official document on file.

That document is then provided to all applicable operational units (may include electronic access). Controlled documents are identified as such and records of their distribution are kept by the QA Department. Document control may be achieved by either electronic or hardcopy distribution.

The QA Department maintains a list of the official versions of controlled documents.

Quality System Policies and Procedures are reviewed at a minimum of every two years and revised as appropriate. Technical procedures used in support of work done for the Department of Defense (DOD) and Department of Energy (DOE), and the TestAmerica Knoxville Quality Assurance Manual must be reviewed at a one year frequency. Changes to documents occur when a procedural change warrants a revision of the document.

6.3 PROCEDURES FOR DOCUMENT CONTROL POLICY

For changes to the QAM, requests for change or revision may be made to the TestAmerica QA Manager. Changes affecting the text of the Corporate Quality Management Plan are forwarded to the Corporate QA Director for review and approval. If the proposed changes are accepted, they are incorporated into the next revision of the appropriate section of the QAM. Each revision to the QAM is approved by the same authorized signatories as shown on the cover page of the QAM. Uncontrolled copies must not be used within the laboratory. Previous revisions are archived by the QA department.

For changes to SOPs, refer to SOP No. KNOX-QA-0018, Preparation and Management of Standard Operating Procedures.

Forms, worksheets, work instructions and information are organized by form number and revision number on the QAQC shared directory on a local area network server.

6.4 OBSOLETE DOCUMENTS

All invalid or obsolete documents are removed, or otherwise prevented from unintended use. The laboratory has specific procedures as described above to accomplish this. In general, obsolete documents are collected from employees according to distribution lists and are marked obsolete on the cover or destroyed. At least one copy of the obsolete document is archived as described in Section 14.

SECTION 7

SERVICE TO THE CLIENT

7.1 OVERVIEW

The laboratory has established procedures for the review of work requests and contracts, oral or written. The procedures include evaluation of the laboratory's capability and resources to meet the contract's requirements within the requested time period. All requirements, including the methods to be used, must be adequately defined, documented and understood. For many environmental sampling and analysis programs, testing design is site or program specific and does not necessarily "fit" into a standard laboratory service or product. It is the laboratory's intent to provide both standard and customized environmental laboratory services to our clients.

A thorough review of technical and QC requirements contained in contracts is performed to ensure project success. The appropriateness of requested methods, and the lab's capability to perform them must be established. Projects, proposals and contracts are reviewed for adequately defined requirements and the laboratory's capability to meet those requirements. Alternate test methods that are capable of meeting the clients' requirements may be proposed by the lab. A review of the lab's capability to analyze non-routine analytes is also part of this review process.

All projects, proposals and contracts are reviewed for the client's requirements in terms of compound lists, test methodology requested, sensitivity (detection and reporting levels), accuracy, and precision requirements (% Recovery and RPD). The reviewer ensures that the laboratory's test methods are suitable to achieve these requirements and that the laboratory holds the appropriate certifications and approvals to perform the work. The laboratory and any potential subcontract laboratories must be certified, as required, for all proposed tests.

The laboratory must determine if it has the necessary physical, personnel and information resources to meet the contract, and if the personnel have the expertise needed to perform the testing requested. Each proposal is checked for its impact on the capacity of the laboratory's equipment and personnel. As part of the review, the proposed turnaround time is checked for feasibility.

Electronic or hard copy deliverable requirements are evaluated against the laboratory's capacity for production of the documentation.

If the laboratory cannot provide all services but intends to subcontract such services, whether to another TestAmerica facility or to an outside firm, this is documented and discussed with the client prior to contract approval. (Refer to Section 8 for Subcontracting Procedures.)

The laboratory informs the client of the results of the review if it indicates any potential conflict, deficiency, lack of accreditation, or inability of the lab to complete the work satisfactorily. Any discrepancy between the client's requirements and the laboratory's capability to meet those requirements is resolved in writing before acceptance of the contract. It is necessary that the contract be acceptable to both the laboratory and the client. Amendments initiated by the client and/or TestAmerica, are documented in writing.

All contracts, QAPPs, Sampling and Analysis Plans (SAPs), contract amendments, and documented communications become part of the project record.

The same contract review process used for the initial review is repeated when there are amendments to the original contract by the client, and the participating personnel are informed of the changes.

7.2 REVIEW SEQUENCE AND KEY PERSONNEL

The contract review process is outlined in SOP No. CA-L-P-002**,** Contract Compliance Policy.

This review encompasses all facets of the operation. The scope of work is distributed to the appropriate personnel, as needed based on scope of contract, to evaluate all of the requirements. Appropriate personnel may include:

- Contract Administrator
- VP of Operations
- Laboratory Manager of Project Managers
- The Laboratory Operations Manager
- Laboratory and/or Corporate Technical Managers / Directors
- Laboratory and/or Corporate Information Technology Managers/Directors
- Account Executives
- Laboratory and/or Corporate Quality
- Laboratory and/or Corporate Environmental Health and Safety Managers/Directors
- The Laboratory Director reviews the formal laboratory quote and makes final acceptance for their facility.

For routine projects and other simple tasks, a review by the Project Manager (PM) is considered adequate. The PM confirms that the laboratory has any required certifications, that it can meet the clients' data quality and reporting requirements and that the lab has the capacity to meet the clients turn around needs.

The Sales Director, Contract Administrator, Account Executive, or local account representative then submits the final proposal to the client.

In the event that one of the above personnel is not available to review the contract, his or her back-up fulfills the review requirements.

The Contracts Department maintains copies of all signed contracts*.* The Project Manager also maintains a copy.

7.3 DOCUMENTATION

Appropriate records are maintained for every contract or work request. All stages of the contract review process are documented and include records of any significant changes. This information is archived in the project files.

The contract is distributed to and maintained by the appropriate sales/marketing personnel and the Regional Account Manager. A copy of the contract and formal quote is filed with the Laboratory Project Manager and/or the Laboratory Director.

Records are maintained of pertinent discussions with a client relating to the client's requirements or the results of the work during the period of execution of the contract. The PM keeps a phone log of conversations with the client. This information is archived in the project file or in the lot folder as appropriate.

7.3.1 Project-Specific Quality Planning

Communication of contract specific technical and QC criteria is an essential activity in ensuring the success of site specific testing programs. To achieve this goal, the laboratory assigns a PM to each client. The PM is the first point of contact for the client. It is the PMs responsibility to ensure that project specific technical and QC requirements are effectively evaluated and communicated to the laboratory personnel before and during the project. QA department involvement may be needed to assist in the evaluation of custom QC requirements.

PMs are the primary client contact and they ensure resources are available to meet project requirements. Although PMs do not have direct reports or staff in production, they coordinate opportunities and work with laboratory management and supervisory staff to ensure available resources sufficient to perform work for the client's project. Project management is positioned between the client and laboratory resources.

Project specific instructions are communicated to the laboratory through the use of the Client Requirements Checklist in the LIMS or by a Quality Assurance Summary. Further details regarding the communication and documentation of project requirements are found in SOP KNOX-AD-0003, Documenting Project Requirements.

The laboratory strongly encourages client visits to the laboratory and for formal/informal information sharing session with employees in order to effectively communicate ongoing client needs as well as project specific details for customized testing programs.

7.4 SPECIAL SERVICES

The laboratory cooperates with clients and their representatives to monitor the laboratory's performance in relation to work performed for the client. It is the laboratory's goal to meet all client requirements in addition to statutory and regulatory requirements. The laboratory has procedures to ensure confidentiality to clients (Section 15 and 25).

The laboratory's standard procedures for reporting data are described in Section 25. Special services are also available and provided upon request. These services include:

- Reasonable access for our clients or their representatives to the relevant areas of the laboratory for the witnessing of tests performed for the client.
- Assist client-specified third party data validators as specified in the client's contract.

- Supplemental information pertaining to the analysis of their samples. Note: An additional charge may apply for additional data/information that was not requested prior to the time of sample analysis or previously agreed upon.

7.5 CLIENT COMMUNICATION

PMs are the primary communication link to the clients. They inform their clients of any delays in project completion as well as any non-conformances in either sample receipt or sample analysis. Project management maintains ongoing client communication throughout the entire client project.

Technical Managers are available to discuss any technical questions or concerns that the client may have.

7.6 REPORTING

The laboratory works with our clients to produce any special communication reports required by the contract.

7.7 CLIENT SURVEYS

The laboratory assesses both positive and negative client feedback. The results are used to improve overall laboratory quality, client service, and testing activities.

TestAmerica's Sales and Marketing teams periodically develops lab and client specific surveys to assess client satisfaction.

SECTION 8

SUBCONTRACTING OF TESTS

8.1 OVERVIEW

For the purpose of this quality manual, the phrase subcontract laboratory refers to a laboratory external to the TestAmerica laboratories. The phrase "work sharing" refers to internal transfers of samples between the TestAmerica laboratories. The term outsourcing refers to the act of subcontracting tests.

When contracting with our clients, the laboratory makes commitments regarding the services to be performed and the data quality for the results to be generated. When the need arises to outsource testing for our clients because project scope, changes in laboratory capabilities, capacity or unforeseen circumstances, we must be assured that the subcontractors or work sharing laboratories understand the requirements and meet the same commitments we have made to the client. Refer to TestAmerica's Corporate SOPs on Subcontracting Procedures (CW-L-S-004) and the Work Sharing Process (CA-C-S-001).

When outsourcing analytical services, the laboratory assures, to the extent necessary, that the subcontract or work sharing laboratory maintains a program consistent with the requirements of this document, the requirements specified in TNI/ISO 17025 and/or the client's Quality Assurance Project Plan (QAPP). All QC guidelines specific to the client's analytical program are transmitted to the subcontractor and agreed upon before sending the samples to the subcontract facility. Additionally, work requiring accreditation is placed with an appropriately accredited laboratory. The laboratory performing the subcontracted work is identified in the final report, as is non-TNI accredited work where required.

Project Managers (PMs), Client Relations Managers, or Account Executives for the Export Lab are responsible for obtaining client approval prior to subcontracting any samples. The laboratory advises the client of a subcontract arrangement in writing and when possible approval from the client is retained in the project folder. Standard TestAmerica Terms & Conditions include the flexibility to subcontract samples within the TestAmerica laboratories. Therefore, additional advance notification to clients for intra-laboratory subcontracting is not necessary unless specifically required by a client contract.

Note: In addition to the client, some regulating agencies (e.g., USDA) or contracts (e.g., DoD and DOE projects) require notification prior to placing such work. Unless the work is done directly for the USDA, this notification is made to the client who is responsible for ensuring notification of the regulating agency.

8.2 QUALIFYING AND MONITORING SUBCONTRACTORS

Whenever a PM, Account Executive (AE) or Client Relations Manager (CSM) becomes aware of a client requirement or laboratory need where samples must be outsourced to another laboratory, the other laboratory(s) are selected based on the following:

- Subcontractors specified by the client - In these circumstances, the client assumes responsibility for the quality of the data generated from the use of a subcontractor.

- Subcontractors reviewed by TestAmerica – Firms which have been reviewed by the company and are known to meet standards for accreditations (e.g., State, TNI and DoD/DOE); technical specifications; legal and financial information.

A listing of vendors is available on the TestAmerica intranet site.

All TestAmerica laboratories are pre-qualified for work sharing provided they hold the appropriate accreditations, can adhere to the project/program requirements, and the client approved sending samples to that laboratory. The client must provide acknowledgement that the samples can be sent to that facility (an e-mail is sufficient documentation or if acknowledgement is verbal, the date, time, and name of person providing acknowledgement must be documented). The originating laboratory is responsible for communicating all technical, quality, and deliverable requirements as well as other contract needs. (Corporate SOP No. CA-C-S-001, Work Sharing Process).

8.2.1 When the potential subcontract laboratory has not been previously approved, PMs may nominate a laboratory as a subcontractor based on need. The decision to nominate a laboratory must be approved by the Laboratory Director. The Laboratory Director requests that the PM begin the process of approving the subcontract laboratory as outlined in Corporate SOP No. CW-L-S-004, Subcontracting Procedures.

Once the appropriate accreditation and legal information is received by the laboratory, it is evaluated for acceptability (where applicable) and forwarded to the Corporate Quality Information Manager (QIM) for review. After the Corporate QIM reviews the documents for completeness, the Corporate QIM will forward the documents to the Finance Department for formal signature and contracting with the laboratory. The approved vendor will be added to the approved subcontractor list on the intranet site and the finance group is concurrently notified for JD Edwards.

The client will assume responsibility for the quality of the data generated from the use of a subcontractor they have requested the lab to use. The qualified subcontractors on the intranet site are known to meet minimal standards. TestAmerica does not certify laboratories. The subcontractor is on our approved list and can only be recommended to the extent that we would use them.

8.3 OVERSIGHT AND REPORTING

8.3.1 The status and performance of qualified subcontractors will be monitored by the Corporate Quality department. Any problems identified will be brought to the attention of TestAmerica's Corporate Finance, Legal and Corporate Quality personnel.

- Complaints shall be investigated. Documentation of the complaint, investigation and corrective action will be maintained in the subcontractor's file on the intranet site. Complaints are posted using the Vendor Performance Report.
- Information shall be updated on the intranet when new information is received from the subcontracted laboratories.
- Subcontractors in good standing will be retained on the intranet listing. CSO personnel will notify all TestAmerica laboratories, Corporate Quality and Corporate Contracts if any laboratory requires removal from the intranet site. This notification will be posted on the

intranet site and e-mailed to all CSO Personnel, Laboratory Directors, QA Managers and Sales Personnel.

Prior to initially sending samples to the subcontracted laboratory, the PM confirms their certification status to determine if it's current and scope-inclusive. The information is documented within the project records.

8.3.2 For continued use of a subcontractor, verification of certification is placed upon the subcontractor for the defined project. Samples are subcontracted under Chain of Custody with the program defined as 'Accreditation Required' and the following statement for verification upon sample receipt:

Note: Since laboratory accreditations are subject to change, TestAmerica Laboratories, Inc. places the ownership of method, analyte & accreditation compliance upon our subcontract laboratories. This sample shipment is forwarded under Chain of Custody. If the laboratory does not currently maintain accreditation in the State of Origin listed above for analytes/tests/matrix being analyzed, the samples must be shipped back to the TestAmerica laboratory or other instructions will be provided. Any changes to accreditation status should be brought to TestAmerica Laboratories, Inc. attention immediately. If all requested accreditations are current to date, return the signed Chain of Custody attesting to said compliance to TestAmerica Laboratories, Inc.

For TestAmerica laboratories, certifications can be viewed on the company's TotalAccess Database.

8.3.3 All subcontracted samples must be accompanied by a TestAmerica Chain of Custody (COC). A copy of the original COC sent by the client must be available in TALS for all samples workshared within TestAmerica. Client COCs are only forwarded to external subcontractors when samples are shipped directly from the project site to the subcontractor lab. Under routine circumstances, client COCs are not provided to external subcontractors.

Through communication with the subcontracted laboratory, the PM monitors the status of the subcontracted analyses, facilitates successful execution of the work, and ensures the timeliness and completeness of the analytical report.

Non-TNI accredited work must be identified in the subcontractor's report as appropriate. If TNI accreditation is not required, the report does not need to include this information.

Reports submitted from subcontractor laboratories are not altered and are included in their original form in the final project report. This clearly identifies the data as being produced by a subcontractor facility. If subcontract laboratory data is incorporated into the laboratories EDD (i.e., imported), the report must explicitly indicate which lab produced the data for which methods and samples.

Note: The results submitted by a TestAmerica work sharing laboratory may be transferred electronically and the results reported by the TestAmerica work sharing lab are identified on the final report. The report must explicitly indicate which lab produced the data for which methods and samples. The final report must include a copy of the completed COC for all work sharing reports.

8.4 CONTINGENCY PLANNING

The full qualification of a subcontractor may be waived to meet emergency needs; however, this decision & justification must be documented in the project files, and the 'Purchase Order Terms And Conditions For Subcontracted Laboratory Services' must be sent with the samples and Chain-of-Custody.

In the event this provision is utilized, the laboratory (e.g., PM) will be required to verify and document the applicable accreditations of the subcontractor. All other quality and accreditation requirements will still be applicable, but the subcontractor need not have signed a subcontract with TestAmerica at this time.

The use of any emergency subcontractor will require the PM to complete a JDE New Vendor Add Form in order to process payment to the vendor and add them to TALS. This form requires the user to define the subcontractor's category/s of testing and the reason for testing.

SECTION 9

PURCHASING SERVICES AND SUPPLIES

9.1 OVERVIEW

Evaluation and selection of suppliers and vendors is performed, in part, on the basis of the quality of their products, their ability to meet the demand for their products on a continuous and short term basis, the overall quality of their services, their past history, and competitive pricing. This is achieved through evaluation of objective evidence of quality furnished by the supplier, which can include certificates of analysis, recommendations, and proof of historical compliance with similar programs for other clients. To ensure that quality critical consumables and equipment conform to specified requirements, all purchases from specific vendors are approved by a member of the supervisory or management staff. Capital expenditures are made in accordance with the TestAmerica's Capital Expenditure, Controlled Purchase Requests and Fixed Asset Capitalization, SOP No. CW-F-S-007.

Contracts are signed in accordance with the TestAmerica's Company Wide Authorization Policy, CW-F-P-002. (RFP's) are issued where more information is required from the potential vendors than just price. Process details are available in TestAmerica's Corporate Procurement and Contracts Policy (Policy No. CW-F-P-004). RFP's allow TestAmerica to determine if a vendor is capable of meeting requirements such as supplying all of the TestAmerica facilities, meeting required quality standards and adhering to necessary ethical and environmental standards. The RFP process also allows potential vendors to outline any additional capabilities they may offer.

Records for services and supplies that may affect the quality of environmental tests must include the following where applicable: date of receipt, expiration date, source, lot or serial number, calibration and verification records and certifications. See the SOPs referenced in Sections 9.3.3, and 9.5, and Section 22.2 for more details.

9.2 GLASSWARE

Glassware used for volumetric measurements must be Class A or verified for accuracy according to laboratory procedure. Pyrex (or equivalent) glass is used where possible. For safety purposes, thick-wall glassware is used where available and appropriate.

9.3 REAGENTS, STANDARDS & SUPPLIES

Purchasing guidelines for equipment, consumables and reagents must meet with the requirements of the specific method and testing procedures for which they are being purchased. Solvents and acids are pre-tested in accordance with TestAmerica's Corporate SOP on Solvent & Acid Lot Testing & Approval, SOP No. CA-Q-S-001. Approval information for the solvents and acids tested under SOP CA-Q-S-001 is stored on the TestAmerica Sharepoint, under Solvent Approvals. A master list of all tested materials, as well as the certificates of analysis for the materials, is stored in the same location.

9.3.1 Purchasing

Chemical reagents, solvents, glassware, and general supplies are ordered as needed to maintain sufficient quantities on hand. Materials used in the analytical process must be of a known quality. The wide variety of materials and reagents available makes it advisable to specify recommendations for the name, brand, and grade of materials to be used in any determination. This information is contained in the method SOP.

Many consumable items are maintained in an on-site consignment system, where the items in inventory have been pre-approved for laboratory use. On-site consignment is an inventory of commonly used items maintained at the laboratory by a laboratory supply company where they track the supply of items and restock as needed. If an item is not included in the on-site consignment system but is needed for laboratory operations, the group leader or designee enters the request into the JD Edwards system. The vendor item catalogue number is entered into the system to specify the required quality. Each request is reviewed and approved by the Laboratory Director or the Technical Manager (or designee) prior to purchase.

9.3.2 Receiving

It is the responsibility of the laboratory associate (typically sample receiving personnel) to receive the shipment. Once the ordered reagents or materials are received, the analyst compares the information on the label or packaging to the original order to ensure that the purchase meets the quality level specified and documents the date the materials were received. Refer to SOP KNOX-QA-0001 for further details.

The laboratory associate verifies the lot numbers of received solvents and acids against the pre-approval lists. If a received material is listed as unapproved, or is not listed, it is sequestered and returned to the vendor. Alternatively, the laboratory may test the material for the intended use, and if it is acceptable, document the approval on the approval list. Records of any testing performed locally are maintained on the shared “public” folder on the computer network.

Materials may not be released for use in the laboratory until they have been inspected, verified as suitable for use, and the inspection/verification has been documented

Safety Data Sheets (SDSs) are available online through the Company’s intranet website. Anyone may review these for relevant information on the safe handling and emergency precautions of on-site chemicals.

9.3.3 Specifications

Methods in use in the laboratory specify the grade of reagent that must be used in the procedure. If the quality of the reagent is not specified, analytical reagent grade will be used. It is the responsibility of the laboratory analyst to check the procedure carefully for the suitability of grade of reagent.

Chemicals are not to be used past the manufacturer’s expiration date and must not be used past the expiration time noted in a method SOP. If expiration dates are not provided, the laboratory may contact the manufacturer to determine an expiration date.

The laboratory assumes a five year expiration date on inorganic dry chemicals and solvents unless noted otherwise by the manufacturer or by the reference source method.

Chemicals/solvents are not to be used past the manufacturer's or SOPs expiration date unless 'verified' (refer to item 3 listed below).

- An expiration date cannot be extended if the dry chemical/solvent is discolored or appears otherwise physically degraded; the dry chemical must be discarded.

- Expiration dates can be extended if the dry chemical/solvent is found to be satisfactory based on acceptable performance of quality control samples (Continuing Calibration Verification (CCV), Method Blanks, Laboratory Control Sample (LCS), etc.).

- If the dry chemical/solvent is used for the preparation of standards, the expiration dates can be extended 6 months if the dry chemical/solvent is compared to an unexpired independent source in performing the method and the performance of the dry chemical/solvent is found to be satisfactory. The comparison must show that the dry chemical/solvent meets CCV limits. The comparison studies are maintained electronically in the group share on the local area network with the associated scanned calibration files.

Wherever possible, standards must be traceable to national or international standards of measurement or to national or international reference materials. Records to that effect are available to the user.

Compressed gases in use are checked for pressure and secure positioning daily. To prevent a tank from going to dryness or introducing potential impurities, the pressure should be closely watched as it decreases to approximately 15% of the original reading, at which point it should be replaced. For example, a standard sized laboratory gas cylinder containing 3,000 psig of gas should be replaced when it drops to approximately 500 psig. The quality of the gases must meet method or manufacturer specification or be of a grade that does not cause any analytical interference.

Water used in the preparation of standards or reagents must have a specific conductivity of less than 1μmho/cm (or resistivity of greater than 1.0 megaohm-cm) at 25°C. The specific conductivity is checked and recorded daily. If the water's conductivity is greater than the specified limit, the Technical Manager must be notified immediately in order to notify all departments, decide on cessation (based on intended use) of activities, and make arrangements for correction.

The laboratory may purchase reagent grade (or other similar quality) water for use in the laboratory. This water must be certified "clean" by the supplier for all target analytes or otherwise verified by the laboratory prior to use. This verification is documented.

Standard lots are verified before first time use if the laboratory switches manufacturers or has historically had a problem with the type of standard. Spiking standards are verified before use and instrument calibration standards are verified with a second source calibration verification standard. (Note: For Ohio EPA VAP, the continuing calibration verification standard must be from the same source used to prepare the standards used for the calibration curve, unless the analytical method states otherwise.)

Purchased bottleware used for sampling must be certified clean and the certificates must be maintained. If uncertified sampling bottleware is purchased, all lots must be verified clean prior

to use. For trace level analyses where vendors do not provide certification of cleanliness, periodic monitoring of uncertified bottleware is conducted with QA Manager approval instead of checking all bottleware lots. This verification must be maintained.

Tedlar bags purchased by the laboratory must be certified clean and the certificates must be maintained. Tedlar bags are not recommended for trace level analyses as the lab default reporting limits are 20x higher for Tedlar bags than for Summa Canisters.

Required records for solvents and standards are specified in the laboratory SOP KNOX-QA-0001, "Standard/Reagent Labeling and Documentation."

9.3.4 Storage

Reagent and chemical storage is important from the aspects of both integrity and safety. Light-sensitive reagents may be stored in brown-glass containers. Storage conditions are per the Corporate Environmental Health & Safety Manual (Corp. Doc. No. CW-E-M-001) and method SOPs or manufacturer instructions.

9.4 PURCHASE OF EQUIPMENT/INSTRUMENTS/SOFTWARE

When a new piece of equipment is needed, either for additional capacity or for replacing inoperable equipment, the analyst or supervisor makes a supply request to the Technical Manager and/or the Laboratory Director. If they agree with the request the procedures outlined in TestAmerica's Corporate Policy No. CA-T-P-001, Qualified Products List, are followed. A decision is made as to which piece of equipment can best satisfy the requirements. The appropriate written requests are completed and purchasing places the order.

Upon receipt of a new or used piece of equipment, it is given an instrument name in the LIMS, (e.g. MX), and added to the equipment list described in Section 20 maintained by the QA Department. Its capability is assessed to determine if it is adequate or not for the specific application. For instruments, a calibration curve is generated, followed by MDLs, Demonstration of Capabilities (DOCs), and other relevant criteria (refer to Section 19). For software, its operation must be deemed reliable and evidence of instrument verification must be retained by the IT Department as specified in the laboratory's procedure for software verification KNOX-IT-0001. Software certificates supplied by the vendors are filed with IT Department. The manufacturer's operation manual is retained at or near the bench.

9.5 SERVICES

Service to analytical instruments (except analytical balances) is performed on an as needed basis. Routine preventative maintenance is discussed in Section 20. The need for service is determined by laboratory analysts and/or Group Leaders. The service providers that perform the services are approved by the Group Leaders/Technical Manager.

Analytical balances are serviced and calibrated annually in accordance with SOP KNOX-QA-0005, "Balance Calibration and Weight Verification." The calibration and maintenance services are performed on-site, and the balances are returned to use immediately following successful calibration. When the calibration certificates are received (usually within two weeks of the service), they are reviewed, and documentation of the review is filed with the certificates. If the

calibration was unsuccessful, the balance is immediately removed from service and segregated pending either further maintenance or disposal.

Calibration services for support equipment such as thermometers, weight sets, autopipettors, etc, are obtained from vendors with current and valid ISO 17025 accreditation for calibration of the specific piece of equipment. Prior to utilizing the vendor's services, the vendor's accreditation status is verified. Once the equipment has been calibrated, the calibration certificates are reviewed by the QA department, and documentation of the review is filed with the calibration certificates. The equipment is then returned to service within the laboratory

9.6 SUPPLIERS

TestAmerica selects vendors through a competitive proposal / bid process, strategic business alliances or negotiated vendor partnerships (contracts). This process is defined in the Procurement & Contracts Policy (Policy No. CW-F-P-004). The level of control used in the selection process is dependent on the anticipated spending amount and the potential impact on TestAmerica business. Vendors that provide test and measuring equipment, solvents, standards, certified containers, instrument related service contracts or subcontract laboratory services are subject to more rigorous controls than vendors that provide off-the-shelf items of defined quality that meet the end use requirements. The JD Edwards purchasing system includes all suppliers/vendors that have been approved for use.

Evaluation of suppliers is accomplished by ensuring the supplier ships the product or material ordered and that the material is of the appropriate quality. This is documented by signing off on packing slips or other supply receipt documents. The purchasing documents contain the data that adequately describe the services and supplies ordered.

Any issues of vendor performance are to be reported immediately by the laboratory staff to the Corporate Purchasing Group by completing a Vendor Performance Report.

The Corporate Purchasing Group works through the appropriate channels to gather the information required to clearly identify the problem and contacts the vendor to report the problem and to make any necessary arrangements for exchange, return authorization, credit, etc.

As deemed appropriate, the Vendor Performance Reports are summarized and reviewed to determine corrective action necessary, or service improvements required by vendors

The laboratory has access to a listing of all approved suppliers of critical consumables, supplies and services. This information is provided through the JD Edwards purchasing system.

9.6.1 New Vendor Procedure

TestAmerica employees who wish to request the addition of a new vendor must complete a J.D. Edwards Vendor Add Request Form.

New vendors are evaluated based upon criteria appropriate to the products or services provided as well as their ability to provide those products and services at a competitive cost. Vendors are

also evaluated to determine if there are ethical reasons or potential conflicts of interest with TestAmerica employees that would make it prohibitive to do business with them as well as their financial stability. The QA Department and/or the Technical Manager are consulted with vendor and product selection that have an impact on quality.

SECTION 10

COMPLAINTS

10.1 OVERVIEW

The laboratory considers an effective client complaint handling process to be of significant business and strategic value. Listening to and documenting client concerns captures 'client knowledge' that enables our operations to continually improve processes and improve client satisfaction. An effective client complaint handling process also provides assurance to the data user that the laboratory will stand behind its data, service obligations and products.

A client complaint is any expression of dissatisfaction with any aspect of our business services, (e.g., communications, responsiveness, data, reports, invoicing and other functions) expressed by any party, whether received verbally or in written form. Client inquiries, complaints or noted discrepancies are documented, communicated to management, and addressed promptly and thoroughly.

The laboratory has procedures for addressing both external and internal complaints with the goal of providing satisfactory resolution to complaints in a timely and professional manner.

The nature of the complaint is identified, documented and investigated, and an appropriate action is determined and taken. In cases where a client complaint indicates that an established policy or procedure was not followed, the QA Department must evaluate whether a special audit must be conducted to assist in resolving the issue. A written confirmation or letter to the client, outlining the issue and response taken is recommended as part of the overall action taken.

The process of complaint resolution and documentation utilizes the procedures outlined in Section 12 (Corrective Actions) and is documented following the procedure for Nonconformance and Corrective Action System (SOP KNOX-QA-0008). Client complaints are recorded as a type of nonconformance memo (NCM) in TestAmerica LIMS (i.e., TALS), and are summarized in the monthly QA Reports to Management. It is the laboratory's goal to provide a satisfactory resolution to complaints in a timely and professional manner.

10.2 EXTERNAL COMPLAINTS

An employee that receives a complaint initiates the complaint resolution process and the documentation of the complaint.

Complaints fall into two categories: correctable and non-correctable. An example of a correctable complaint would be one where a report re-issue would resolve the complaint. An example of a non-correctable complaint would be one where a client complains that their data was repeatedly late. Non-correctable complaints are reviewed for preventive action measures to reduce the likelihood of future occurrence and mitigation of client impact.

The general steps in the complaint handling process are:

- Receiving and Documenting Complaints
- Complaint Investigation and Service Recovery

- Process Improvement

The laboratory informs the initiator of the complaint of the results of the investigation and the corrective action taken, if any.

10.3 INTERNAL COMPLAINTS

Internal complaints include, but are not limited to: errors and non-conformances, training issues, internal audit findings, and deviations from methods. Corrective actions may be initiated by any staff member who observes a nonconformance and follow the procedures outlined in Section 12. In addition, Corporate Management, Sales and Marketing and Information Technology (IT) may initiate a complaint by contacting the laboratory or through the corrective action system described in Section 12.

10.4 MANAGEMENT REVIEW

The number and nature of client complaints is reported by the QA Manager to the laboratory and QA Director in the QA Monthly report. Monitoring and addressing the overall level and nature of client complaints and the effectiveness of the solutions is part of the Annual Management Review (Section 16).

SECTION 11

CONTROL OF NON-CONFORMING WORK

11.1 OVERVIEW

When data discrepancies are discovered or deviations and departures from laboratory standard procedures, policies and/or client requests have occurred, corrective action is taken immediately. First, the laboratory evaluates the significance of the nonconforming work. Then, a corrective action plan is initiated based on the outcome of the evaluation. If it is determined that the nonconforming work is an isolated incident, the plan could be as simple as adding a qualifier to the final results and/or making a notation in the case narrative. If it is determined that the nonconforming work is a systematic or improper practices issue, the corrective action plan could include a more in depth investigation and a possible suspension of an analytical method. In all cases, the actions taken are documented using the laboratory's corrective action system (refer to Section 12).

Due to the frequently unique nature of environmental samples, sometimes departures from documented policies and procedures are needed. When a laboratory analyst encounters such a situation, the problem is typically discussed with the group leader. The group leader or laboratory analyst may elect to discuss it with the Technical Manager or have the Project Manager contact the client to decide on a logical course of action. Once an approach is agreed upon, the laboratory analyst documents it using the laboratory's corrective action system described in Section 12. This information is supplied to the client in the form of a case narrative with the report.

Note: For Ohio EPA VAP work, the laboratory must implement corrective action procedures to resolve the deviation and limit qualification of the final results. The laboratory is not permitted to deviate from its VAP approved SOP for nonconformances under the laboratory's control if it intends to attest under affidavit that the "results" are VAP certified. When all corrective actions listed in the SOP have been exhausted for nonconformances under the laboratory's control, data still considered qualified is noted as not VAP certified on the affidavit. The SOPs must include exceptions to taking corrective actions for situations outside the laboratory's control. For example, this includes but is not limited to samples prepared or analyzed outside holding times due to no fault of the laboratory and insufficient sample amount. The positive or negative bias associated with the situation outside the laboratory's control must be narrated as described in the SOP and the data is reported as VAP certified on the affidavit.

Project Managers may encounter situations where a client may request that a special procedure be applied to a sample that is not standard lab practice. Based on a technical evaluation, the lab may accept or opt to reject the request based on technical or ethical merit. If accepted, such a request is documented in project specific instructions to the laboratory.

11.2 RESPONSIBILITIES AND AUTHORITIES

Under certain circumstances the Laboratory Director, Technical Manager, Group Leader or the QA Manager may exceptionally authorize departures from documented procedures or policies depending on the nature and extent of the departure. The departures may be a result of

procedural changes due to the nature of the sample; a one-time procedure for a client; QC failures with insufficient sample to reanalyze, etc. In most cases, the client is informed of the departure prior to the reporting of the data. Any departures must be well documented using the laboratory's corrective action procedures. This information may also need to be documented on data review checklists as appropriate. Any impacted data must be referenced in a case narrative and/or flagged with an appropriate data qualifier.

Any misrepresentation or possible misrepresentation of analytical data discovered by any laboratory staff member must be reported to facility Senior Management within 24-hours. The Senior Management staff is comprised of the Laboratory Director, the QA Manager, the Client Relations Manager, the Technical Manager(s) and the Operations Manager. The Laboratory Director and QA Manager must be included in the notification. The reporting of issues involving alleged violations of the company's Data Integrity or Manual Integration procedures must be conveyed to an Ethics and Compliance Officer (ECO), (e.g., the VP QA/EHS) and the laboratory's Quality Director within 24 hours of discovery.

Whether an inaccurate result was reported due to calculation or quantitation errors, data entry errors, improper practices, or failure to follow SOPs, the data must be evaluated to determine the possible effect.

The Laboratory Director, QA Manager, ECOs, VP of Operations and the Quality Directors have the authority and responsibility to halt work, withhold final reports, or suspend an analysis for due cause as well as authorize the resumption of work.

11.3 EVALUATION OF SIGNIFICANCE AND ACTIONS TAKEN

For each nonconforming issue reported, an evaluation of its significance and the level of management involvement needed is made. This includes reviewing its impact on the final data, whether or not it is an isolated or systematic issue, and how it relates to any special client requirements.

Corporate SOP entitled Data Recalls (CW-Q-S-005) is the procedure to be followed when it is discovered that erroneous or biased data may have been reported to clients or regulatory agencies.

Corporate SOP entitled Internal Investigations (CW-L-S-002) is the procedure to be followed for investigation and correction of situations that involved alleged incidents of misconduct or violation of the company's ethics policy.

Laboratory level decisions are documented and approved using the laboratory's standard nonconformance/corrective action reporting (Section 13) in lieu of the data recall determination form contained in TestAmerica's Corporate SOP No. CW-Q-S-005.

11.4 PREVENTION OF NONCONFORMING WORK

If it is determined that the nonconforming work could recur, further corrective actions must be made following the laboratory's corrective action system. On a monthly basis, the QA Department evaluates non-conformances to determine if any nonconforming work has been repeated multiple times. If so, the laboratory's corrective action process may be followed.

11.5 METHOD SUSPENSION/RESTRICTION (STOP WORK PROCEDURES)

In some cases it may be necessary to suspend/restrict the use of a method or target compound which constitutes significant risk and/or liability to the laboratory. Suspension/restriction procedures can be initiated by any of the persons noted in Section 11.2, Paragraph 5.

Prior to suspension/restriction, confidentiality is respected, and the problem with the required corrective and preventive action is stated in writing and presented to the Laboratory Director.

The Laboratory Director arranges for the appropriate personnel to meet with the QA Manager as needed. This meeting is held to confirm that there is a problem, that suspension/restriction of the method is required and is concluded with a discussion of the steps necessary to bring the method/target or test fully back on line. In some cases that may not be necessary if all appropriate personnel have already agreed there is a problem and there is agreement on the steps needed to bring the method, target or test fully back on line. The QA Manager also initiates a corrective action report as described in Section 12 if one has not already been started. A copy of any meeting notes and agreed upon steps must be faxed or e-mailed by the laboratory to the appropriate General Manager and member of Corporate QA. This fax/e-mail acts as notification of the incident.

After suspension/restriction, the lab will hold all reports to clients pending review. No faxing, mailing or distributing through electronic means may occur. The report must not be posted for viewing on the internet. It is the responsibility of the Laboratory Director to hold all reporting and to notify all relevant laboratory personnel regarding the suspension/restriction (i.e., Project Management, Log-in, etc.). Clients are NOT generally be notified at this time. Analysis may proceed in some instances depending on the nonconformance issue.

Within 72 hours, the QA Manager determines if compliance is now met and reports can be released, OR determine the plan of action to bring work into compliance, and release work. A team, with all principals involved (Laboratory Director, Technical Manager, QA Manager, Project Manager, Group Leader) devises a start-up plan to cover all steps from client notification through compliance and release of reports. Project Management and the Directors of Client Services and Sales and Marketing must be notified if clients must be notified or if the suspension/restriction affects the laboratory's ability to accept work. The QA Manager must approve start-up or elimination of any restrictions after all corrective action is complete. This approval is given by final signature on the completed corrective action report.

SECTION 12

CORRECTIVE ACTION

12.1 OVERVIEW

A major component of TestAmerica's Quality Assurance (QA) Program is the problem investigation and feedback mechanism designed to keep the laboratory staff informed on quality related issues and to provide insight to problem resolution. When nonconforming work or departures from policies and procedures in the quality system or technical operations are identified, the corrective action procedure provides a systematic approach to assess the issues, restore the laboratory's system integrity, and prevent reoccurrence. Corrective actions are documented using Nonconformance Memos (NCMs) and Corrective Action Reports (CARs) (refer to Figure 12-1). Corrective actions for internal or external systems audit findings are documented using the corrective action responses to each audit.

12.2 GENERAL

Problems within the quality system or within analytical operations may be discovered in a variety of ways, such as QC sample failures, internal or external audits, proficiency testing (PT) performance, client complaints, staff observation, etc.

The purpose of a corrective action system is to:

- Identify non-conformance events and assign responsibility for investigation.
- Resolve non-conformance events and assign responsibility for any required corrective action.
- Identify systematic problems before they become serious.
- Identify and track Client complaints and provide resolution (see more on client complaints in Section 11).

12.2.1 Nonconformance Memo (NCM) - is used to document the following types of corrective actions:

- Deviations from an established procedure or SOP.
- QC outside of limits (non matrix related).
- Isolated Reporting / Calculation Errors.
- Client Complaints.
- Equipment Failures (Equipment Tag-out)
- Discrepancies in materials / goods received vs. manufacturer packing slips.

See SOP KNOX-QA-0008, Nonconformance and Corrective Action System, current revision, for details.

12.2.2 Corrective Action Report (CAR) - is used to document the following types of corrective actions:

- Questionable trends that are found in the review of NCMs.
- Issues found while reviewing NCMs that warrant further investigation.
- Internal and external audit findings.
- Failed or Unacceptable PT results.
- Corrective actions that cross multiple departments in the laboratory.
- Systematic Reporting / Calculation Errors.
- Excessive revised reports.
- Identified poor process or method performance trends.

This will provide background documentation to enable root cause analysis and preventive action. Data Recall Investigations, and Client Complaints are tracked as part of the laboratory's corrective action tracking system.

12.3 CLOSED LOOP CORRECTIVE ACTION PROCESS

Any employee in the company can initiate a corrective action. There are four main components to a closed-loop corrective action process once an issue has been identified: Cause Analysis, Selection and Implementation of Corrective Actions (both short and long term), Monitoring of the Corrective Actions, and Follow-up.

12.3.1 Cause Analysis

- Upon discovery of a non-conformance event, the event must be defined and documented. A CAR or NCM must be initiated, someone is assigned to investigate the issue and the event is investigated for cause. Table 12-1 provides some general guidelines on determining responsibility for assessment.
- The cause analysis step is the key to the process as a long term corrective action cannot be determined until the cause is determined.
- If the cause is not readily obvious, the Group Leader, Technical Manager, or QA Manager (or QA designee) is consulted.

12.3.2 Selection and Implementation of Corrective Actions

- Where corrective action is needed, the laboratory identifies potential corrective actions. The action(s) most likely to eliminate the problem and prevent recurrence are selected and implemented. Responsibility for implementation is assigned.
- Corrective actions are to a degree appropriate to the magnitude of the problem identified through the cause analysis.
- Whatever corrective action is determined to be appropriate, the laboratory documents and implements the changes. The CAR or NCM is used for this documentation.

12.3.3 Root Cause Analysis

Root Cause Analysis is a class of problem solving (investigative) methods aimed at identifying the basic or causal factor(s) that underlie variation in performance or the occurrence of a significant failure. At first glance, the immediate response is typically directed at a symptom and

not the cause. Typically, root cause analysis works best with three or more incidents to triangulate a weakness. Corporate SOP Root Cause Analysis (No. CA-Q-S-009) describes the procedure.

Systematically analyze and document the Root Causes of the more significant problems that are reported. Identify, track, and implement the corrective actions required to reduce the likelihood of recurrence of significant incidents. Trend the root cause data from these incidents to identify root causes that, when corrected, can lead to dramatic improvements in performance by eliminating entire classes of problems.

Identify the one event associated with problem and ask why this event occurred. Brainstorm the root causes of failures; for example, by asking why events occurred or conditions existed; and then why the cause occurred 5 consecutive times until you get to the root cause. For each of these sub events or causes, ask why it occurred. Repeat the process for the other events associated with the incident.

Root cause analysis does not mean the investigation is over. Look at technique, or other systems outside the normal indicators. Often creative thinking finds root causes that ordinarily would be missed, and continue to plague the laboratory or operation.

12.3.4 Monitoring of the Corrective Actions

- The Group Leaders, Operation Manager and QA Manager are responsible to ensure that the corrective action taken was effective.
- Ineffective actions are documented and re-evaluated until acceptable resolution is achieved. Group Leaders are accountable to the Laboratory Director to ensure final acceptable resolution is achieved and documented appropriately.
- Each NCM is entered into a database for tracking purposes and a monthly summary of all NCMs is printed out for review to aid in ensuring that the appropriate corrective actions have taken effect. CARs are also compiled and reviewed monthly.
- TestAmerica laboratories began using the Incident/Corrective Action Tracker (iCAT) database developed by the company in 2015. (Previously, a local database served this purpose.) An incident is an event triggering the need for one or more corrective actions as distinct from a corrective action, a potential deficiency stemming from an incident that requires investigation and possibly fixing. The database is independent of TALS, available to all local and corporate managers, and capable of notifying and tracking multiple corrective actions per event, dates, and personnel. iCAT allows associated document upload, categorization (such as, external/internal audit, client service concerns, data quality issues, proficiency testing, etc.), and trend analysis. Refer to Figure 12-1.
- The QA Manager reviews monthly NCMs for trends. Highlights are included in the QA monthly report (refer to Section 16). If a significant trend develops that adversely affects quality, an audit of the area is performed and corrective action implemented.
- Any out-of-control situations that are not addressed acceptably at the laboratory level may be reported to the Corporate Quality Director by the QA Manager, indicating the nature of the out-of-control situation and problems encountered in solving the situation.

12.3.5 Follow-up Audits

- Follow-up audits may be initiated by the QA Manager and are performed as soon as possible when the identification of a nonconformance casts doubt on the laboratory's compliance with its own policies and procedures, or on its compliance with state or federal requirements. (Section 15 includes additional information regarding internal audit procedures.)
- These audits often follow the implementation of the corrective actions to verify effectiveness. An additional audit would only be necessary when a critical issue or risk to business is discovered.

12.4 TECHNICAL CORRECTIVE ACTIONS

In addition to providing acceptance criteria and specific protocols for technical corrective actions in the method SOPs, the laboratory has general procedures to be followed to determine when departures from the documented policies and procedures and quality control have occurred (refer to Section 11 for information regarding the control of non-conforming work). The documentation of these procedures is through the use of an NCM.

Table 12-1 includes examples of general technical corrective actions. For specific criteria and corrective actions refer to specific method SOPs.

Table 12-1 provides some general guidelines for identifying the individual(s) responsible for assessing each QC type and initiating corrective action. The table also provides general guidance on corrective actions if associated QC measurements are unacceptable. Specific procedures are included in Method SOPs, and QAM Sections 19 and 20. All corrective actions are reviewed monthly, at a minimum, by the QA Manager and highlights are included in the QA monthly report.

To the extent possible, samples are reported only if all quality control measures are acceptable. If the deficiency does not impair the usability of the results, data are reported with an appropriate data qualifier and/or the deficiency is noted in the case narrative. Where sample results may be impaired, the Project Manager is notified by NCM and appropriate corrective action (e.g., reanalysis) is taken and documented**.**

12.5 BASIC CORRECTIONS

When mistakes occur in records, each mistake is crossed-out, [not obliterated (e.g. no white-out)], and the correct value entered alongside. All such corrections are initialed (or signed) and dated by the person making the correction. In the case of records stored electronically, the original "uncorrected" file must be maintained intact and a second "corrected" file is created.

This same process applies to adding additional information to a record. All additions made later than the initial must also be initialed (or signed) and dated.

When corrections are due to reasons other than obvious transcription errors, the reasons for the corrections (or additions) are also documented.

Figure 12-1.
Example – Corrective Action Report

10/17/2017 ICat Corrective Action 7035 for Incident 2591

TestAmerica Knoxville - Quality Assurance

Corrective Action 7035

Incident 2591: CAR 2017#1 SSAS failure for Hydrogen Chloride
Incident Status: Closed
Response Due to Client: Friday, Feb 17, 2017

Created By:	Kevin McGee	Created On:	Thursday, Feb 9, 2017
Laboratory Function:	Method Performance Studies and On-Going Cks	Date Follow-up Due:	Tuesday, Feb 28, 2017
Corrective Action Type:	Bias and precision studies	Date Follow-up Done:	Wednesday, Mar 1, 2017
Department:		Response Due to QA:	Friday, Feb 17, 2017
Finding Number:		Planned Closure Date:	Tuesday, Feb 28, 2017
Is Repeat Finding?:	No	Date Closed:	Wednesday, Mar 1, 2017
Finding Reference:			
Assigned To/Lead:	Donald Wasmund		
Priority:	3 (Normal Importance)		
Follow-up Assigned To:	Kevin McGee		
C.A. Status:	Closed		

Issue Requiring Corrective Action:

Hydrogen Chloride in impinger solution for lot # 120116P was outside of acceptance limits. The reported value for Hydrogen Chloride was 5.39 mg/L with an assigned value of 6.06 mg/L. The acceptance range was 5.45-6.67 mg/L.

Investigation/Response:

a) The acceptance limits of +/- 10% for the source air audit sample is narrow. b) The CCV for the original analysis was -5%.and c) the assigned value was approximately 7 to 8% lower than claimed by the manufacturer. The instrument was recalibrated and the results for CCV/LCS data were within 99-100%. The original run had CCVs at 94-95%. The retest result passed at 103% recovery. However, the retest of the original audit sample passed at 94%. The group leader believes the source air audit sample was 7 – 8 % lower than claimed by the manufacturer. The client's data was accepted within HT and there was no adverse effect except extra costs associated with the reanalysis with a new source air audit sample.

Root Cause:

a) The acceptance limits of +/- 10% for the source air audit sample is narrow. b) The CCV for the original analysis was -5%.and c) the assigned value was approximately 7 to 8% lower than claimed by the manufacturer. The instrument was recalibrated and the results for CCV/LCS data were within 99-100%. The original run had CCVs at 94-95%. The retest result passed at 103% recovery. However, the retest of the original audit sample passed at 94%. The group leader believes the source air audit sample was 7 – 8 % lower than claimed by the manufacturer. The client's data was accepted within HT and there was no adverse effect except extra costs associated with the reanalysis with a new source air audit sample.

Corrective Action Plan:

1. Recalibrate instrument. Reanalyze the original samples along with a new audit sample, within holding time. 2. Reissue deliverable including the new audit results. 3. Review audit results when received.

Corrective Action Documents (0)

No documents.

For QA Use Only

QA Comments	Follow Up
Enter a QA Comment	*Enter Follow Up*

Notifications

Location QA (notification required)

Name	Title
Kevin McGee	QA Manager
Annette Ribet	Project Management Assistant II
Hayley Waterland	

Additional Notifications

Name	Title
Annette Ribet	Project Management Assistant II
Donald Wasmund	Senior Analytical Consultant
Kevin McGee	QA Manager
Robyn Wagner	Operations Manager

http://icat.testamericainc.com/CorrectiveAction?actionId=7035 1/1

Table 12-1.

Example – General Corrective Action Procedures

QC Activity ***(Individual Responsible for Initiation/Assessment)***	**Acceptance Criteria**	**Recommended Corrective Action**
Initial Instrument Blank *(Analyst)*	- Instrument response < Reporting Limit (RL)[1].	- Prepare another instrument blank. - If same response, determine cause of contamination: reagents, environment, instrument equipment failure, etc.
Initial Calibration Standards *(Analyst, Group Leader)*	- Correlation coefficient r≥0.990 for organics and r≥0.995 for inorganics or - %RSD within acceptance range. - See details in Method SOP.	- Reanalyze standards. - If still unacceptable, remake standards and recalibrate instrument.
Tuning (GC/MS Methods) (Analyst)	- Refer to Method SOP for specific ion criteria.	- Retune instrument and verify. (Samples may not be run without valid tune)
Independent Calibration Verification (Second Source) *(Analyst, Group Leader)*	- % Recovery within acceptance limits.	- Remake and reanalyze standard. - If still unacceptable, then remake calibration standards or use new primary standards and recalibrate instrument.
Continuing Calibration Standards *(Analyst, Data Reviewer)*	% Difference (or %Drift) within acceptance limits.	- Reanalyze standard. - If still unacceptable, then recalibrate and rerun affected samples.
Matrix Spike / Matrix Spike Duplicate (MS/MSD) *(Analyst, Data Reviewer)*	- % Recovery within limits documented in TALS.	- If the acceptance criteria for duplicates or matrix spikes are not met because of matrix interferences, the acceptance of the analytical batch is determined by the validity of the LCS. - If the LCS is within acceptable limits the batch is acceptable. - The results of the duplicates, matrix spikes and the LCS are reported with the data set. - For matrix spike or duplicate results outside criteria the data for that sample shall be reported with qualifiers.
Laboratory Control Sample (LCS) and LCSD (where applicable) *(Analyst, Data Reviewer)*	- % Recovery within limits specified in QuantIMS. This includes any allowable marginal exceedance (Marginal Exceedances are not allowed for Ohio VAP).	- Batch must be re-prepared and re-analyzed. **Note:** See Method SOPs for further details. For example, if there is insufficient sample or the holding time cannot be met, contact client and report with flags.

QC Activity ***(Individual Responsible for Initiation/Assessment)***	**Acceptance Criteria**	**Recommended Corrective Action**
Surrogates *(Analyst, Data Reviewer)*	- % Recovery within limits specified in TALS.	- Individual sample must be repeated. - Surrogate results outside criteria shall be reported with qualifiers. **Note:** See Method SOPs for further details. For example, if there is insufficient sample or the holding time cannot be met, contact client and report with flags.
Method Blank (MB) *(Analyst, Data Reviewer)*	< Reporting Limit [1]	- Reanalyze Method Blank. - If still positive, determine source of contamination. If necessary, reprocess (i.e. digest or extract) entire sample batch. Report Method blank results. - Qualify the result(s) if the concentration of a targeted analyte in the Method Blank is at or above the reporting limit AND is > 1/10 of the amount measured in the sample.

Note:
1. See specific method SOPs for acceptance criteria. Concentrations up to five times the reporting limit may be allowed for the common laboratory and reagent contaminants: methylene chloride, toluene, acetone, 2-butanone and phthalates. Some program requirements (e.g. DOD QSM and Ohio EPA VAP) have more stringent requirements that must be followed when performing work for those programs. For example, DOD QSM requires the Method Blanks < ½ Reporting Limit with common lab contaminants <Reporting Limit. (Note: Ohio EPA VAP requires all analytes of concern in Method Blanks to be less than the RL.)

SECTION 13

PREVENTIVE ACTION / IMPROVEMENT

13.1 OVERVIEW

The laboratory's preventive action programs improve or eliminate potential causes of nonconforming product and/or nonconformance to the quality system. This preventive action process is a proactive and continuous process of improvement activities that can be initiated through feedback from clients, employees, business providers, and affiliates. The QA Department has the overall responsibility to ensure that the preventive action process is in place, and that relevant information on actions is submitted for management review.

Dedicating resources to an effective preventive action system emphasizes the laboratory's commitment to its Quality Program. It is beneficial to identify and address negative trends before they develop into complaints, problems and corrective actions. Additionally, the laboratory continually strives to improve customer service and satisfaction through continuous improvements to laboratory systems.

Opportunities for improvement may be discovered through any of the following:

- review of the monthly QA Metrics Report,
- trending NCMs,
- review of control charts and QC results,
- trending proficiency testing (PT) results,
- performance of management system reviews,
- trending client complaints,
- review of processing operations, or
- staff observations.

The monthly QA Metrics Report shows performance indicators in all areas of the laboratory and quality system. These areas include revised reports, corrective actions, audit findings, internal auditing and data authenticity audits, client complaints, PT samples, holding time violations, SOPs, ethics training, etc. The metrics report is reviewed monthly by the laboratory management, Corporate QA and TestAmerica's Executive Committee. These metrics are used in evaluating the management and quality system performance on an ongoing basis and provide a tool for identifying areas for improvement.

Items identified as continuous improvement opportunities to the management system may be issued as goals from the annual management systems review, recommendations from internal audits, white papers, Lesson Learned, Technical Services audit report, Technical Best Practices, or as Corporate or management initiatives.

The laboratory's corrective action process is integral to implementation of preventive actions. A critical piece of the corrective action process is the implementation of actions to prevent further

occurrence of a non-compliance event. Historical review of corrective action and non-conformances provides a valuable mechanism for identifying preventive action opportunities.

13.1.1 The following elements are part of a preventive action/ process improvement system:

- Identification of an opportunity for preventive action or process improvement.
- Process for the preventive action or improvement.
- Define the measurements of the effectiveness of the process once undertaken.
- Execution of the preventive action or improvement.
- Evaluation of the plan using the defined measurements.
- Verification of the effectiveness of the preventive action or improvement.
- Close-Out by documenting any permanent changes to the Quality System as a result of the Preventive Action or Process Improvement. Documentation of Preventive Action/ process improvement is incorporated into the monthly QA reports, corrective action process, management review, and through the review and revision of the QAM and/or laboratory SOPs.

13.1.2 Any Preventive Actions/Process Improvements undertaken or attempted are taken into account during the Annual Management Systems Review (Section 16). A highly detailed report is not required; however, a summary of successes and failures within the preventive action program is sufficient to provide management with a measurement for evaluation.

13.2 MANAGEMENT OF CHANGE

The Management of Change process is designed to manage significant events and changes that occur within the laboratory. This is routinely managed by the Laboratory Director with input from the General Manager, the QA Manager, Operations Manager, Technical Managers, Group Leaders, and IT support staff. The laboratory manages change by documenting and maintaining a history of organization/staffing, equipment, certifications, and procedures.

Section 14

CONTROL OF RECORDS

The laboratory maintains a records management system appropriate to its needs and that complies with applicable standards or regulations as required. The system produces unequivocal, accurate records that document all laboratory activities. The laboratory retains all original observations, calculations and derived data, calibration records and a copy of the analytical report for a minimum of five years after it has been issued. Refer to SOP KNOX-AD-0001, Record Retention and Document Storage for further details.

14.1 OVERVIEW

The laboratory has established procedures for identification, collection, indexing, access, filing, storage, maintenance and disposal of quality and technical records. A record index is listed in Table 14-1. Quality records are maintained by the QA department in a database, which is backed up as part of the regular network backup. Hardcopy quality records are stored in fireproof filing cabinets. Records are of two types; either electronic or hard copy paper formats depending on whether the record is computer or hand generated (some records may be in both formats). Technical records are maintained by Group Leaders and the local IT staff.

Table 14-1. Record Index[1]

	Record Types [1]:	**Retention Time:**
Technical Records	- Raw Data - Logbooks[2] - Standards - Certificates - Analytical Records - MDLs/IDLs/DOCs - Lab Reports	5 Years from analytical report issue*
Official Documents	- Quality Assurance Manual (QAM) - Work Instructions - Policies - SOPs - Policy Memorandums - Manuals - Published Methods	Indefinitely*
QA Records	-Certifications -Method and Software Validation/Verification Data	Indefinitely*
QA Records	- Internal & External Audits/Response - Corrective/Preventive Actions - Management Reviews - Data Investigation	5 Years from archival* **Data Investigation:** 5 years or the life of the affected raw data storage whichever is greater (beyond 5 years if ongoing project or pending investigation)

	Record Types [1]:	Retention Time:
Project Records	- Sample Receipt & COC Documentation - Contracts and Amendments - Correspondence - QAPP -SAP - Telephone Logbooks - Lab Reports	5 Years from analytical report issue*
Administrative Records	Finance and Business Operations	Refer to CW-L-WI-001
	EH&S Manual, Permits	Indefinitely
	Disposal Records	Indefinitely
	Employee Handbook	Indefinitely
	Personnel files, Employee Signature & Initials, Administrative Training Records (e.g., Ethics)	Refer to HR Manual
	Administrative Policies	Indefinitely
	Technical Training Records	7 years
	Legal Records	Indefinitely
	HR Records	Refer to CW-L-WI-001
	IT Records	Refer to CW-L-WI-001
	Corporate Governance Records	Refer to CW-L-WI-001
	Sales & Marketing	5 years
	Real Estate	Indefinitely

[1] Record Types encompass hardcopy or electronic records.
[2] Examples of Logbook types: Maintenance, Instrument Run, Preparation (standard and samples), Standard and Reagent Receipt, Archiving, Balance Calibration, Temperature (hardcopy or electronic records).
* Exceptions listed in Table 14-2.

14.1.1 All records are stored and retained in such a way that they are secure and readily retrievable at the laboratory facility or the Iron Mountain data storage facility that provides a suitable environment to prevent damage or deterioration and to prevent loss. All records are protected against fire, theft, loss, environmental deterioration, and vermin. In the case of electronic records, storage media are protected from deterioration caused by magnetic fields and/or electronic deterioration.

Access to the data is limited to laboratory and company employees and shall be documented with an access log. Records are maintained for a minimum of five years unless otherwise specified by a client or regulatory requirement.

Note: For the Ohio EPA VAP program the laboratory is required to notify Ohio EPA of its intent to dispose of any records.

For raw data and project records, record retention is calculated from the date the project report is issued. For other records, such as Controlled Documents, QA, or Administrative Records, the retention time is calculated from the date the record is formally retired. Records related to the

programs listed in Table 14-2 have lengthier retention requirements and are subject to the requirements in Section 14.1.3.

14.1.2 Programs with Longer Retention Requirements

Some regulatory programs have longer record retention requirements than the standard record retention time. These are detailed in Table 14-2 with their retention requirements. In these cases, the longer retention requirement is enacted. If special instructions exist such that client data cannot be destroyed prior to notification of the client, the container or box containing that data is marked as to who to contact for authorization prior to destroying the data. Refer to SOP KNOX-AD-0001, Record Retention and Document Storage for details on how records are retained for these programs.

Table 14-2. Special Record Retention Requirements

Program	[1]Retention Requirement
Drinking Water – All States	10 years (lab reports and raw data) 10 years – Radiochemistry (project records)
FIFRA – 40 CFR Part 160	Retain for life of research or marketing permit for pesticides regulated by EPA
Housing and Urban Development (HUD) Environmental Lead Testing	10 years
Alaska	10 years
Louisiana – All	10 years
Michigan Department of Environmental Quality – all environmental data	10 years
NY Potable Water NYCRR Part 55-2	10 years
Ohio EPA VAP	10 years and state contacted prior to disposal
TSCA - 40 CFR Part 792	10 years after publication of final test rule or negotiated test agreement
OSHA	30 years

[1]Note: Extended retention requirements must be noted with the archive documents or addressed in facility-specific records retention procedures.

The laboratory has procedures to protect and back-up records stored electronically and to prevent unauthorized access to or amendment of these records. All analytical data is maintained as hard copy or in a secure readable electronic format. For analytical reports that are maintained as copies in PDF format, refer to section 19.14.1 for more information.

The record keeping system allows for historical reconstruction of all laboratory activities that produced the analytical data, as well as rapid recovery of historical data. The history of the sample from when the laboratory took possession of the samples must be readily understood through the documentation. This includes inter-laboratory transfers of samples and/or extracts.

- The records include the identity of personnel involved in sampling, sample receipt, preparation, or testing. All analytical work contains the initials (at least) of the personnel involved. A copy of the chain of custody is stored with the invoice, associated data review checklists, and other lot specific documents as described in SOP KNOX-AD-0001. The chain of custody would indicate the name of the sampler.

- All information relating to the laboratory facilities equipment, analytical test methods, and related laboratory activities, such as sample receipt, sample preparation, or data verification are documented.

- The record keeping system facilitates the retrieval of all working files and archived records for inspection and verification purposes (e.g., set format for naming electronic files, set format for what is included with a given analytical data set). Instrument data is stored electronically with the Lot raw data for samples and the associated quality control samples. Instrument calibration data is stored electronically by analytical group, method, instrument and date. Run logs are maintained for each instrument; a copy of each day's run log or instrument sequence is stored to aid in reconstructing an analytical sequence. Where an analysis is performed without an instrument, bound logbooks or bench sheets are used to record and file data. Standard and reagent information is recorded in logbooks.

- Changes to hardcopy records follow the procedures outlined in Section 12 and 19. Changes to electronic records in LIMS or instrument data are recorded in audit trails.

- The reason for a signature or initials on a document is clearly indicated in the records such as "sampled by," "prepared by," "reviewed by", or "analyzed by".

- All generated data except those that are generated by automated data collection systems, are recorded directly, promptly and legibly in permanent dark ink.

- Hard copy data may be scanned into PDF format for record storage as long as the scanning process can be verified in order to ensure that no data is lost and the data files and storage media must be tested to verify the laboratory's ability to retrieve the information prior to the destruction of the hard copy that was scanned. The procedure for scanning the records is discussed in SOP KNOX-AD-0004, Data Reporting, and KNOX-AD-0001, Record Retention and Document Storage.

- Also refer to Section 19.13.1 'Computer and Electronic Data Related Requirements'**.**

14.2 TECHNICAL AND ANALYTICAL RECORDS

14.2.1 The laboratory retains records of original observations, derived data and sufficient information to establish an audit trail, calibration records, staff records and a copy of each analytical report issued, for a minimum of five years unless otherwise specified by a client or regulatory requirement (refer to Table 14-2). The records for each analysis contain sufficient information to enable the analysis to be repeated under conditions as close as possible to the original. The records include the identity of laboratory personnel responsible for performance of each analysis and reviewing results.

14.2.2 Observations, data and calculations are recorded real-time they are made and are

identifiable to the specific task.

14.2.3 Changes to hardcopy records follow the procedures outlined in Section 12 and 19. Changes to electronic records in LIMS or instrument data are recorded in audit trails.
The essential information to be associated with analysis, such as strip charts, tabular printouts, computer data files, analytical notebooks, and run logs, include:

- Laboratory sample ID code**;**
- Date of analysis; Time of analysis is also required if the holding time is seventy-two (72) hours or less, or when time critical steps are included in the analysis (e.g., drying times, incubations, etc.); instrumental analyses have the date and time of analysis recorded as part of their general operations. The date and time may also be recorded in the associated logbook or benchsheet.
- Instrumentation identification and instrument operating conditions/parameters. Operating conditions/parameters are typically recorded in instrument maintenance logs.
- Analysis type**;**
- All manual calculations and manual integrations**;**
- Laboratory Analyst's or operator's initials/signature**;**
- Sample preparation including cleanup, separation protocols, lab sample ID codes, volumes, weights, instrument printouts, calculations, and reagents**;**
- Test results**;**
- Standard and reagent origin, receipt, preparation, and use**;**
- Calibration criteria, frequency and acceptance criteria**;**
- Data and statistical calculations, review, confirmation, interpretation, assessment and reporting conventions**;**
- Quality control protocols and assessment**;**
- Electronic data security, software documentation and verification, software and hardware audits, backups, and records of any changes to automated data entries; and
- Method performance criteria including expected quality control requirements. These are indicated in the LIMS or in the associated analytical SOPs

14.2.4 All logbooks used during receipt, preparation, storage, analysis, and reporting of samples or monitoring of support equipment shall undergo a documented supervisory or peer review on a periodic basis.

14.3 LABORATORY SUPPORT ACTIVITIES

In addition to documenting all the above-mentioned activities, the following are retained QA records and project records (previous discussions in this section relate where and how these data are stored):

- All original raw data, whether hard copy or electronic, for calibrations, samples and quality control measures, including analysts' work sheets and data output records (chromatograms, strip charts, and other instrument response readout records)**;**

- A written description or reference to the specific test method used which includes a description of the specific computational steps used to translate parametric observations into a reportable analytical value**;**
- Copies of final reports**;**
- Archived SOPs**;**
- Correspondence relating to laboratory activities for a specific project**;**
- All corrective action reports, audits and audit responses**;**
- Proficiency test results and raw data; and
- Results of data review, verification, and crosschecking procedures.

14.3.1 Sample Handling Records

Records of all procedures to which a sample is subjected while in the possession of the laboratory are maintained. These include but are not limited to records pertaining to:

- Sample preservation including appropriateness of sample container and compliance with holding time requirement;
- Sample identification, receipt, acceptance or rejection and login;
- Sample storage and tracking including shipping receipts, sample transmittal / COC forms; and
- Procedures for the receipt and retention of samples, including all provisions necessary to protect the integrity of samples.

14.4 ADMINISTRATIVE RECORDS

The laboratory also maintains the administrative records in either electronic or hard copy form. See Table 14-1.

14.5 RECORDS MANAGEMENT, STORAGE AND DISPOSAL

14.5.1 All records (including those pertaining to test equipment), certificates and reports are safely stored, held secure and in confidence to the client. Certification related records are available upon request.

14.5.2 All information necessary for the historical reconstruction of data is maintained by the laboratory. Records that are stored only on electronic media must be supported by the hardware and software necessary for their retrieval.

14.5.3 Records that are stored or generated by computers or personal computers have hard copy, write-protected backup copies, or an electronic audit trail controlling access**.**

14.5.4 The laboratory has a record management system for control of laboratory notebooks, instrument logbooks, standards logbooks, and project records. Laboratory notebooks are sequentially numbered by QA and issued to the analytical group as needed. Bench sheets are

filed and archived with the project raw data. Completed logbooks are returned to QA for archive storage. Records are considered archived when moved to the archive server on the local area network or when logbooks are turned in to QA for storage. Access to archived hard-copy information is documented with in/out cards.

14.5.5 Transfer of Ownership

In the event that the laboratory transfers ownership or goes out of business, the laboratory ensures that the records are maintained or transferred according to client's instructions. Upon ownership transfer, record retention requirements must be addressed in the ownership transfer agreement and the responsibility for maintaining archives is clearly established. In addition, in cases of bankruptcy, appropriate regulatory and state legal requirements concerning laboratory records must be followed. In the event of the closure of the laboratory, all records will revert to the control of the corporate headquarters. Should the entire company cease to exist, as much notice as possible will be given to clients and the accrediting bodies who have worked with the laboratory during the previous 5 years of such action.

14.5.6 Records Disposal

14.5.6.1 Records are removed from the archive and destroyed after 5 years unless otherwise specified by a client or regulatory requirement. On a project specific or program basis, clients may need to be notified prior to record destruction. Records are destroyed in a manner that ensures their confidentiality such as shredding, mutilation or incineration.

14.5.6.2 Electronic copies of records must be destroyed by erasure or physically damaging off-line storage media so no records can be read.

14.5.6.3 If a third party records management company is hired to dispose of records, a "Certificate of Destruction" is required. [Refer to Policy No. CW-L-P-001 (Records Retention).]

SECTION 15

AUDITS

15.1 INTERNAL AUDITS

Internal audits are performed to verify that laboratory operations comply with the requirements of the lab's quality system and with the external quality programs under which the laboratory operates. Audits are planned and organized by the QA staff. Personnel conducting the audits should be independent of the area being evaluated. Auditors will have sufficient authority, access to work areas, and organizational freedom necessary to observe all activities affecting quality and to report the assessments to laboratory management and when requested to corporate management.

Audits are conducted and documented as described in the TestAmerica Corporate SOP on Internal Auditing, SOP No. CW-Q-S-003. The types and frequency of routine internal audits are described in Table 15-1. Special or ad hoc assessments may be conducted as needed under the direction of the QA staff.

Table 15-1. Types of Internal Audits and Frequency

Description	Performed by	Frequency
Quality Systems Audits	QA Department, QA approved designee, or Corporate QA	All areas of the laboratory annually
QA Technical Audits	Joint responsibility: a) QA Manager or designee b) Technical Manager or Designee (Refer to CW-Q-S-003)	Technical Audits Frequency: 50% of methods annually
SOP Method Compliance	Joint responsibility: a) QA Manager or designee b) Technical Manager or Designee (Refer to CW-Q-S-003)	SOP Compliance Review Frequency: • Every 2 years • 100% of SOPs annually (DoD/DOE Labs)
Special	QA Department or Designee	Surveillance or spot checks performed as needed, e.g., to confirm corrective actions from other audits.
Performance Testing	Laboratory Analysts with QA oversight	Two successful per year for each TNINELAC field of testing or as dictated by regulatory requirements

15.1.1 Annual Quality Systems Audit

An annual quality systems audit is required to ensure compliance to analytical methods and SOPs, TestAmerica's Data Integrity and Ethics Policies, TNI quality systems, client and state requirements, and the effectiveness of the internal controls of the analytical process, including

but not limited to data review, quality controls, preventive action and corrective action. The completeness of earlier corrective actions is assessed for effectiveness and sustainability. The audit is divided into sections for each operating or support area of the lab, and each section is comprehensive for a given area. The area audits may be performed on a rotating schedule throughout the year to ensure adequate coverage of all areas. This schedule may change as situations in the laboratory warrant

Note: Part of the quality systems audit relates to regulatory compliance. An assessment of the laboratory's compliance to regulatory requirements is performed by Corporate QA through monthly management reports, review of client and regulatory concerns and also through periodic on-site evaluations.

The annual quality systems audit must include a review of logbooks and benchsheets used in laboratory areas as well as the items listed in the Internal Audit Checklists as described in SOP CW-Q-S-003.

15.1.2 QA Technical Audits

QA technical audits assess data authenticity and analyst integrity. These audits are based on client projects, associated sample delivery groups, and the methods performed. Reported results are compared to raw data to verify the authenticity of results. The validity of calibrations and QC results are compared to data qualifiers, footnotes, and case narratives. Documentation is assessed by examining run logs and records of manual integrations. Manual calculations are checked. Where possible, electronic audit miner programs (e.g., MintMiner and Chrom AuditMiner) are used to identify unusual manipulations of the data deserving closer scrutiny. QA technical audits include all methods within a two-year period. All analysts should be reviewed over the course of a two year period through at least one QA Technical Audit.

The QA Technical Audits must include a review of raw sample data, calibration data and QC data records.

15.1.3 SOP Method Compliance

Compliance of all SOPs with the source methods and compliance of the operational groups with the SOPs are assessed by the Technical Manager or qualified designee at least every two years. (Annually for methods and administrative SOPs related to DoD and DOE programs.) It is also recommended that the work of each newly hired laboratory analyst is assessed within 3 months of working independently, (e.g., completion of method IDOC). In addition, as laboratory analysts add methods to their capabilities, (new IDOC) reviews of the laboratory analyst work products are performed within 3 months of completing the documented training.

15.1.4 Special Audits

Special audits are conducted on an as needed basis, generally as a follow up to specific issues such as client complaints, corrective actions, PT results, data audits, system audits, validation comments, regulatory audits or suspected ethical improprieties. Special audits are focused on a specific issue, and report format, distribution, and timeframes are designed to address the nature of the issue.

15.1.5 Performance Testing

The laboratory participates semi-annually in performance audits conducted through the analysis of PT samples provided by a third party. The laboratory generally participates in the following types of PT studies: Drinking Water, Nonpotable Water, Soil, and Air.

It is TestAmerica's policy that PT samples be treated as typical samples in the production process. Furthermore, where PT samples present special or unique problems, in the regular production process they may need to be treated differently, as would any special or unique request submitted by any client. The QA Manager must be consulted and in agreement with any decisions made to treat a PT sample differently due to some special circumstance.

Written responses to unacceptable PT results are required. In some cases it may be necessary for blind QC samples to be submitted to the laboratory to show a return to control.

15.2 EXTERNAL AUDITS

External audits are performed when certifying agencies or clients conduct on-site inspections or submit performance testing samples for analysis. It is TestAmerica's policy to cooperate fully with regulatory authorities and clients. The laboratory makes every effort to provide the auditors with access to personnel, documentation, and assistance. Group Leaders are responsible for providing corrective actions to the QA Manager who coordinates the response for any deficiencies discovered during an external audit. Audit responses are due in the time allotted by the client or agency performing the audit. When requested, a copy of the audit report and the lab's corrective action plan are forwarded to Corporate Quality.

The laboratory cooperates with clients and their representatives to monitor the laboratory's performance in relation to work performed for the client. The client may only view data and systems related directly to the client's work. All efforts are made to keep other client information confidential.

15.2.1 Confidential Business Information (CBI) Considerations

During on-site audits, on-site auditors may come into possession of information claimed as business confidential. A business confidentiality claim is defined as "a claim or allegation that business information is entitled to confidential treatment for reasons of business confidentiality or a request for a determination that such information is entitled to such treatment." When information is claimed as business confidential, the laboratory must place on (or attach to) the information at the time it is submitted to the auditor, a cover sheet, stamped or typed legend or other suitable form of notice, employing language such as "trade secret", "proprietary" or "company confidential". Confidential portions of documents otherwise non-confidential must be clearly identified. CBI may be purged of references to client identity by the responsible laboratory official at the time of removal from the laboratory. However, sample identifiers may not be obscured from the information. Additional information regarding CBI can be found in within the 2009 TNI standards.

15.3 AUDIT FINDINGS

Audits are documented in summary report(s) providing the findings for each laboratory area and recommended corrective actions to the appropriate Group Leader. The laboratory corrective action is compiled by QA and responses to external audits are signed by the QA Manager and the Laboratory Director. The laboratory's corrective action responses may include action plans

that could not be completed within a predefined timeframe. In these instances, a completion date must be set and agreed to by operations management and the QA Manager.

Developing and implementing corrective actions to findings is the responsibility of the Group Leader where the finding originated. Findings that are not corrected by specified due dates are reported monthly to management in the QA monthly report. When requested, a copy of the audit report and the labs corrective action is forwarded to Corporate Quality.

If any audit finding casts doubt on the effectiveness of the operations or on the correctness or validity of the laboratory's test results, the laboratory takes timely corrective action, and notifies clients in writing if the investigations show that the laboratory results have been affected. Once corrective action is implemented, a follow-up audit is scheduled to ensure that the problem has been corrected.

Clients must be notified promptly in writing, of any event such as the identification of defective measuring or test equipment that casts doubt on the validity of results given in any test report or amendment to a test report. The investigation must begin within 24-hours of discovery of the problem and all efforts are made to notify the client within two weeks after the completion of the investigation.

SECTION 16

MANAGEMENT REVIEWS

16.1 QUALITY ASSURANCE REPORT

A comprehensive QA Report is prepared each month by the laboratory's QA Department and forwarded to the Laboratory Director, Technical Managers, their Quality Director as well as the VP of Operations. All aspects of the QA system are reviewed to evaluate the suitability of policies and procedures. During the course of the year, the Laboratory Director, VP of Operations or Corporate QA may request that additional information be added to the report.

On a monthly basis, Corporate QA compiles information from all the monthly laboratory reports. The Corporate Quality Directors prepare a report that includes a compilation of all metrics and notable information and concerns regarding the QA programs within the laboratories. The report also includes a listing of new regulations that may potentially impact the laboratories. This report is presented to the Senior Management Team and VPs of Operations.

16.2 ANNUAL MANAGEMENT REVIEW

The senior lab management team (Laboratory Director, Technical Managers, QA Manager, and the Client Relations Manager) conducts a review annually of its quality systems and LIMS to ensure its continuing suitability and effectiveness in meeting client and regulatory requirements and to introduce any necessary changes or improvements. It will also provide a platform for defining goals, objectives, and action items that feed into the laboratory planning system. Corporate Operations and Corporate QA personnel are included in this meeting at the discretion of the Laboratory Director. The LIMS review consists of examining any audits, complaints or concerns that have been raised through the year that are related to the LIMS. The laboratory summarizes any critical findings that cannot be solved by the lab and reports them to Corporate IT.

This management systems review (Corporate SOP No. CA-Q-S-004 Management Systems Review & Work Instruction No. CW-Q-WI-003 uses information generated during the preceding year to assess the "big picture" by ensuring that routine quality actions taken and reviewed on a monthly basis are not components of larger systematic concerns. The monthly review keeps the quality systems current and effective, therefore, the annual review is a formal senior management process to review specific existing documentation. Significant issues from the following documentation are compiled or summarized by the QA Manager prior to the review meeting:

- Matters arising from the previous annual review.
- Prior Monthly QA Reports issues.
- Laboratory QA Metrics.
- Review of report reissue requests.
- Review of client feedback and complaints.

- Issues arising from any prior management or staff meetings.
- Minutes from prior senior lab management meetings. Issues that may be raised from these meetings include:
  - Adequacy of staff, equipment and facility resources.
  - Adequacy of policies and procedures.
  - Future plans for resources and testing capability and capacity.
- The annual internal double blind PT program sample performance (if performed),
- Compliance to the Ethics Policy and Data Integrity Plan. Including any evidence/incidents of inappropriate actions or vulnerabilities related to data Integrity.

A report is generated by the QA Manager and management. The report is distributed to the appropriate General Manager and the Quality Director. The report includes, but is not limited to:

- The date of the review and the names and titles of participants.
- A reference to the existing data quality related documents and topics that were reviewed.
- Quality system or operational changes or improvements that are made as a result of the review [e.g., an implementation schedule including assigned responsibilities for the changes (Action Table)].

Changes to the quality systems requiring update to the laboratory QAM are included in the next revision of the QAM.

16.3 POTENTIAL INTEGRITY RELATED MANAGERIAL REVIEWS

Potential integrity issues (data or business related) must be handled and reviewed in a confidential manner until such time as a follow-up evaluation, full investigation, or other appropriate actions have been completed and issues clarified. TestAmerica's Corporate Internal Investigation SOP is followed (SOP No. CW-L-S-002). All investigations that result in finding of inappropriate activity are documented and include any disciplinary actions involved, corrective actions taken, and all appropriate notifications of clients.

TestAmerica's President and CEO, Executive VP of Operations, VP of Client & Technical Services, VP of Operations, and Quality Directors receive a monthly report from the VP-QA/EHS summarizing any current data integrity or data recall investigations. The VP's of Operations are also made aware of progress on these issues for their specific labs.

SECTION 17

PERSONNEL

17.1 OVERVIEW

The laboratory's management believes that its highly qualified and professional staff is the single most important aspect in assuring a high level of data quality and service. The staff consists of professionals and support personnel as outlined in the organization chart in Figure 4-1.

All personnel must demonstrate competence in the areas where they have responsibility. Staff that are undergoing training have appropriate supervision until they have demonstrated their ability to perform their job function on their own. Staff shall be qualified for their tasks based on appropriate education, training, experience and/or demonstrated skills as required.

The laboratory employs sufficient personnel with the necessary education, training, technical knowledge and experience for their assigned responsibilities.

All personnel are responsible for complying with all QA/QC requirements that pertain to the laboratory and their area of responsibility. Each staff member must have a combination of experience and education to adequately demonstrate a specific knowledge of their particular area of responsibility. Technical staff must also have a general knowledge of lab operations, test methods, QA/QC procedures and records management.

Laboratory management is responsible for formulating goals for lab staff with respect to education, training and skills and ensuring that the laboratory has a policy and procedures for identifying training needs and providing training of personnel. The training is relevant to the present and anticipated responsibilities of the lab staff.

The laboratory only uses personnel that are employed by or under contract to the laboratory. Contracted personnel, when used, must meet competency standards of the laboratory and work in accordance to the laboratory's quality system.

17.2 EDUCATION AND EXPERIENCE REQUIREMENTS FOR TECHNICAL PERSONNEL

The laboratory makes every effort to hire analytical staff that possess a college degree (AA, BA, BS) in an applied science with some chemistry in the curriculum. Exceptions may be made based upon the technical nature of the position and the individual's experience and abilities. Selection of qualified candidates for laboratory employment begins with documentation of minimum education, training, and experience prerequisites needed to perform the prescribed task. Minimum education and training requirements for TestAmerica employees are outlined in job descriptions and are generally summarized for analytical staff in the table below.

The laboratory maintains job descriptions for all personnel who manage, perform or verify work affecting the quality of the environmental testing the laboratory performs. Job Descriptions are

located on the TestAmerica intranet site's Human Resources web-page (also see Section 4 for position descriptions/responsibilities).

As a general rule for analytical staff:

Specialty	Education	Experience
Extractions, Digestions, some electrode methods (pH, DO, Redox, etc.), or Titrimetric and Gravimetric Analyses	H.S. Diploma	On the job training (OJT)
CVAA, Single component or short list Chromatography (e.g., Fuels, BTEX-GC, IC	A college degree in an applied science or 2 years of college and at least 1 year of college chemistry	Or 2 years prior analytical experience is required
ICP, ICPMS, Long List or complex chromatography (e.g., Pesticides, PCB, Herbicides, HPLC, etc.), GCMS	A college degree in an applied science or 2 years of college chemistry	Or 5 years of prior analytical experience
Spectra Interpretation	A college degree in an applied science or 2 years of college chemistry	And 2 years relevant experience or 5 years of prior analytical experience
Technical Managers/Department Managers – **General**	Bachelors Degree in an applied science or engineering with 24 semester hours in chemistry An advanced (MS, PhD.) degree may substitute for one year of experience	And 2 years experience in environmental analysis of representative analytes for which they will oversee

When an analyst does not meet these requirements, they can perform a task under the direct supervision of a qualified analyst, peer reviewer or Group Leader, and are considered an analyst in training. The person supervising an analyst in training is accountable for the quality of the analytical data and must review and approve data and associated corrective actions.

17.3 TRAINING

The laboratory is committed to furthering the professional and technical development of employees at all levels.

Orientation to the laboratory's policies and procedures, in-house method training, and employee attendance at outside training courses and conferences all contribute toward employee proficiency. Below are examples of various areas of required employee training:

Required Training	Time Frame	Employee Type
Environmental Health & Safety	Prior to lab work	All

Required Training	Time Frame	Employee Type
Ethics – New Hires	1 week of hire	All
Ethics - Comprehensive	90 days of hire	All
Data Integrity	30 days of hire	Technical and PMs
Quality Assurance	90 days of hire	All
Ethics – Comprehensive Refresher	Annually	All
Initial Demonstration of Capability (DOC)	Prior to unsupervised method performance	Technical

The laboratory maintains records of relevant authorization/competence, education, professional qualifications, training, skills and experience of technical personnel (including contracted personnel) as well as the date that approval/authorization was given. These records are kept on file at the laboratory. Also refer to "Demonstration of Capability" in Section 19.

The training of technical staff is kept up to date by:

- Each employee must have documentation in their training file that they have read, understood and agreed to follow the most recent version of the laboratory QAM and SOPs in their area of responsibility. This documentation is updated as SOPs are updated.
- Documentation from any training courses or workshops on specific equipment, analytical techniques or other relevant topics are maintained in their training file.
- Documentation of proficiency (refer to Section 19).
- An Ethics Agreement signed by each staff member (renewed each year) and evidence of annual ethics training.
- A Confidentiality Agreement signed by each staff member signed at the time of employment.
- Human Resources maintains documentation and attestation forms on employment status and records; benefit programs; timekeeping/payroll; and employee conduct (e.g., ethics). This information is maintained in the employee's secured personnel file.

The QA Manager is responsible for QA and Ethics Orientation, Initial and On-Going Ethics and Data Integrity Training and QA training. The EH&S Coordinator is responsible for EH&S Orientation and Training. Group Leaders and Technical Managers are responsible for technical training.

The QA Manager evaluates the effectiveness of training through the review of demonstration of capability documentation, on-going proficiency test results, nonconformances and corrective action reports, and internal and external audit reports.

Further details of the laboratory's training program are described in the Personnel Orientation and Training SOP KNOX-QA-0009.

17.4 DATA INTEGRITY AND ETHICS TRAINING PROGRAM

Establishing and maintaining a high ethical standard is an important element of a Quality System. Ethics and data integrity training is integral to the success of TestAmerica and is provided for each employee at TestAmerica. It is a formal part of the initial employee orientation within 1 week of hire followed by technical data integrity training within 30 days, comprehensive training within 90 days, and an annual refresher for all employees. Senior management at each facility performs the ethics training for their staff.

In order to ensure that all personnel understand the importance TestAmerica places on maintaining high ethical standards at all times; TestAmerica has established a Company Wide Ethics Policy No. CW-L-P-004 and an Ethics Statement. All initial and annual training is documented by signature on the Ethics Statement demonstrating that the employee has participated in the training and understands their obligations related to ethical behavior and data integrity.

Violations of this Ethics Policy will not be tolerated. Employees who violate this policy will be subject to disciplinary actions up to and including termination. Criminal violations may also be referred to the Government for prosecution. In addition, such actions could jeopardize TestAmerica's ability to do work on Government contracts, and for that reason, TestAmerica has a Zero Tolerance approach to such violations.

Employees are trained as to the legal and environmental repercussions that result from data misrepresentation. Key topics covered in the presentation include:

- Organizational mission and its relationship to the critical need for honesty and full disclosure in all analytical reporting.
- Ethics Policy.
- How and when to report ethical/data integrity issues. Confidential reporting.
- Record keeping.
- Discussion regarding data integrity procedures.
- Specific examples of breaches of ethical behavior (e.g., peak shaving, altering data or computer clocks, improper macros, etc., accepting/offering kickbacks, illegal accounting practices, unfair competition/collusion).
- Internal monitoring. Investigations and data recalls.
- Consequences for infractions including potential for immediate termination, debarment, or criminal prosecution.
- Importance of proper written narration / data qualification by the analyst and project manager with respect to those cases where the data may still be usable but are in one sense or another partially deficient.

Additionally, a data integrity hotline (1-800-736-9407) is maintained by TestAmerica and administered by the Corporate Quality Department.

SECTION 18

ACCOMMODATIONS AND ENVIRONMENTAL CONDITIONS

18.1 OVERVIEW

The laboratory is a 28,000 ft^2 secure laboratory facility with controlled access and designed to accommodate an efficient workflow and to provide a safe and comfortable work environment for employees. All visitors sign in and are escorted by laboratory personnel. Access is controlled by various measures.

The laboratory is equipped with structural safety features. Each employee is familiar with the location, use, and capabilities of general and specialized safety features associated with their workplace. The laboratory provides and requires the use of protective equipment including safety glasses, protective clothing, gloves, etc. OSHA and other regulatory agency guidelines regarding required amounts of bench and fume hood space, lighting, ventilation (temperature and humidity controlled), access, and safety equipment are met or exceeded.

Traffic flow through sample preparation and analysis areas is minimized to reduce the likelihood of contamination. Adequate floor space and bench top area is provided to allow unencumbered sample preparation and analysis space. Sufficient space is also provided for storage of reagents and media, glassware, and portable equipment. Ample space is also provided for refrigerated sample storage before analysis and archival storage of samples after analysis. Laboratory HVAC and deionized water systems are designed to minimize potential trace contaminants.

The laboratory is separated into specific areas for sample receiving, sample preparation, volatile organic sample analysis, non-volatile organic sample analysis, specialty organics sample preparation, specialty organics analysis, metals sample preparation, metals analysis, inorganic sample analysis, and administrative functions.

18.2 ENVIRONMENT

Laboratory accommodation, test areas, energy sources, lighting are adequate to facilitate proper performance of tests. The facility is equipped with heating, ventilation, and air conditioning (HVAC) systems appropriate to the needs of environmental testing performed at this laboratory.

The environment in which these activities are undertaken does not invalidate the results or adversely affect the required accuracy of any measurements.

The laboratory provides for the effective monitoring, control and recording of environmental conditions that may affect the results of environmental tests as required by the relevant specifications, methods, and procedures. Such environmental conditions include humidity controls, temperature controls, and voltage conditioning with an uninterruptible backup power supply.

When any of the method or regulatory required environmental conditions change to a point where they may adversely affect test results, analytical testing is discontinued until the environmental conditions are returned to the required levels.

Environmental conditions of the facility housing the computer network and LIMS are regulated to protect against raw data loss.

18.3 WORK AREAS

There is effective separation between neighboring areas when the activities therein are incompatible with each other. For example:

- Volatile organic chemical handling areas, including sample preparation and waste disposal, and volatile organic chemical analysis areas.

Access to and use of all areas affecting the quality of analytical testing is defined and controlled by secure access to the laboratory building as described below in the Building Security section.

Adequate measures are taken to ensure good housekeeping in the laboratory and to ensure that any contamination does not adversely affect data quality. These measures include regular cleaning to control dirt and dust within the laboratory.

Work areas are available to ensure an unencumbered work area. Work areas include:

- Access and entryways to the laboratory.
- Sample receipt areas.
- Sample storage areas.
- Chemical and waste storage areas.
- Data handling and storage areas.
- Sample processing areas.
- Sample analysis areas.

18.4 FLOOR PLAN

A floor plan can be found in Appendix 1.

18.5 BUILDING SECURITY

Building access codes and alarm codes are distributed to employees as necessary.

Visitors to the laboratory sign in and out in a visitor's logbook. A visitor is defined as any person who visits the laboratory who is not an employee of the laboratory. In addition to signing into the laboratory, the Environmental, Health and Safety Manual contains requirements for visitors and vendors. There are specific safety forms that must be reviewed and signed.

Visitors (with the exception of company employees) are escorted by laboratory personnel at all times, or the location of the visitor is noted in the visitor's logbook.

SECTION 19

TEST METHODS AND METHOD VALIDATION

19.1 OVERVIEW

The laboratory uses methods that are appropriate to meet our clients' requirements and that are within the scope of the laboratory's capabilities. These include sampling, handling, transport, storage and preparation of samples, and, where appropriate, an estimation of the measurement of uncertainty as well as statistical techniques for analysis of environmental data.

Instructions are available in the laboratory for the operation of equipment as well as for the handling and preparation of samples. All instructions, Standard Operating Procedures (SOPs), reference methods and manuals relevant to the working of the laboratory are readily available to all staff. Deviations from published methods are documented (with justification) in the laboratory's approved SOPs. SOPs are submitted to clients for review at their request. Significant deviations from published methods require client approval and regulatory approval where applicable.

The list of test methods used by the laboratory can be found in Table 19-1.

19.2 STANDARD OPERATING PROCEDURES (SOPs)

The laboratory maintains SOPs that accurately reflect all phases of the laboratory such as assessing data integrity, corrective actions, handling customer complaints as well as all analytical methods and sampling procedures. The method SOPs are derived from the most recently promulgated/approved, published methods and are specifically adapted to the laboratory facility. Modifications or clarifications to published methods are clearly noted in the SOPs. All SOPs are controlled in the laboratory.

- All SOPs contain a revision number, effective date, and appropriate approval signatures. Controlled copies are available to all staff.
- Procedures for writing an SOP by reference to TestAmerica's Corporate SOP entitled 'Writing a Standard Operating Procedure (SOP)', No, CW-Q-S-002 or the laboratory's SOPs KNOX-QA-0018 "Preparation and Management of Standard Operating Procedures," and KNOX-QA-0011 "Document Control and Distribution."
- SOPs are reviewed at a minimum of every 2 years (annually for Drinking Water and DoD/DOE SOPs), and where necessary, revised to ensure continuing suitability and compliance with applicable requirements. (Note: The laboratory must ensure laboratory analysts comply with the procedures in its VAP approved SOPs.)

19.3 LABORATORY METHODS MANUAL

For each test method, the laboratory has available the published referenced method as well as the laboratory developed SOP.

Note: If more stringent standards or requirements are included in a mandated test method or regulation than those specified in this manual, the laboratory demonstrates that such requirements are met. If it is not clear which requirements are more stringent, the standard from

the method or regulation is to be followed. Any exceptions or deviations from the referenced methods or regulations are noted in the specific analytical SOP.

The laboratory maintains an SOP Index for both technical and non-technical SOPs. Technical SOPs are maintained to describe a specific test method. Non-technical SOPs are maintained to describe functions and processes not related to a specific test method.

19.4 SELECTION OF METHODS

Since numerous methods and analytical techniques are available, continued communication between the client and laboratory is imperative to assure the correct methods are utilized. Once client methodology requirements are established, this and other pertinent information is summarized by the Project Manager. These mechanisms ensure that the proper analytical methods are applied when the samples arrive for log-in. For non-routine analytical services (e.g., special matrices, non-routine compound lists, etc.), the method of choice is selected based on client needs and available technology. The methods selected must be capable of measuring the specific parameter of interest, in the concentration range of interest, and with the required precision and accuracy.

19.4.1 Sources of Methods

Routine analytical services are performed using standard EPA-approved methodology. In some cases, modification of standard approved methods may be necessary to provide accurate analyses of particularly complex matrices. When the use of specific methods for sample analysis is mandated through project or regulatory requirements, only those methods are used.

When clients do not specify the method to be used or methods are not required, the methods used are clearly validated and documented in an SOP and available to clients and/or the end user of the data.

The analytical methods used by the laboratory are those currently accepted and approved by the U. S. EPA and the state or territory from which the samples were collected. Reference methods include:

- *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, US EPA, January 1996.*
- *Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act, Analysis and Sampling Procedures; 40CFR Part 136 as amended by Method Update Rule; May 18, 2012, Methods for Chemical Analysis of Water and Wastes, EPA 600 (4-79-020), 1983.*
- *Methods for the Determination of Inorganic Substances in Environmental Samples, EPA-600/R-93/100, August 1993.*
- *Methods for the Determination of Metals in Environmental Samples, EPA/600/4-91/010, June 1991. Supplement I: EPA-600/R-94/111, May 1994.*
- *Standard Methods for the Examination of Water and Wastewater, 18th/19th /20th edition; Eaton, A.D. Clesceri, L.S. Greenberg, A.E. Eds; American Water Works Association, Water Pollution Control Federation, American Public Health Association: Washington, D.C.*
- *Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846), Third Edition, September 1986, Final Update I, July 1992, Final Update IIA, August 1993, Final Update II,*

September 1994; Final Update IIB, January 1995; Final Update III, December 1996, Final Update IV, January 2008. Final Update V, August 2015

- *Annual Book of ASTM Standards, American Society for Testing & Materials (ASTM), Philadelphia, PA.*
- *National Status and Trends Program, National Oceanographic and Atmospheric Administration, Volume I-IV, 1985-1994.*
- *Manual for the Certification of Laboratories Analyzing Drinking Water (EPA 815-R-05-004, January 2005)*
- *Code of Federal Regulations (CFR) 40, Parts 136, 141, 172, 173, 178, 179 and 261*

The laboratory reviews updated versions to all the aforementioned references for adaptation based upon capabilities, instrumentation, etc., and implements them as appropriate. As such, the laboratory strives to perform only the latest versions of each approved method as regulations allow or require.

Other reference procedures for non-routine analyses may include methods established by specific states (e.g., Underground Storage Tank methods), ASTM or equipment manufacturers. Sample type, source, and the governing regulatory agency requiring the analysis will determine the method utilized.

The laboratory informs the client when a method proposed by the client may be inappropriate or out of date. After the client has been informed, and they wish to proceed contrary to the laboratory's recommendation, it is documented.

19.4.2 Demonstration of Capability

Before the laboratory may institute a new method and begin reporting results, the laboratory confirms that it can properly operate the method. In general, this demonstration does not test the performance of the method in real world samples, but in an applicable and available clean matrix sample. If the method is for the testing of analytes that are not conducive to spiking, demonstration of capability may be performed on quality control samples.

19.4.2.1 A demonstration of capability (DOC, Lab SOP# KNOX-QA-0009) is performed whenever there is a change in instrument type (e.g., new instrumentation), method or personnel (e.g., laboratory analyst has not performed the test within the last 12 months). Note: The laboratory shall have a DOC for all analytes included in the methods that the laboratory performs, and proficiency DOCs for each analyst shall include all analytes that the laboratory routinely performs. Addition of non-routine analytes does not require new DOCs for all analysts if those analysts are already qualified for routine analytes tested using identical chemistry and instrument conditions.

19.4.2.2 The initial demonstration of capability must be thoroughly documented and approved by the Technical Manager and QA Manager prior to independently analyzing client samples. All associated documentation must be retained in accordance with the laboratory's archiving procedures.

19.4.2.3 The laboratory must have an approved SOP, demonstrate satisfactory performance, and conduct a method detection limit study (when applicable). There may be other requirements as stated within the published method or regulations (e.g., retention time window study).

Note: In some instances, a situation may arise where a client requests that an unusual analyte be reported using a method where this analyte is not normally reported. If the analyte is being reported for regulatory purposes, the method must meet all procedures outlined within this QAM (SOP, MDL, and Demonstration of Capability). If the client states that the information is not for regulatory purposes, the result may be reported as long as the following criteria are met:

- The instrument is calibrated for the analyte to be reported using the criteria for the method and ICV/CCV criteria are met (unless an ICV/CCV is not required by the method or criteria are per project DQOs).
- The laboratory's nominal or default reporting limit (RL) is equal to the limit of quantitation (LOQ), must be at or above the lowest non-zero standard in the calibration curve and must be reliably determined. Project RLs are client specified reporting levels which may be higher than the LOQ. Results reported below the LOQ must be qualified as estimated values. Also see Section 19.6.1.3, Relationship of Limit of Detection (LOD) to Limit of Quantitation (LOQ).
- The client request is documented and the lab informs the client of its procedure for working with unusual compounds. The final report must be footnoted: (e.g., *Reporting Limit based on the low standard of the calibration curve.)*

19.4.3 <u>Initial Demonstration of Capability (IDOC) Procedures</u>

19.4.3.1 A quality control sample shall be obtained from an outside source. If not available, the QC sample may be prepared by the laboratory using stock standards that are prepared independently from those used in instrument calibration.

19.4.3.2 The analyte(s) shall be diluted in a volume of clean matrix sufficient to prepare four aliquots at the concentration specified by the method or the laboratory SOP.

19.4.3.3 At least four aliquots are prepared (including any applicable routine clean-up procedures) and analyzed according to the test method (either concurrently or over a period of days).

19.4.3.4 Using all of the results, calculate the mean recovery in the appropriate reporting units and the standard deviation for each parameter of interest.

19.4.3.5 When it is not possible to determine the mean and standard deviation, such as for presence, absence and logarithmic values, the laboratory will assess performance against criteria described in the laboratory SOP.

19.4.3.6 Compare the information obtained above to the corresponding acceptance criteria for precision and accuracy in the test method (if applicable) or in laboratory generated acceptance criteria (LCS or interim criteria) if there is no mandatory criteria established. If any one of the parameters do not meet the acceptance criteria, the performance is unacceptable for that parameter.

19.4.3.7 When one or more of the tested parameters fail at least one of the acceptance criteria, the analyst must proceed according to either option listed below:

- Locate and correct the source of the problem and repeat the test for all parameters of interest beginning with 19.4.3.3 above.
- Beginning with 19.4.3.3 above, repeat the test for all parameters that failed to meet criteria. Repeated failure, however, will confirm a general problem with the measurement system. If this occurs, locate and correct the source of the problem and repeat the test for all compounds of interest beginning with 19.4.3.1 above.

Note: Results of successive LCS analyses can be used to fulfill the DOC requirement.

19.4.3.8 Refer to SOP KNOX-QA-0009, Personnel Orientation and Training for further details.

A certification statement (see Figure 19-1 for an example) is used to document the completion of each initial demonstration of capability. A copy of the certification is archived in the analyst's training file.

19.5 LABORATORY DEVELOPED METHODS AND NON-STANDARD METHODS

Any new method developed by the laboratory must be fully defined in an SOP and validated by qualified personnel with adequate resources to perform the method. Method specifications and the relation to client requirements must be clearly conveyed to the client if the method is a non-standard method (not a published or routinely accepted method). The client must also be in agreement to the use of the non-standard method.

19.6 VALIDATION OF METHODS

Validation is the confirmation by examination and the provision of objective evidence that the particular requirements for a specific intended use are fulfilled.

All non-standard methods, laboratory designed/developed methods, standard methods used outside of their scope, and major modifications to published methods must be validated to confirm they are fit for their intended use. The validation will be as extensive as necessary to meet the needs of the given application. The results are documented with the validation procedure used and contain a statement as to the fitness for use.

19.6.1 Method Validation and Verification Activities for All New Methods

While method validation can take various courses, the following activities can be required as part of method validation. Method validation records are designated QC records and are archived accordingly.

19.6.1.1 Determination of Method Selectivity

Method selectivity is the demonstrated ability to discriminate the analyte(s) of interest from other compounds in the specific matrix or matrices from other analytes or interference. In some

cases to achieve the required selectivity for an analyte, a confirmation analysis is required as part of the method.

19.6.1.2 Determination of Method Sensitivity

Sensitivity can be both estimated and demonstrated. Whether a study is required to estimate sensitivity depends on the level of method development required when applying a particular measurement system to a specific set of samples. Estimations and/or demonstrations of sensitivity are performed as required by regulation or client agreement, such as the procedure in 40 CFR Part 136 Appendix B, under the Clean Water Act.

19.6.1.3 Relationship of Limit of Detection (LOD) to the Limit of Quantitation (LOQ)

An important characteristic of expression of sensitivity is the difference in the LOD and the QL. The LOD is the minimum level at which the presence of an analyte can be reliably concluded. The QL is the minimum concentration of analyte that can be quantitatively determined with acceptable precision and bias. For most instrumental measurement systems, there is a region where semi-quantitative data is generated around the LOD (both above and below the estimated MDL or LOD) and below the QL. In this region, detection of an analyte may be confirmed but quantification of the analyte is unreliable within the accuracy and precision guidelines of the measurement system. When an analyte is detected below the QL, and the presence of the analyte is confirmed by meeting the qualitative identification criteria for the analyte, the analyte can be reliably reported, but the amount of the analyte can only be estimated. If data is to be reported in this region, it must be done so with a qualification that denotes the semi-quantitative nature of the result.

19.6.1.4 Determination of Interferences

A determination that the method is free from interferences in a blank matrix is performed.

19.6.1.5 Determination of Range

Where appropriate to the method, the quantitation range is determined by comparison of the response of an analyte in a curve to established or targeted criteria. Generally the upper quantitation limit is defined by highest acceptable calibration concentration. The lower Limit of Quantitation or LOQ cannot be lower than the lowest non-zero calibration level (QL check standard level for ICP), and can be constrained by required levels of bias and precision.

19.6.1.6 Determination of Accuracy and Precision

Accuracy and precision studies are generally performed using replicate analyses, with a resulting percent recovery and measure of reproducibility (standard deviation, relative standard deviation) calculated and measured against a set of target criteria.

19.6.1.7 Documentation of Method

The method is formally documented in an SOP. If the method is a minor modification of a standard laboratory method that is already documented in an SOP, an SOP Attachment describing the specific differences in the new method is acceptable in place of a separate SOP.

19.6.1.8 Continued Demonstration of Method Performance

Continued demonstration of Method Performance is addressed in the SOP. Continued demonstration of method performance is generally accomplished by batch specific QC samples such as LCS, method blanks or PT samples.

19.7 METHOD DETECTION LIMITS (MDL)/ LIMITS OF DETECTION (LOD)

Method detection limits (MDL) are initially determined in accordance with 40 CFR Part 136, Appendix B or alternatively by other technically acceptable practices that have been accepted by regulators. MDL is also sometimes referred to as Limit of Detection (LOD). The MDL theoretically represents the concentration level for each analyte within a method at which the analyst is 99% confident that the true value can be differentiated from blanks. The MDL is determined for each analyte initially during the method validation process and updated as required in the analytical methods, whenever there is a significant change in the procedure or equipment, or based on project specific requirements (refer to 20.7.10). Generally, the analyst prepares at least seven replicates of solution spiked at one to five times the estimated method detection limit (most often at the lowest standard in the calibration curve) into the applicable matrix with all the analytes of interest. Each of these aliquots is extracted (including any applicable clean-up procedures) and analyzed in the same manner as the samples. Where possible, the seven replicates should be analyzed over 2-4 days to provide a more realistic MDL. The replicates may be prepared and analyzed over a period of time (e.g. over multiple batches) or they may be performed within the same batch. If more than seven replicates are used, care must be taken to ensure the appropriate t-value multiplier is applied. MDL studies for work in support of Ohio EPA VAP must be spiked at or below the reporting limit.

19.7.1 Refer to the Corporate SOP No. CA-Q-S-006 and SOP KNOX-QA-0023 for details on the laboratory's MDL process.

19.8 INSTRUMENT DETECTION LIMITS (IDL)

19.8.1 The IDL is sometimes used to assess the reasonableness of the MDLs or in some cases required by the analytical method or program requirements. IDLs are most used in metals analyses but may be useful in demonstration of instrument performance in other areas.

19.8.2 IDLs are calculated to determine an instrument's sensitivity independent of any preparation method. IDLs are calculated either using 7 replicate spike analyses, like MDL but without sample preparation, or by the analysis of 10 instrument blanks and calculating 3 x the absolute value of the standard deviation.

19.8.3 If IDL is > than the MDL, it may be used as the reported MDL.

19.9 VERIFICATION OF DETECTION AND REPORTING LIMITS

19.9.1 Once an MDL is established, it must be verified, on each instrument, by analyzing a quality control sample (prepared as a sample) at no more than 3 times the calculated MDL for single analyte analyses (e.g., most wet chemistry methods) and no more than 4 times the calculated MDL for multiple analyte methods (e.g., GC, GCMS, ICP, etc.). The analytes must be qualitatively identified. This verification does not apply to methods that are not readily spiked (e.g. pH, turbidity, etc.) or where the lab does not report to the MDL. If the MDL does not verify, then the lab redevelops their MDL or use the level where qualitative identification is established. MDLs must be verified at least annually.

The following applies to methods specified on the laboratory's DoD ELAP scope of accreditation. Once the MDL is determined, it must be verified on each instrument used for the given method to analyze DoD/DOE samples. TestAmerica defines the DoD/DOE Quality System Manual (QSM) Detection Limit (DL) as being equal to the MDL. TestAmerica also defines the DoD/DOE QSM Limit of Detection (LOD) as being equal to the lowest concentration standard that successfully verifies the MDL, also referred to as the MDLV standard. MDL and MDLV standards are extracted/digested and analyzed through the entire analytical process. The MDL and MDLV determinations do not apply to methods that are not readily spiked (e.g. pH, turbidity, etc.) or where the lab does not report to the MDL. If the MDLV standard is not successful, then the laboratory will redevelop their MDL or perform and pass two consecutive MDLVs at a higher concentration and set the LOD at the higher concentration. Initial and quarterly verification is required for all methods listed in the laboratory's DoD ELAP Scope of Accreditation. Refer to the laboratory SOP CA-Q-S-006 and the laboratory attachment for further details.

19.9.2 When the laboratory establishes a quantitation limit, it must be initially verified by the analysis of a low level standard or QC sample at 1-2 times the reporting limit and annually thereafter. The annual requirement is waved for methods that have an annually verified MDL.

The following applies to methods specified on the laboratory's DoD ELAP scope of accreditation. The laboratory quantitation limit is equivalent to the DoD/DOE Limit of Quantitation (LOQ), which is at a concentration equal to or greater than the lowest non-zero calibration standard. The DoD/DOE QSM requires the laboratory to perform an initial characterization of the bias and precision at the LOQ and quarterly LOQ verifications thereafter. If the quarterly verification results are not consistent with three-standard deviation confidence limits established initially, then the bias and precision will be reevaluated and clients contacted for any on-going projects where the bias and precision at the LOQ has been specified in the project planning documents. For DoD/DOE projects, TestAmerica makes a distinction between the Reporting Limit (RL) and the LOQ. The RL is a level at or above the LOQ that is used for specific project reporting purposes, as agreed to between the laboratory and the client. The RL cannot be lower than the LOQ concentration, but may be higher.

19.10 RETENTION TIME WINDOWS

Most organic analyses and some inorganic analyses use chromatography techniques for qualitative and quantitative determinations. For every chromatography analysis each analyte will have a specific time of elution from the column to the detector. This is known as the analyte's retention time. The variance in the expected time of elution is defined as the retention time window. As the key to analyte identification in chromatography, retention time windows must be

established on every column for every analyte used for that method. These records are kept with the files associated with each instrument as applicable. Complete details are available in the laboratory SOPs.

19.11 EVALUATION OF SELECTIVITY

The laboratory evaluates selectivity by following the checks within the applicable analytical methods, which include mass spectral tuning, mass resolution, second column confirmation, ICP interelement interference checks, chromatography retention time windows, and method blanks.

19.12 ESTIMATION OF UNCERTAINTY OF MEASUREMENT

19.12.1 Uncertainty is "a parameter associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the measurand" (as defined by the International Vocabulary of Basic and General Terms in Metrology, ISO Geneva, 1993, ISBN 92-67-10175-1). Knowledge of the uncertainty of a measurement provides additional confidence in a result's validity. Its value accounts for all the factors which could possibly affect the result, such as adequacy of analyte definition, sampling, matrix effects and interferences, climatic conditions, variances in weights, volumes, and standards, analytical procedure, and random variation. Some national accreditation organizations require the use of an "expanded uncertainty": the range within which the value of the measurand is believed to lie within at least a 95% confidence level with the coverage factor k=2.

19.12.2 Uncertainty is not error. Error is a single value, the difference between the true result and the measured result. On environmental samples, the true result is never known. The measurement is the sum of the unknown true value and the unknown error. Unknown error is a combination of systematic error, or bias, and random error. Bias varies predictably, constantly, and independently from the number of measurements. Random error is unpredictable, assumed to be Gaussian in distribution, and reducible by increasing the number of measurements.

19.12.3 The minimum uncertainty associated with results generated by the laboratory can be determined by using the Laboratory Control Sample (LCS) accuracy range for a given analyte. The LCS limits are used to assess the performance of the measurement system since they take into consideration all of the laboratory variables associated with a given test over time (except for variability associated with the sampling and the variability due to matrix effects). The percent recovery of the LCS is compared either to the method-required LCS accuracy limits or to the statistical, historical, in-house LCS accuracy limits.

19.12.4 Refer to SOP KNOX-QA-0019 "Estimation of Measurement Uncertainty" for details regarding calculations that may be used to estimate measurement uncertainty associated with laboratory results.

19.12.5 In the case where a well recognized test method specifies limits to the values of major sources of uncertainty of measurement (e.g. 524.2, 525, etc) and specifies the form of presentation of calculated results, no further discussion of uncertainty is required.

19.13 CONTROL OF DATA

The laboratory has policies and procedures in place to ensure the authenticity, integrity, and accuracy of the analytical data generated by the laboratory.

19.13.1 Computer and Electronic Data Related Requirements

The three basic objectives of our computer security procedures and policies are shown below. More detail is outlined in the laboratory SOPs KNOX-IT-0001, 'Good Automated Laboratory Practices' and KNOX-IT-0002, 'Electronic Data and Software Backup.' The laboratory is currently running TALS which is a TestAmerica developed LIMS system that has been highly customized to meet the needs of TestAmerica Knoxville. It is referred to as LIMS for the remainder of this section. The LIMS utilizes a SQL Server Enterprise Addition-SQL2008-SP3 which is an industry standard relational database platform. It is referred to as Database for the remainder of this section.

19.13.1.1 Maintain the Database Integrity: Assurance that data is reliable and accurate through data verification (review) procedures, password-protecting access, anti-virus protection, data change requirements, as well as an internal LIMS permissions procedure.

- LIMS Database Integrity is achieved through data input validation, internal user controls, and data change requirements.
- Spreadsheets and other software developed in-house must be verified with documentation through hand calculations prior to use. Cells containing calculations must be lock-protected.
- Instrument hardware and software adjustments are safeguarded through maintenance logs, audit trails, and controlled access.

19.13.1.2 Ensure Information Availability: Protection against loss of information or service through scheduled back-ups, stable file server network architecture, secure storage of media, line filter, Uninterruptible Power Supply (UPS), and maintaining older versions of software as revisions are implemented.

19.13.1.3 Maintain Confidentiality: Ensure data confidentiality through physical access controls such as password protection or controlled website access approval.

19.13.2 Data Reduction

The complexity of the data reduction depends on the analytical method and the number of discrete operations involved (e.g., extractions, dilutions, instrument readings and concentrations). The laboratory analyst calculates the final results from the raw data or uses appropriate computer programs to assist in the calculation of final reportable values.

Manual integration of peaks will be documented and reviewed and the raw data will be flagged in accordance with the TestAmerica Corporate SOP CA-Q-S-002, "*Acceptable Manual Integration Practices"* and SOP KNOX-QA-0022.

Analytical results are reduced to appropriate concentration units specified by the analytical method, taking into account factors such as dilution, sample weight or volume, etc. Method Blank correction is not performed unless it is specifically required by the method. Calculations are independently verified by appropriate laboratory staff. Calculations and data reduction steps for the methods are summarized in the respective analytical SOPs.

In general, data will be processed by a laboratory analyst in one of the following ways:

- Manual computation of results directly on the data sheet or on calculation pages attached to the data sheets.
- Input of raw data for computer processing.
- Direct acquisition and processing of raw data by a computer.

19.13.2.1 If data are manually processed by a laboratory analyst, all steps in the computation are provided including equations used and the source of input parameters such as response factors (RFs), dilution factors, and calibration constants. If calculations are not performed directly on the data sheet, they may be attached to the data sheets. (Note: This section does not apply to the Ohio VAP as all computations are done by the instrument data system and by the LIMS.)

19.13.2.2 For data that are input by a laboratory analyst and processed using a computer, a copy of the input is kept and uniquely identified with the project number and other information as needed. The samples analyzed must be clearly identified.

19.13.2.3 If data are directly acquired from instrumentation and processed, the laboratory analyst must verify that the following are correct:

- Project and sample numbers
- Calibration constants/RFs
- Units
- Numerical values used for reporting limits.

19.13.2.4 In general, sample results are reported to 2 significant figures on the final report.

19.13.3 Logbook / Worksheet Use Guidelines

Logbooks and worksheets are filled out ‘real time’ and have enough information on them to trace the events of the applicable analysis/task. (e.g. calibrations, standards, analyst, sample ID, date, time on short holding time tests, temperatures when applicable, calculations are traceable, etc.).

- Corrections are made following the procedures outlined in Section 12.
- Logbooks are controlled by the QA department. A record is maintained of all logbooks in the lab.
- Unused portions of pages must be “Z”’d out, signed and dated.
- Worksheets are created with the approval of the Technical Director/QA Manager at the facility. The QA Manager or designee controls all worksheets following the procedures in Section 6.

19.13.4 Review / Verification Procedures

A minimum of three levels of review are performed before final sample data is reported to the client.

- First level technical review.
- Second level technical review.
- Third level project management completeness review.

19.13.4.1 The initial first level technical review ensures that:

- Sample preparation information is correct and complete including documentation of standard identification, sample amounts, etc.
- Analysis information is correct and complete including proper identification of analysis output (charts, chromatograms, mass spectra, etc.).
- Analytical results are correct and complete including calculation or verification of instrument calibration, QC results, and qualitative and quantitative sample results with appropriate qualifiers.
- The appropriate SOPs have been followed and are identified in the project records.
- Proper documentation procedures have been followed.
- All nonconformances have been documented.
- Special sample preparation and analytical requirements have been met.
- The data generated have been reported with the appropriate number of significant figures as defined by the analytical method in the LIMS or otherwise specified by the client.

The initial verification of the data reduction (level 1 review) by the laboratory analyst is documented on a data review checklist, which is signed and dated by the laboratory analyst. The data review checklists identify which records must be checked as part of the data review.

19.13.4.2 Following the completion of the initial verification by the laboratory analyst performing the data reduction, a systematic check of the data that has been fully reduced and checked through level 1 review is performed by an experienced peer, group leader, or designee. This check (level 2 review) is performed to ensure that level 1 review has been completed correctly and thoroughly. This review includes an evaluation of all items required in the raw data package. Any exceptions noted by the laboratory analyst must be reviewed. Included in this review is an assessment of the acceptability of the data with respect to:

- Adherence of the procedure used to the requested analytical method SOP.
- Correct interpretation of chromatograms, mass spectra, etc.
- Correctness of numerical input when computer programs are used (checked randomly).
- Correct identification and quantitation of constituents with appropriate qualifiers.
- Numerical correctness of calculations and formulas (checked randomly).
- Acceptability of QC data.
- Documentation that instruments were operating according to method specifications (calibrations, performance checks, etc.).
- Documentation of dilution factors, standard concentrations, etc.
- Sample holding time assessment.

The level 2 review also serves as verification that the process the laboratory analyst

has followed is correct in regard to the following:

- The analytical procedure follows the methods and specific instructions given on the project QAS or equivalent summary form.
- Nonconforming events have been addressed by corrective action as defined on a nonconformance memo.
- Valid interpretations have been made during the examination of the data and the review comments of the initial reviewer are correct.
- Manual Integrations are valid and properly documented.
- The package contains all of the necessary documentation for data review and report production and results are reported in a manner consistent with the method used for preparation of data reports.

The specific items covered in the level 2 review may vary according to the analytical method, but this review of the data must be documented by signing the data review checklist.

19.13.4.3 A third-level review is performed by the PM. This review is required before results are submitted to clients. This review serves to verify the completeness of the data report and to ensure that project requirements are met for the analyses performed. The items to be reviewed are:

- Analysis results are present for every sample in the analytical batch, reporting group, or sample delivery group (SDG).
- Every parameter or target compound requested is reported with either a value or reporting limit.
- The correct units and correct number of significant figures are utilized.
- All nonconformances and receipt variances with the resolution, including holding time violations and data evaluation statements that impact the data quality, are accompanied by clearly expressed comments from the laboratory.
- The final report is legible, contains all the supporting documentation required by the project, and is in either the standard TestAmerica Knoxville format or in the client-required format.

A narrative to accompany the final report is finalized by the PM. This narrative will include relevant comments collected during the earlier reviews.

19.13.4.4 Additional reviews are performed by the QA department. These reviews are typically performed after the data has been reported to the client. These reviews are a routine part of the Quality System and are discussed in further detail in Section 15.1. For example, the QA department reviews 10% of all DoD and DOE data packages for technical completeness and accuracy.

19.13.5 Manual Integrations

Computerized data systems provide the laboratory analyst with the ability to re-integrate raw instrument data in order to optimize the interpretation of the data. Though manual integration of data is an invaluable tool for resolving variations in instrument performance and some sample matrix problems, when used improperly, this technique would make unacceptable data appear to meet quality control acceptance limits. Improper re-integrations lead to legally indefensible data, a poor reputation, or possible laboratory decertification. Because guidelines for re-integration of data are not provided in the methods and most methods were written prior to widespread implementation of computerized data systems, the laboratory trains all analytical staff on proper manual integration techniques using TestAmerica's Corporate SOP CA-Q-S-002 and SOP KNOX-QA-0022 as the guidelines**.**

19.13.5.1 The laboratory analyst must adjust the baseline or the area of a peak in some situations, for example when two compounds are not adequately resolved or when a peak shoulder needs to be separated from the peak of interest. The laboratory analyst must use professional judgment and common sense to determine when manual integrating is required. Laboratory Analysts are encouraged to ask for assistance from a senior laboratory analyst or manager when in doubt.

19.13.5.2 Laboratory Analysts must not increase or decrease peak areas for the sole purpose of achieving acceptable QC recoveries that would have otherwise been unacceptable. The intentional recording or reporting of incorrect information (or the intentional omission of correct information) is against company principles and policy and is grounds for immediate termination.

19.13.5.3 Client samples, performance evaluation samples, and quality control samples are all treated equally when determining whether or not a peak area or baseline is manually adjusted.

19.13.5.4 All manual integrations receive a second level review. Manual integrations must be indicated on an expanded scale "after" chromatograms such that the integration performed can be easily evaluated during data review. Expanded scale "before" chromatograms are also required for all manual integrations on QC parameters (initial calibrations, calibration verifications, laboratory control samples, internal standards, surrogates, etc.) unless the laboratory has another documented corporate approved procedure in place that can demonstrate an active process for detection and deterrence of improper integration practices.

Figure 19-1.
Example - Demonstration of Capability Documentation

Analyst Demonstration of Capability
TestAmerica Knoxville

Analyst Name

MM/DD/YYYY

Preparation Method(s):
Analytical Method(s):
Matrix:
Method Description:

Preparation SOP No:

Analytical SOP No:

We, the undersigned, CERTIFY that:

1. The analyst identified above, using the cited test method with the specifications in the cited SOP, which is in use at this facility for the analysis of samples under the laboratory's Quality Assurance Plan, has completed the Demonstration of Capability (DOC).
2. The test method(s) was performed by the analyst identified on this certificate.
3. A copy of test method(s) and laboratory SOPs are available for all personnel on-site. **These documents have been reviewed by the analyst as part of this DOC.**
4. The data associated with the demonstration of capability are true, accurate, complete and self-explanatory.
5. All raw data necessary to reconstruct and validate these analyses have been retained at the facility. The associated information is organized and available for review.

Analyst	**Signature**	**Date**
Technical Director	**Signature**	**Date**
Quality Assurance Officer	**Signature**	**Date**

Table 19-1 Analytical Methods and Matrices

Analytical Parameters	Fields of Testing[1]				
	Drinking Water (SDWA)	**Non-Potable Water (CWA/RCRA)**	**Solid and Chemical Materials (RCRA-SW846)**	**Air and Emissions (CAA)**	**Biological Tissue**
Anions (Br^-, Cl^-, F^-, NO_2, NO_3, o-PO_4, SO_4	**EPA 300.0**	**EPA 300.0 (CWA)** **EPA 9056 (RCRA)**	**EPA 9056**	Mod Method 26A/0050 (9057 Mod)	---
Ash	---	---	**ASTM D482**	---	---
Density	---	---	ASTM D1963, D854	---	---
Halogens	---	---	EPA 5050/9056 (KNOX-WC-0016)	---	---
Heat of Combustion (Btu)	---	---	**ASTM D5865, D240**	---	---
Hexavalent Chromium	---	---	---	Method 0061/7199	---
pH	---	EPA 9040C (RCRA) SM4500 H+B (CWA)	EPA 9040C EPA 9045D	---	---
Hardness	---	**SM 2340B (CWA)**	---	---	---
Particulates	---	---	---	PM-10, **0050/5, 5B, 5J**, 201A, **202**, **TCEQ-23**, OTM-27, OTM-28	---
Mercury	---	**EPA 7470A (RCRA)**	**EPA 7471A&B**	**EPA 29/0060/7470A** ASTM D6784-02/7470A EPA IO-3.1/7470A	**EPA3051/3052/ 7470A**
Metals	---	**EPA 200.7 (CWA)** **EPA 3005A/ 6010B&C** **EPA 3010A/ 6010B&C (RCRA)**	**EPA 3050B/ 6010B&C** **EPA 3051/3052/6010B&C**	**EPA 29/ 0060/6010B&C** **EPA IO-3.1/6010B&C** **40CFR60-12 (Pb)**	**EPA 3051/3052/ 6010B&C**
Sulfur	---	---	ASTM D3177, ASTM D129	---	---
Viscosity	---	---	**ASTM D445**	---	---

Table 19-1 (continued) Analytical Methods and Matrices

Analytical Parameters	Fields of Testing[1]				
	Drinking Water (SDWA)	**Non-Potable Water (CWA/RCRA)**	**Solid and Chemical Materials (RCRA-SW846)**	**Air and Emissions (CAA)**	**Biological Tissue**
Volatiles by GC/MS	---	**EPA 5030B EPA 8260B (RCRA)**	**EPA 5035 EPA 8260B**	**TO-14A, TO-15 EPA 0031/5041A (VOST)**	---
Volatiles by GC	---	---	---	EPA 0040 Condensates **ASTM D1946**	---
Semivolatiles by GC/MS	---	**EPA 3520C EPA 8270C&D (RCRA)**	**EPA3550B&C EPA 3640A EPA 8270C&D**	**EPA 3542/8270C&D TO-13A**	---
Semivolatiles by GC	---	**EPA 3520C PCBs EPA 8082A (RCRA)**	**EPA 3550B&C EPA 3640A EPA 8082A**	**EPA 3542**/8082A **EPA 3542**/8081A **TO-4A, TO-10A** TCO/Grav	**EPA 3550B&C EPA 3640A** PCBs EPA 8082A
Dioxins/Furans by HRGC/HRMS	**EPA 1613B**	**EPA 1613B (CWA) EPA 8290 EPA 8290A (RCRA)**	**EPA 3640A EPA 8290 EPA 8290A**	**TO-9A, Method 23/8290/8290A EPA 0023A/8290/8290A**	**EPA 3640A EPA 8290 EPA 8290A EPA 1613B**
Lipids	---	---	---	---	EPA 8290, Micro-Lipids (KNOX-OP-0019)
PCBs by HRGC/HRMS	---	**EPA 1668A&B&C CWA**	**EPA3640A EPA 1668A&B&C**	**EPA 1668A&B&C**	**EPA 3640A EPA 1668A&B&C**
Polycyclic Aromatic Hydrocarbons (PAH)	---	**EPA 3520C EPA 8270C&D** ID0016	**EPA 3550B&C/3640A/ 8270C&D EPA 3540C/3640A/ ID0016**	**EPA 3542/8270C&D EPA 3542/ID0016**	**EPA 3550B&C/ 3640A/** 8270C&D EPA **3540C/3640A/ ID0016**

(1) **NELAC accredited analytical methods and accepted prep methods are highlighted in bold fon**

SECTION 20

EQUIPMENT and CALIBRATIONS

20.1 OVERVIEW

The laboratory purchases the most technically advanced analytical instrumentation for sample analyses. Instrumentation is purchased on the basis of accuracy, dependability, efficiency and sensitivity. Each laboratory is furnished with all items of sampling, preparation, analytical testing and measurement equipment necessary to correctly perform the tests for which the laboratory has capabilities. Each piece of equipment is capable of achieving the required accuracy and complies with specifications relevant to the method being performed. Before being placed into use, the equipment (including sampling equipment) is calibrated and checked to establish that it meets its intended specification. The calibration routines for analytical instruments establish the range of quantitation. Calibration procedures are specified in laboratory SOPs for the analytical methods. A list of laboratory equipment and instrumentation is presented in Table 20-1.

Equipment is only operated by authorized and trained personnel. Manufacturer's instructions for equipment use are readily accessible to all appropriate laboratory personnel.

20.2 PREVENTIVE MAINTENANCE

20.2.1 The laboratory follows a well-defined maintenance program to ensure proper equipment operation and to prevent the failure of laboratory equipment or instrumentation during use. This program of preventive maintenance helps to avoid delays due to instrument failure.

20.2.2 Routine preventive maintenance procedures and frequency, such as cleaning, and replacements, are performed according to the procedures outlined in the manufacturer's manual. Qualified personnel must also perform maintenance when there is evidence of degradation of peak resolution, a shift in the calibration curve, loss of sensitivity, or failure to continually meet one of the quality control criteria.

20.2.3 Table 20-2 summarizes the schedules for routine maintenance. It is the responsibility of each Group Leader to ensure that instrument maintenance logs are kept for all equipment in his/her department. Preventative maintenance procedures may also be outlined in analytical SOPs or instrument manuals. (Note: for some equipment, the log used to document maintenance is also used to monitor performance.)

20.2.4 Instrument maintenance logs are controlled and are used to document instrument problems, instrument repair and maintenance activities. Maintenance logs are kept for all major pieces of equipment. Instrument maintenance logs may also be used to specify instrument operating parameters.

20.2.4.1 Documentation must include all major maintenance activities such as contracted preventive maintenance and service and in-house activities such as the replacement of electrical components, lamps, tubing, valves, columns, detectors, cleaning and adjustments.

20.2.4.2 Each entry in the instrument log includes the Laboratory Analyst's initials, the date, a detailed description of the problem (or maintenance needed/scheduled), a detailed explanation of the solution or maintenance performed, and a verification that the equipment is functioning properly (state what was used to determine a return to control, e.g., continuing instrument calibration verification (CCV) run on *'date'* was acceptable, or instrument recalibrated on 'date' with acceptable verification, etc.). An entry in the associated analytical runlog documenting successful calibration may also be used to document instrument return to control following maintenance.

20.2.4.3 When maintenance or repair is performed by an outside agency, service receipts detailing the service performed are affixed into the maintenance logbook. The analyst signs across the entered item and the logbook page so that it is clear that the insert is missing if only half a signature is found in the logbook.

20.2.4.4 In addition, the maintenance records contain:

- The identification of the instrument/equipment **(**instrument's Serial Number and Model Number).
- The date the instrument/equipment was put into use.
- If available, the condition when the instrument was received (e.g., new, used, reconditioned).

20.2.5 If an instrument requires repair (subjected to overloading or mishandling, gives suspect results, or otherwise has shown to be defective or outside of specified limits), it is taken out of operation and tagged as out of service or otherwise isolated until such a time as the repairs have been made and the instrument can be demonstrated as operational by calibration and/or verification or other test to demonstrate acceptable performance. The laboratory examines the effect of this defect on previous analyses (refer to Sections 12 and 13).

20.2.6 In the event of equipment malfunction that cannot be resolved, service is obtained from the instrument vendor manufacturer, or qualified service technician, if such a service can be tendered. If on-site service is unavailable, arrangements are made to have the instrument shipped back to the manufacturer for repair. Back up instruments, which have been approved for the analysis perform the analysis normally carried out by the malfunctioning instrument. If the back up is not available and the analysis cannot be carried out within the needed timeframe, the samples are subcontracted.

20.2.7 At a minimum, if an instrument is sent out for service or transferred to another facility, it must be recalibrated and the laboratory MDL verified (using an MDLV) prior to return to lab operations.

20.2.8 An inventory of critical spare parts is maintained to minimize delays in the completion of analyses. For most test methods, back-up instrumentation is also maintained to minimize delays.

20.3 SUPPORT EQUIPMENT

This section applies to all devices that may not be the actual test instrument, but are necessary to support laboratory operations. These include but are not limited to: balances, ovens,

refrigerators, freezers, incubators, water baths, temperature measuring devices, and volumetric dispensing devices if quantitative results are dependent on their accuracy, as in standard preparation and dispensing or dilution into a specified volume. All raw data records associated with the support equipment are retained to document instrument performance. Refer to Table 20-3.

20.3.1 Weights and Balances

The accuracy of the balances used in the laboratory is checked every working day, before use. All balances are placed on stable counter tops. Balances must have their calibration checked each day of use with two weights bracketing the working range; refer to Table 20-3.

Each balance is checked prior to initial serviceable use with at least two certified ASTM type 1 weights spanning its range of use (weights that have been calibrated to ASTM type 1 weights may also be used for daily verification). ASTM type 1 weights used only for calibration of other weights (and no other purpose) are inspected for corrosion, damage or nicks at least annually and if no damage is observed, they are calibrated at least every 5 years by an outside calibration laboratory. Any weights (including ASTM Type 1) used for daily balance checks or other purposes are recalibrated/recertified annually to NIST standards (this may be done internally if the laboratory maintains “calibration only” ASTM type 1 weights).

All balances are serviced annually by a qualified service representative who supplies the laboratory with a certificate that identifies traceability of the calibration to the NIST standards.

All of this information is recorded in logs, and the recalibration/recertification certificates are kept on file. Further details on balance calibration may be found in SOP KNOX-QA-0005, Balance Calibration and Weight Verification.

20.3.2 pH and Conductivity Meters

The pH meters used in the laboratory are accurate to ± 0.1 pH units, and have a scale readability of at least 0.05 pH units. The meters automatically compensate for the temperature, and are calibrated with at least two working range buffer solutions before each use.

Conductivity meters are also calibrated before each use with a known standard to demonstrate the meters do not exceed an error of 1% or one umhos/cm.

All of this information is documented in logbooks.

Consult the pH and Routine Monitoring of Deionized Water SOPs for further information.

20.3.3 Thermometers

All thermometers are calibrated on an annual basis with a NIST-traceable thermometer. IR thermometers and digital thermometers are calibrated quarterly.

• If the temperature measuring device is used over a range of 10°C or less, then a single point verification within the range of use is acceptable;

• If the temperature measuring device is used over a range of greater than 10°C, then the verification must bracket the range of use.

The NIST mercury reference thermometer(s) are recalibrated every five years (unless thermometer has been exposed to temperature extremes or apparent separation of internal liquid) by an approved outside service and the provided certificate of traceability is kept on file. NIST digital reference thermometers are recalibrated every two years. The NIST thermometer(s) have increments of 1ºC, and have a range applicable to all method and certification requirements. The NIST traceable thermometer is used for no other purpose than to calibrate other thermometers.

Thermometer calibrations are documented as described in SOP KNOX-QA-0010, Temperature Monitoring and Thermometer Calibration.

20.3.4 Refrigerators/Freezer Units, Waterbaths, Ovens and Incubators

The temperatures of all refrigerator units and freezers used for sample and standard storage are monitored each working day. Monitoring is performed 7 days per week to ensure that samples remain within an acceptable range.

Ovens, waterbaths and incubators are monitored on days of use.

All of this equipment has a unique identification number, and is assigned a unique thermometer for monitoring.

Sample storage refrigerator temperatures are kept between > 0ºC and ≤ 6 ºC.

Specific temperature settings/ranges for other refrigerators, ovens waterbaths, and incubators can be found in method specific SOPs.

The temperatures are documented in temperature logbooks or in the method-specific logbooks/benchsheets.

20.3.5 Autopipettors, Dilutors, and Syringes

Mechanical volumetric dispensing devices including burettes (except Class A Glassware and Glass microliter syringes) are given unique identification numbers and the delivery volumes are verified gravimetrically, at a minimum, on a quarterly basis.
Any device not regularly verified cannot be used for any quantitative measurements.

Refer to SOP KNOX-QA-0012, Pipetter and Volumetric Labware Calibration Verification.

Micro-syringes are purchased from Hamilton Company. Each syringe is traceable to NIST. The laboratory keeps on file an “Accuracy and Precision Statement of Conformance” from Hamilton attesting established accuracy.

20.4 INSTRUMENT CALIBRATIONS

Calibration of analytical instrumentation is essential to the production of quality data. Strict calibration procedures are followed for each method. These procedures are designed to determine and document the method detection limits, the working range of the analytical instrumentation and any fluctuations that may occur from day to day.

Sufficient raw data records are retained to allow an outside party to reconstruct all facets of the initial calibration. Records contain, but are not limited to, the following: calibration date, method, instrument, laboratory analyst(s) initials or signatures, analysis date, analytes, concentration, response, type of calibration (Avg RF, curve, or other calculations that are used to reduce instrument responses to concentration).

Sample results must be quantitated from the initial calibration and must not be quantitated from any continuing instrument calibration verification unless otherwise required by regulation, method or program.

If the initial calibration results are outside of the acceptance criteria, corrective action is performed and any affected samples are reanalyzed if possible. If the reanalysis is not possible, any data associated with an unacceptable initial calibration is reported with appropriate data qualifiers (refer to Section 13).

Note: Instruments are calibrated initially and as needed after that and at least annually. The annual initial calibration requirement does not apply to isotope dilution methods**.**

20.4.1 CALIBRATION STANDARDS

20.4.1.1 Calibration standards are prepared using the procedures indicated in the Reagents and Standards section of the determinative method SOP. If a reference method does not specify the number of calibration standards, a minimum of 3 calibration points (exception being ICP and ICP/MS methods) shall be used.

20.4.1.2 Standards for instrument calibration are obtained from a variety of sources. All standards are traceable to national or international standards of measurement, or to national or international standard reference materials.

20.4.1.3 The lowest concentration calibration standard that is analyzed during an initial calibration must be at or below the stated reporting limit for the method based on the final volume of extract (or sample).

20.4.1.4 The other concentrations define the working range of the instrument/method or correspond to the expected range of concentrations found in actual samples that are also within the working range of the instrument/method. Results of samples not bracketed by initial instrument calibration standards (within calibration range to at least the same number of significant figures as that used to report the sample data) must be reported as having less certainty, e.g., defined qualifiers or flags (additional information may be included in the case narrative). The exception to these rules is ICP methods which define the working range with periodic linear dynamic range studies, rather than through the range of concentrations of daily calibration standards.

20.4.1.5 All initial calibrations are verified with a standard obtained from a second source and traceable to a national standard, when available (or vendor certified different lot if a second source is not available). For unique situations, such as air analysis where no other source or lot is available, a standard made by a different laboratory analyst is used for verification. This verification occurs immediately after the calibration curve has been analyzed, and before the analysis of any samples.

20.4.2 Continuing Calibration Verification (CCV)

The calibration relationship established during the initial calibration must be verified at least daily as specified in the laboratory method SOPs in accordance with the referenced analytical methods and in the 2009 TNI Standard. The process of calibration verification applies to both external standard and internal standard calibration techniques, as well as to linear and non-linear calibration models.

Note: The process of calibration verification referred to is fundamentally different from the approach called "calibration" in some methods. As described in those methods, the calibration factors or response factors calculated during calibration are used to update the calibration factors or response factors used for sample quantitation. This approach, while employed in other EPA programs, amounts to a daily single-point calibration.

All target analytes and surrogates, including those reported as non-detects, must be included in periodic calibration verifications for purposes of retention time confirmation and to demonstrate that calibration verification criteria are being met.

Note: For Ohio EPA VAP projects the calibration solution used for calibration verification must be from the same source as that used for the calibration curve unless the method states otherwise.

All samples must be bracketed by periodic analyses of standards that meet the QC acceptance criteria (e.g., calibration and retention time). The required frequency is found in the analytical method SOPs.

Note: If an internal standard calibration is being used (basically GCMS and some GC methods) then bracketing standards are not required, only daily verifications are needed. The results from these verification standards must meet the calibration verification criteria and the retention time criteria (if applicable).

Generally, the initial calibrations must be verified at the beginning of each 12-hour analytical shift during which samples are analyzed. (Some methods may specify more or less frequent verifications). The 12-hour analytical shift begins with the injection of the continuing calibration verification standard (or the MS tuning standard in MS methods). The shift ends after the completion of the analysis of the last sample, QC, or standard that can be injected within 12 hours of the beginning of the shift.

A continuing calibration verification (CCV) must be repeated at the beginning and, for methods that have quantitation by external calibration models, at the end of each analytical batch. Some

methods have more frequent CCV requirements see specific SOPs. Most Inorganic methods require the CCV to be analyzed after ever 10 samples or injections, including matrix or batch QC samples.

Note: If an internal standard calibration is being used (basically GCMS) then bracketing standards are not required, only daily verifications are needed. The results from these verification standards must meet the calibration verification criteria and the retention time criteria (if applicable).

If the results of a CCV are outside the established acceptance criteria and analysis of a second consecutive (and immediate) CCV fails to produce results within acceptance criteria, corrective action shall be performed. Once corrective actions have been completed & documented, the laboratory shall demonstrate acceptable instrument / method performance by analyzing two consecutive CCVs, or a new initial instrument calibration shall be performed. (Note: For Ohio EPA VAP projects, if the instrument conditions have been changed, the laboratory must analyze a new calibration curve.)

Sample analyses and reporting of data may not occur or continue until the analytical system is calibrated or calibration verified. However, data associated with an unacceptable continuing calibration verification may be fully useable under the following special conditions listed in Section 20.4.2.1, below, and reported based upon discussion and approval of the client.

20.4.2.1 Verification of Linear or Non-Linear Calibrations

Continuing calibration verification for calibrations involves the calculation of the percent drift or the percent difference of the instrument response between the initial calibration and each subsequent analysis of the continuing calibration verification standard. (These calculations are available in the laboratory method SOPs.) Continuing calibration verification standards are evaluated based on the % Difference from the average CF or RF of the initial calibration or based on % Drift or % Recovery if a linear or quadratic curve is used.

Regardless of whether a linear or non-linear calibration model is used, if initial continuing calibration verification criterion is not met, then no sample analyses may take place until the calibration has been verified or a new initial calibration is performed that meets the specifications listed in the method SOPs. If the calibration cannot be verified after the analysis of a single verification standard, then adjust the instrument operating conditions and/or perform instrument maintenance, and analyze another aliquot of the verification standard. If the calibration cannot be verified with the second standard, then a new initial calibration is performed.

- When the acceptance criteria for the continuing calibration verification are exceeded high, i.e., high bias, and there are associated samples that are non-detects, then those non-detects may be reported. Otherwise, the samples affected by the unacceptable continuing calibration verification shall be reanalyzed after a new initial calibration curve has been established, evaluated and accepted.

- When the acceptance criteria for the continuing calibration verification are exceeded low, i.e., low bias, those sample results may be reported if they exceed a maximum regulatory limit/decision level. Otherwise, the samples affected by the unacceptable verification shall be reanalyzed after a new calibration curve has been established, evaluated and accepted. Alternatively, a reporting limit standard may be analyzed to demonstrate that the laboratory can still support non-detects at their reporting limit. (Note: This is not permitted for Ohio EPA VAP projects.)

20.5 TENTATIVELY IDENTIFIED COMPOUNDS (TICS) – GC/MS ANALYSIS

For samples containing components not associated with the calibration standards, a library search may be made for the purpose of tentative identification. The necessity to perform this type of identification will be determined by the purpose of the analyses being conducted. Data system library search routines must not use normalization routines that would misrepresent the library or unknown spectra when compared to each other.

Note: If the TIC compound is not part of the client target analyte list but is calibrated by the laboratory and is both qualitatively and/or quantitatively identifiable, it should not be reported as a TIC. If the compound is reported on the same form as true TICs, it must be qualified and/or narrated that the reported compound is qualitatively and quantitatively (if verification in control) reported compared to a known standard that is in control (where applicable). TestAmerica Knoxville will provide this service upon client request.

For example, the RCRA permit or waste delisting requirements may require the reporting of non-target analytes. Only after visual comparison of sample spectra with the nearest library searches may the analyst assign a tentative identification. See SOP KNOX-MS-0014, Tentatively Identified Compounds, for guidelines for making tentative identifications.

Note: For Ohio EPA VAP projects the laboratory may not attest under affidavit that TICs are “certified data.”

20.6 GC/MS TUNING

Prior to any GCMS analytical sequence, including calibration, the instrument parameters for the tune and subsequent sample analyses within that sequence must be set.

Prior to tuning/auto-tuning the mass spec, the parameters may be adjusted within the specifications set by the manufacturer or the analytical method. These generally don't need any adjustment but it may be required based on the current instrument performance. If the tune verification does not pass it may be necessary to clean the source or perform additional maintenance. Any maintenance is documented in the maintenance log or run log.

Table 20-1. Laboratory Instrument List

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Knoxville Instrument List

Instrument Type	Manufacturer	Model Number	Serial Number	Name	LIMS ID	Year Put into Service	Condition When Received
ICP-AES	Thermo Jarrell Ash	61E Trace	248490	ST1	ST1	1994	NEW
ICP-AES	Thermo Scientific	6500 Duo	20101714	Duo	Duo	2010	NEW
Mercury Analyzer (CVAAS)	Leeman Labs, Inc.	Hydra AA	6021	HG	HG	2006	NEW
GC/MS Semivolatiles	Hewlett-Packard	5973/6890	US00035127 (GC) US10450996 (MS)	MY	MY	2000	NEW
GC/MS Semivolatiles	Agilent Technologies	5975/6890	CN10816002 (GC) US81839504 (MS)	MP	MP	2008	NEW
GC/MS Semivolatiles	Hewlett-Packard	5973/6890	US00026427 (GC) US82321805 (MS)	MA	MA	1999	NEW
GC/MS Semivolatiles	Agilent Technologies	5973/6890	US10146146 (GC) US10451834 (MS)	MD	MD	2001	NEW
GC/MS Volatiles	Agilent Technologies	5973/6890	US10129076 (GC) US94260093 (MS)	ME	ME	2001	NEW
GC/MS Volatiles	Agilent Technologies	5975C	CN10031137 (GC) US10053001 (MS)	MR	MR	2010	NEW
GC/MS Volatiles	Agilent Technologies	5973/6890	US10506023 (GC) US44621247 (MS)	MG	MG	2005	NEW
GC/MS Volatiles	Agilent Technologies	5973/6890N	US10345111 (GC) US33220174 (MS)	MK	MK	2003	NEW
GC/MS Volatiles	Hewlett-Packard	5973/6890	DE00020254 (GC) US80310976 (MS)	MZ	MZ	1998	NEW
GC/MS Volatiles	Hewlett-Packard	5973/6890	US00021530 (GC) US80210991 (MS)	MX	MX	1998	NEW
GC/MS Volatiles	Hewlett-Packard	5973/6890	US00028390 (GC) US91911868 (MS)	MJ	MJ	2000	NEW
HRGC/HRMS	Finnigan	MAT-95/6890	2631	M1	M1D M1A	1991	NEW
HRGC/HRMS	Finnigan	MAT-95S/6890	2725	M2	M2A	1998	NEW
HRGC/HRMS	Thermo Scientific	DFS	03097	DFS	D11A	2009	NEW
HRGC/HRMS	Thermo Scientific	DFS	03190	DFS	D2A	2012	USED
Ion Chromatograph	Dionex	DX-320	00070167	Lil Mike	320	2000	NEW
Ion Chromatograph	Dionex	DX-600	02070458	Aragon	600	2002	NEW
Ion Chromatograph	Dionex	ICS-1500	03100244	1500	1500	2003	NEW
Calorimeter	Parr	Bomb Calorimeter 1266	A1126DDEA	NA	NA	2003	NEW
Furnace (Ash)	Barnstead Thermolyne Furnace	30400	1262041236063	NA	NA	2003	NEW
GPC	J2 Scientific	GPC Accuprep	05L-1179-4.0	GPC1	NA	2003	NEW
GPC	J2 Scientific	GPC Accuprep	1122-1.0	GPC2	NA	2008	USED
pH Meter	Accumet	Ab15	AB92318635	pH Meter	NA	2004	NEW
Spectrophotometer	Thermo Electron	Spectronic 20D+	3DUK270002	SPEC20	SPEC20	2007	NEW
GC-FID	Varian	3600 FID	0295	DW	DW	1998	NEW
GC-FID	Varian	3300 FID	3890	CO	CO	1987	NEW
GC-TCD	Varian	3400 TCD	3961	GR	GR	1989	NEW
GC-FID	Varian	3400 FID	4644	GTO	GTO	1987	NEW
GC-FID	Hewlett-Packard	5890 Series II	3126A36555	GX	GX	2006	USED
GC-ECD	Hewlett-Packard	6890 ECD	US00021272	GST	GST	1997	NEW
GC-ECD	Agilent Technologies	6890 ECD	US00041050	GH	GH	2001	NEW
GC-ECD	Hewlett-Packard	5890 ECD	3235A46090	GMN	MN	1986	NEW
GC-ECD	Agilent Technologies	6890 ECD	US10346012	CD	CD	2003	NEW

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Table 20-2 – Preventive Maintenance Procedures for Laboratory Equipment

Instrument/ Equipment Type	Activity	Frequency
Gas chromatograph	Check for sufficient supply of carrier and detector gases. Check for correct column flow and/or inlet pressures.	Daily – documented in runlog
	Fill solvent reservoirs	Daily – documented in runlog
	Check temperature program/instrument method.	Daily – documented in runlog
	Air analyses: Check liquid nitrogen and carrier gas levels.	Daily – documented in runlog
	Break off front portion of capillary columns. Replace column if this fails to restore column performance or when column performance (e.g. peak tailing, poor resolution, high backgrounds, etc.) indicates it is required.	As needed - documented in the instrument maintenance log
	Replace injection port liner when front portion of capillary column is removed or when breakdown exceeds limits.	As needed - documented in the instrument maintenance log
	Replace or repair flow controller if constant gas flow cannot be maintained.	As needed - documented in the instrument maintenance log
	Replace fuse.	As needed - documented in the instrument maintenance log
	Reactivate external carrier gas dryers.	As needed - documented in the instrument maintenance log
	Detectors: clean when baseline indicates contamination or when response is low. FID: clean/replace jet, replace igniter. ECD: follow manufacturers suggested maintenance schedule	As needed - documented in the instrument maintenance log
	Check inlets, septa. Replace septum.	As needed - documented in the instrument maintenance log
	Clean injector port.	As needed - documented in the instrument maintenance log
	Clip column leader.	As needed - documented in the instrument maintenance log
	Reactivate flow controller filter dryers when presence of moisture is suspected.	As needed - documented in the instrument maintenance log
	ECD: perform wipe test.	Semiannually – document in the instrument maintenance log
Ion Chromatograph	Check all lines for crimping, leaks and discoloration.	Daily – documented in runlog
	Check pump and gas pressure.	Daily – documented in runlog

Table 20-2 – Preventive Maintenance Procedures for Laboratory Equipment

Instrument/ Equipment Type	Activity	Frequency
	Clean conductivity cell.	As needed - documented in the instrument maintenance log
	Change column and guard column.	As needed - documented in the instrument maintenance log
	Change column and/or guard column bed support	As needed - documented in the instrument maintenance log
	De-gas pump head when flow is erratic.	As needed - documented in the instrument maintenance log
	Check/replace eluant end line filter.	As needed - documented in the instrument maintenance log
GC (Fixed Gases)	Check for correct column flow and/or inlet pressure	Daily – documented with successful calibration
	Check for correct carrier gas (He or Ar)	Daily – documented with successful calibration
	Check temperatures of injector, detector.	Daily – documented with successful calibration
	Verify temperature programs.	Daily – documented with successful calibration
	Check baseline level (offset)	Daily – documented with successful calibration
	Replace column.	As Needed
GC/MS (LRMS)	Check for correct column flow and/or inlet pressure.	Daily – documented with successful tune and calibration
	Check temperatures of injector, detector. Verify temperature programs.	Daily – documented with successful tune and calibration
	Check inlets, septa	Daily – documented with successful tune and calibration
	Check baseline level.	Daily – documented with successful tune and calibration
	Check relative abundance and mass assignments of the tuning compounds	Daily – documented with successful tune and calibration
	Ensure communication is established between the mass spec and the GC system.	Daily – documented with successful tune and calibration
	Check mass calibration (PFTBA or FC-43)	As needed - documented in the instrument maintenance log
	Change injection port liner.	As needed - documented in the instrument run/maintenance log
	Clip column	As needed - documented in the instrument run/maintenance log
	Replace electron multiplier when the tuning voltage approaches the maximum and/or when sensitivity falls below required level	As needed - documented in the instrument maintenance log

Table 20-2 – Preventive Maintenance Procedures for Laboratory Equipment

Instrument/ Equipment Type	Activity	Frequency
	Clean source, including lenses – the source cleaning is indicated by a variety of symptoms including inability of the analyst to tune the instrument to specifications, poor response, and high background contamination	As needed - documented in the instrument maintenance log
	Replace filaments when both filaments burn out or performance indicates need for replacement	As needed - documented in the instrument maintenance log
	Check ion source and analyzer (clean, replace parts as needed)	As needed - documented in the instrument maintenance log
	Clean air filters on GC/MS system.	As needed - documented in the instrument maintenance log
	Replace traps on Entech and Tekmar	As needed - documented in the instrument maintenance log
	Replace side plate o-ring.	As needed - documented in the instrument maintenance log
	Change inlet liners, seals and septa as needed, usually indicated by a loss of response in analytes that are sensitive to active sites or dirty parts	As needed - documented in the instrument run/maintenance log
	Check calibration vial.(PFTBA or FC-43)	As needed - documented in the instrument maintenance log
	Replace the exhaust filters on the mechanical rough pump every 1-2 years	As needed - documented in the instrument maintenance log
	Replace the diffusion pump fluid.	As needed - documented in the instrument maintenance log
	Replace the split vent trap between injection port and EPC	As needed - documented in the instrument maintenance log
	Change oil in the mechanical rough pump	Semi-annually: documented in the instrument maintenance log
ICP	Check that argon manifold gas pressure is 80 psi.	Daily – documented on chart cover page
	Check that nebulizer is not clogged.	Daily – documented on chart cover page
	Check that capillary tubing is clean and in good condition.	Daily – documented on chart cover page
	Check that peristaltic pump windings are secure.	Daily – documented on chart cover page
	Check that high voltage switch is on.	Daily – documented on chart cover page
	Check that exhaust fans are working.	Daily – documented on chart cover page
	Clean plasma torch assembly to remove accumulated deposits.	Daily – documented on chart cover page

Table 20-2 – Preventive Maintenance Procedures for Laboratory Equipment

Instrument/ Equipment Type	Activity	Frequency
	Check spray chamber O-rings	Daily – documented on chart cover page
	Clean nebulizer and drain chamber.	As needed
	Clean filters on back of power unit to remove dust.	As needed
	Replace when needed: peristaltic pump tubing sample capillary tubing autosampler sipper probe.	As needed
	Clean and lubricate autosampler arm.	As needed
	Check that cooling water supply system is full and drain bottle is not full.	As needed
	Clean air filter on water cooling system.	As needed
	Manufacturer service engineer for scheduled preventive maintenance service.	Annually
	Change vacuum pump oil on ST1	Annually
Cold Vapor Atomic Absorption (Leeman Mercury Analyzer)	Check tubing.	Daily
	Check maintenance schedule flags.	Daily
	Adjust/change Hg lamp.	As needed
	Clean or replace optical cell.	As needed
	Lubricate pump and autosampler arm.	As needed
	Change the drying tube.	As needed
GCMS HRGC/HRMS Isotope Dilution	Replace septum	As needed
	Replace injection port liner	As needed
	Perform column maintenance	As needed
	Replace carrier gas filter	As needed
	Check carrier gas pressure (record)	Weekly
	Install column (type and ID No.)	As needed
	Evaluate air spectrum, masses 28,32	Weekly
	Check tray chiller and water level.	Monthly
	Replace inlet seal.	As needed
	Clean injection port body.	As needed
	Replace interface ferrule on xfer line.	As needed
	Clean ion source	As needed
	Install clean ion volume	As needed
	Install new filament	As needed
	Replace reference gas reservoir septum (HRMS)	As needed

Table 20-2 – Preventive Maintenance Procedures for Laboratory Equipment

Instrument/ Equipment Type	Activity	Frequency
	Change mechanical pump oil	Annually
	Check coolant level and temp	As needed
	Check cooling fans	Weekly
	Check PCB seating and alignment	Biannually
	Check power supply voltages	As needed
	Check 5 volt card cage power supply (MAT 95, 95S, and 90S)	Monthly
Gel Permeation Chromatography (GPC)	Check solvent reservoir and waste container	Daily
	Check system for air bubbles	Daily
	Check all lines, valves and fittings for leaks	Daily
	Check column for dry patches, voids or channeling	Daily
	Check column pressure	Daily
	Prime sample pump several times before first injection	Daily
	Always watch first injection of ensure entire sample is loaded and there are no leaks at the injection port	Daily
	Perform flow rate check of the system	Weekly
	Verify tray calibration	Monthly
	Replace the solvent pump inlet check valve and outlet check valve	Yearly
	Replace the solvent pump seal	Yearly
	Replace the injection port seal on direct inject systems	Yearly
	Repack column with new beads when calibration does not meet QC criteria	As needed
	Do a Methanol cleaning run when column becomes extremely colored	As needed
	If separation is noticed in the column bed and plunger, push column bed back together and perform a calibration check to ensure the dump/collect windows have not changes	As needed
	Replace solvent line filters	As needed
	Replace the detector lamp	As needed
	Verify tray snap points each time trays are removed from the auto-sampler base	As needed
	Replace the syringe pump assembly	As needed
Sonicator	Tune sonicator assembly	Daily

Table 20-2 – Preventive Maintenance Procedures for Laboratory Equipment

Instrument/ Equipment Type	Activity	Frequency
	Disassemble and clean sonicator probe tips.	As Needed
	Replace probe tip.	As Needed
Calorimeter	Check O_2 tank level and change tank if low.	Daily – documented with successful calibration
	Verify temperature with external thermometer if method performance criteria cannot be consistently met.	As Needed
	Replace defective or worn parts and stems on bombs.	As Needed
	Polish bomb interior.	As Needed
Gas Chromatograph (ACS group)	Check for correct column flow and/or inlet pressure	Daily
	Check temperatures of injector, detector.	Daily
	Verify temperature programs.	Daily
	Check baseline level (offset)	Daily
	Replace sparger septum in PAT used for Method 0040	Weekly
	Replace the trap on the purge-and trap.	As Needed
	For Method 0040: Replace the carrier gas and purge gas filters.	As Needed
	Clip column ends and reinstall column	As Needed
	Replace column.	As Needed
	Clean sparger for Method 0040.	As Needed
	Re-ignite FID	As Needed
Muffle Furnace (ACS group)	Verify temperatures with platinum resistance thermometer per SOP.	Annually

Table 20-3. Periodic Calibration

Instrument/ Device	Type of Calibration/ Number of Standards	Frequency	Acceptance Limits	Corrective Action
Analytical Balance	Accuracy determined using NIST traceable weights. Minimum of 2 standards bracketing the weight of interest.	Each day of use	Varies by balance and weight. See Balance SOP.	Clean, check level, recheck. If fails, call QA.
Top Loading Balance	Accuracy determined using NIST traceable weights. Minimum of 2 standards bracketing the weight of interest.	Each day of use	Varies by balance. See Balance SOP.	Clean, check level, recheck. If fails, call QA.
NIST Traceable Working Weights	Accuracy verified against NIST Reference Weights	Annually	See Balance and Weights SOP	Replace
NIST Reference Weights	Accuracy determined by A2LA or NVLAP accredited weights and measurement laboratory.	5 years	As per certificate.	Replace.
NIST-Traceable Reference Thermometer	Accuracy determined by approved calibration laboratory.	5 years for mercury (2 years for digital)	As per certificate.	Replace (or service digital).
Liquid in Glass Working Thermometer	Against NIST-traceable thermometer	When received and annually at appropriate temperature range for intended use	+/-0.5°C	Replace
Digital Working Thermometers	Against NIST-traceable thermometer	Quarterly	+/-0.5°C	Replace
Refrigerator	Temperature checked using NIST-traceable thermometer.	Daily.	> 0ºC and ≤ 6 ºC	Check temperature, reread, issue nonconformance, tag out, and move samples to working unit as described in SOP KNOX-QA-0010 Temperature Monitoring and Thermometer Calibration.

Instrument/ Device	Type of Calibration/ Number of Standards	Frequency	Acceptance Limits	Corrective Action
Freezer	Temperature checked using NIST-traceable thermometer	Daily.	<-10°C <-20°C for Sediment and Tissue Samples	Check temperature, reread, issue nonconformance, tag out, and move samples to working unit as described in SOP KNOX-QA-0010 Temperature Monitoring and Thermometer Calibration.
Oven	Temperature checked using NIST-traceable thermometer.	When in use.	104 ± 1°C (% moisture) or as defined in analytical SOP	Adjust. Repair or Replace.
Volumetric Dispensing Devices (Eppendorf ® pipette, automatic volumetric or dispensing devices)	One delivery by weight. Using DI water, dispense into tared vessel. Record weight with device ID number. Volumetric dispensing devices used in support of DoD QSM require 10 replicate weighings. See SOP KNOX-QA-0012 for further details.	Quarterly	± 3% (+/-2% D for 10 replicate average)	Adjust. Repair or Replace.
Volumetric Labware (e.g. Class B volumetric glassware)	For non Class A Volumetric labware: 10 replicate weighings prior to first use. See SOP KNOX-QA-0012 for further details.	Before first use.	+/-2% D for 10 replicate average	Replace.
Non-Volumetric Labware (Non-Class A) used for measuring initial sample volume or final extract or digestate volume.	Verified by weight of DI water. Volumetric labware used in support of DoD QSM require 10 replicate weighings. See SOP KNOX-QA-0012 for further details	Once Per New Lot of Volumetric Labware	± 3%	Replace.

SECTION 21

MEASUREMENT TRACEABILITY

21.1 OVERVIEW

Traceability of measurements are assured using a system of documentation, calibration, and analysis of reference standards. Laboratory equipment that are peripheral to analysis and whose calibration is not necessarily documented in a test method analysis or by analysis of a reference standard are subject to ongoing certifications of accuracy. At a minimum, these must include procedures for checking specifications of ancillary equipment: balances, thermometers, temperature, Deionized (DI) and Reverse Osmosis (RO) water systems, automatic pipettes and other volumetric measuring devices. (Refer to Section 20.3) With the exception of Class A Glassware and Glass microliter syringes, quarterly accuracy checks are performed for all mechanical volumetric devices. Wherever possible, subsidiary or peripheral equipment is checked against standard equipment or standards that are traceable to national or international standards. Class A Glassware and Glass microliter syringes are routinely inspected for chips, acid etching or deformity (e.g., bent needle). If the Class A glassware or syringe is suspect, the accuracy of the glassware will be assessed prior to use.

21.2 NIST-TRACEABLE WEIGHTS AND THERMOMETERS

Reference standards of measurement are used for calibration only and for no other purpose, unless it can be shown that their performance as reference standards would not be invalidated.

For NIST-traceable weights and thermometers, the laboratory requires that all calibrations be conducted by a calibration laboratory accredited by A2LA, NVLAP (National Voluntary Laboratory Accreditation Program), APLAC (Asia-Pacific Laboratory Accreditation Cooperation), or EA (European Cooperation for Accreditation). A certificate and scope of accreditation is kept on file at the laboratory.

An external certified service engineer services laboratory balances on an annual basis. This service is documented on each balance with a signed and dated certification sticker. Balance calibrations are checked each day of use. All mercury thermometers are calibrated annually against a traceable reference thermometer. Temperature readings of ovens, refrigerators, and freezers are checked on each day of use.

21.3 REFERENCE STANDARDS / MATERIALS

Reference standards/materials, where commercially available, are traceable to certified reference materials. Commercially prepared reference standards, to the extent available, are purchased from vendors that are accredited to ISO Guide 34 and ISO/IEC Guide 17025. All reference standards from commercial vendors shall be accompanied with a certificate that includes at least the following information:

- Manufacturer
- Analytes or parameters calibrated
- Identification or lot number
- Calibration method

- Concentration with associated uncertainties
- Purity

If a standard cannot be purchased from a vendor that supplies a Certificate of Analysis, the purity of the standard is documented by analysis. The receipt of all reference standards must be documented. Reference standards are labeled with a unique Standard Identification Number and expiration date. All documentation received with the reference standard is retained as a QC record and references the Standard Identification Number.

All reference, primary and working standards/materials, whether commercially purchased or laboratory prepared, must be checked regularly to ensure that the variability of the standard or material from the 'true' value does not exceed method requirements. The accuracy of calibration standards is checked by comparison with a standard from a second source. In cases where a second standard manufacturer is not available, a vendor certified different lot is acceptable for use as a second source. For unique situations, such as air analysis where no other source or lot is available, a standard made by a different analyst is acceptable for this comparison. The appropriate Quality Control (QC) criteria for specific standards are defined in laboratory SOPs. In most cases, the analysis of an Initial Calibration Verification (ICV) or LCS (where there is no sample preparation) is used as the second source confirmation. These checks are generally performed as an integral part of the analysis method (e.g., calibration checks, laboratory control samples).

All standards and materials must be stored and handled according to method or manufacturer's requirements in order to prevent contamination or deterioration. Refer to the Corporate Environmental Health and Safety Manual or laboratory SOPs. For safety requirements, please refer to method SOPs and the laboratory Environmental Health and Safety Manual.

Standards and reference materials shall not be used after their expiration dates unless their reliability is verified by the laboratory and their use is approved by the Quality Assurance Manager. The laboratory must have documented contingency procedures for re-verifying expired standards.

21.4 DOCUMENTATION AND LABELING OF STANDARDS, REAGENTS, AND REFERENCE MATERIALS

Reagents must be at a minimum the purity required in the test method. The date of reagent receipt and the expiration date are documented. The lots for most of the common solvents and acids are tested for acceptability prior to company wide purchase. Refer to TestAmerica's Corporate SOP No. CA-Q-S-001, Solvent and Acid Lot Testing.

All manufacturer or vendor supplied Certificates of Analysis or Purity must be retained, stored appropriately, and readily available for use and inspection. These records are maintained in the analytical laboratory. Records must be kept of the date of receipt and date of expiration of standards, reagents and reference materials. In addition, records of preparation of laboratory standards, reagents, and reference materials must be retained, stored appropriately, and be readily available for use and inspection. For detailed information on documentation and labeling, please refer to SOP KNOX-QA-0001, Standard/Reagent Labeling and Documentation.

Commercial materials purchased for preparation of calibration solutions, spike solutions, etc.., are usually accompanied with an assay certificate or the purity is noted on the label. If the assay purity is 96% or better, the weight provided by the vendor may be used without correction. If the assay purity is less than 96%, a correction is made to concentrations applied to solutions prepared from the stock commercial material. (For 1613B dioxin/furan analyses the purity must be 98% or corrections must be made.) Blended gas standard cylinders use a nominal concentration if the certified value is within +/-15%, otherwise the certified values is used for the canister concentration.

21.4.1 All standards, reagents, and reference materials must be labeled in an unambiguous manner. Standards are logged into the laboratory's LIMS system, and are assigned a unique identification number. The following information is typically recorded in the electronic database within the LIMS.

- Standard ID
- Description of Standard
- Department
- Preparer's name
- Final volume and number of vials prepared
- Solvent type and lot number
- Preparation Date
- Expiration Date
- Standard source type (stock or daughter)
- Standard type (spike, surrogate, other)
- Parent standard ID (if applicable)
- Parent Standard Analyte Concentration (if applicable)
- Parent Standard Amount used (if applicable)
- Component Analytes
- Final concentration of each analyte
- Comment box (text field)

Note: All solvents and acids are stored at ambient temperature unless otherwise specified in the SOPs.

Records are maintained electronically for standard and reference material preparation. These records show the traceability to purchased stocks or neat compounds. These records also include method of preparation, date of preparation, expiration date and preparer's name or initials. Preparation procedures are provided in the Method SOPs and as described below.

21.4.2 All standards, reagents, and reference materials must be clearly labeled with a minimum of the following information:

- Expiration Date (include prep date for reagents)
- Standard ID
- Special Health/Safety warnings if applicable (Refer to the Health and Safety Manual)

Note: Refer to SOP KNOX-QA-0001 for more details.

All containers of prepared reagents must include an expiration date and an ID number to trace back to preparation.

Procedures for preparation of reagents can be found in the Method SOPs.

Standard ID numbers must be traceable through associated logbooks, worksheets and preparation/analytical batch records.

All reagents and standards must be stored in accordance to the following priority: 1) with the manufacturer's recommendations; 2) with requirements in the specific analytical methods and 3) according to the analytical SOPs.

SECTION 22

SAMPLING

22.1 OVERVIEW

TestAmerica Knoxville does not provide sampling services. The laboratory's responsibility in the sample collection process lies in supplying the sampler with the necessary coolers, reagent water, sample containers, preservatives, sample labels, custody seals, COC forms, ice, and packing materials required to properly preserve, pack, and ship samples to the laboratory. TestAmerica Knoxville also provides pre-cleaned sampling media for sample collection (e.g. source emission testing air sampling media).

22.2 SAMPLING CONTAINERS

The laboratory offers clean sampling containers for use by clients. The laboratory purchases clean containers from ESS and I-Chem (ESS QC class and I-Chem 300 Series containers). Certificates of cleanliness for bottles and preservatives are provided by the supplier and maintained at the laboratory. Alternatively, the certificates may be maintained by the supplier and available to the laboratory on-line.

22.2.1 Preservatives

Upon request, preservatives are provided to the client in pre-cleaned sampling containers. In some cases containers are purchased pre-preserved from the container supplier. Whether prepared by the laboratory or bought pre-preserved, the grades of the preservatives are at a minimum:

- Hydrochloric Acid – Reagent ACS (Certified VOA Free) or equivalent
- Methanol – Purge and Trap grade (for Volatiles with TerraCore)
- Nitric Acid – Instra-Analyzed or equivalent
- Sodium Bisulfate – ACS Grade or equivalent (for Volatiles with TerraCore)
- Sodium Hydroxide – Instra-Analyzed or equivalent
- Sulfuric Acid – Instra-Analyzed or equivalent

22.3 DEFINITION OF HOLDING TIME

The date and time of sampling documented on the COC form establishes the day and time zero. As a general rule, when the maximum allowable holding time is expressed in "days" (e.g., 14 days, 28 days), the holding time is based on calendar day measured. Holding times expressed in "hours" (e.g., 6 hours, 24 hours, etc.) are measured from date and time zero. The first day of holding time ends twenty-four hours after sampling. Holding times for analysis include any necessary reanalysis.

22.3.1 Semi-Volatile - Holding times for sample preparation for semi-volatile organics are measured from the sampling date until the day solvent contacts the sample. Holding times for analysis are measured from the date of initiation of extraction to the date of injection into the gas chromatograph.

22.3.2 Volatiles - Holding times for volatile organics are measured from the date (and time where applicable) of sampling to the date of injection into the gas chromatograph. Holding times for Encore preservation of volatiles samples is measured from the date and time of sampling to the date and time of sample preservation.

22.3.3 Inorganics - For inorganic and metals analysis, the preparation/digestion/distillation must be started within the maximum holding time as measured from the sampling date (and time where applicable). TestAmerica Knoxville measures the holding time for inorganics from sampling date (and time where applicable) to analysis date (and time where applicable).

22.4 SAMPLING CONTAINERS, PRESERVATION REQUIREMENTS, HOLDING TIMES

The preservation and holding time criteria specified in the following tables are derived from the source documents for the methods. If method required holding times (refer to Tables 22-1 to 22-6) -or preservation requirements are not met, the reports are qualified using a flag, footnote or case narrative. As soon as possible or "ASAP" is an EPA designation for tests for which rapid analysis is advised, but for which neither EPA nor the laboratory have a basis for a holding time.

22.5 SAMPLE ALIQUOTS / SUBSAMPLING

Taking a representative sub-sample from a container is necessary to ensure that the analytical results are representative of the sample collected in the field. The size of the sample container, the quantity of sample fitted within the container, and the homogeneity of the sample need consideration when sub-sampling for sample preparation. It is the laboratory's responsibility to take a representative subsample or aliquot of the sample provided for analysis.

Analysts must handle each sample as if it is potentially dangerous. At a minimum, safety glasses, gloves, and lab coats must be worn when preparing aliquots for analysis.

Refer to SOP KNOX-QA-0006, Subsampling, for details on the procedures to obtain representative subsamples for analysis from the samples submitted by the client.

Tables 22-1 to 22-6 detail holding times, preservation and container requirements, and sample volumes for SDWA and NPDES methods. The sample volumes are intended to be a minimal amount to perform the method, the containers that are used may be of larger size. ***Please Note:*** *the holding times are program specific and different programs may have different holding times for equivalent methods (e.g., there are differences in Holding times for many Organic analytes between SDWA and NPDES. RCRA methods may also be different).*

Table 22-1.
Holding Times, Preservation and Container Requirements: Drinking Water (SDWA)

PARAMETER	CONTAINER	PRESERVATION[1,2] Temp. [6]	Chemical	HOLDING TIME[3]	SAMPLE VOLUME
Nitrate	Plastic/Glass	4ºC	None	48 hours[4]	250 mL
Dioxin	Glass[5]	4ºC	$Na_2S_2O_3$	1 year	1 L

Key to Table

1. Sample preservation should be performed immediately upon sample collection. For composite chemical samples, each aliquot should be preserved at the time of collection. When use of an automated sampler makes it impossible to preserve each aliquot, then chemical samples may be preserved by maintaining at 4°C until compositing and sample splitting is completed.
2. When any sample is to be shipped by common carrier or sent through the United States mails, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR Part 172). The person offering such material for transportation is responsible for ensuring compliance. For the preservation requirements of Table 6-8, the Office of Hazardous Materials, Materials Transportation Bureau, Department of Transportation has determined that the Hazardous Materials Regulations do not apply to the following materials: Hydrochloric acid, (HCl) in water, solutions at concentrations of 0.04% by weight or less (pH about 1.96 or greater); Nitric acid (HNO_3) in water solutions at concentrations of 0.15% by weight or less (pH about 1.62 or greater); Sulfuric acid (H_2SO_4) in water solutions at concentrations of 0.35% by weight or less pH about 1.15 or greater); and Sodium hydroxide (NaOH) in water solutions at concentrations of 0.080% by weight or less (pH about 12.30 or less).
3. Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still be considered valid. Holding Times are determined from time of collection to time of analysis.
4. If the sample is chlorinated, the holding time for an un-acidified sample kept at 4°C is extended to 14 days.
5. With Teflon lined septum.
6. For samples with a temperature requirement of 4°C, a sample temperature of just above the water freezing temperature to < 6°C is acceptable.

Table 22-2
Holding Times, Preservation and Container Requirements: NPDES - Inorganic

PARAMETER	CONTAINER [1]	PRESERVATION[2,3] Temp[10].	Chemical	HOLDING TIME[4]	SAMPLE VOLUME
Boron	Plastic[5]	None	HNO_3 to pH<2	6 months	200 mL
Bromide	Plastic/Glass	None	None	28 days	100 mL
Chloride	Plastic/Glass	None	None	28 days	50 mL
Fluoride	Plastic	None	None	28 days	300 mL
Hardness	Plastic/Glass	None	HNO_3 to pH<2[7]	6 months	100 mL
Hydrogen Ion (pH)	Plastic/Glass	None	None	15 min.[6]	200 mL
Mercury	Plastic/Glass	None	HNO_3 to pH<2	28 days	200 mL
Metals[8,9]	Plastic/Glass	None	HNO_3 to pH<2[11]	6 months	200 mL
Nitrate	Plastic/Glass	≤ 6ºC	None	48 hours	100 mL
Nitrate-Nitrite	Plastic/Glass	≤ 6ºC	H_2SO_4 to pH <2	28 days	100 mL
Nitrite	Plastic/Glass	≤ 6ºC	None	48 hours	100 mL
Orthophosphate	Plastic/Glass	≤ 6ºC	Filter within 15 min.	48 hours	250 mL
Sulfate	Plastic/Glass	≤ 6ºC	None	28 days	250 mL

Key to Table

1. Plastic should be Polyethylene.
2. Sample preservation should be performed immediately upon sample collection. For composite chemical samples, each aliquot should be preserved at the time of collection. When use of an automated sampler makes it impossible to preserve each aliquot, then chemical samples may be preserved by maintaining at ≤ 6ºC until compositing and sample splitting is completed.
3. When any sample is to be shipped by common carrier or sent through the United States mails, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR Part 172). The person offering such material for transportation is responsible for ensuring compliance. For the preservation requirements of Table 6-8, the Office of Hazardous Materials, Materials Transportation Bureau, Department of Transportation has determined that the Hazardous Materials Regulations do not apply to the following materials: Hydrochloric acid, (HCl) in water, solutions at concentrations of 0.04% by weight or less (pH about 1.96 or greater); Nitric acid (HNO_3) in water solutions at concentrations of 0.15% by weight or less (pH about 1.62 or greater); Sulfuric acid (H_2SO_4) in water solutions at concentrations of 0.35% by weight or less pH about 1.15 or greater); and Sodium hydroxide (NaOH) in water solutions at concentrations of 0.080% by weight or less (pH about 12.30 or less).
4. Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still be considered valid. Holding Times are determined from time of collection to time of analysis.
5. May also be collected in quartz or PFTE Plastic.
6. For compliance testing, the analysis must be performed in the field at the time of analysis. If transported to the laboratory for analysis, the analysis will be performed as soon as practical and reported qualified.
7. H_2SO_4 to a pH <2 is also acceptable.
8. Except Mercury and Hexavalent Chromium.
9. For dissolved metals, samples must be filtered on site before adding HNO_3 preservative (or before

Key to Table

shipping to laboratory).

10. Aqueous samples must be preserved at ≤6 °C unless otherwise indicated, and should not be frozen unless data demonstrating that sample freezing does not adversely impact sample integrity is maintained on file and accepted as valid by the regulatory authority. Also, for purposes of NPDES monitoring, the specification of ‘‘≤ °C’’ is used in place of the ‘‘4 °C’’ and ‘‘<4 °C’’ sample temperature requirements listed in some methods.

11 Acid preservation may be omitted for shipping and laboratory will acidify at least 24 hours prior to analysis.

Table 22-3
Holding Times, Preservation and Container Requirements: NPDES - Organic

PARAMETER	CONTAINER	PRESERVATION[1,2] Temp.[7]	Chemical	HOLDING TIME[3]	SAMPLE VOLUME
CDD/CDFs[6] – Aqueous: Field/Lab Preservation	Glass	≤ 6ºC	pH <9, 0.008 % $Na_2S_2O_3$[5]	1 year	1 L
CDD/CDFs[6] – Solids/Mixed Phase/ - Field Preservation	Glass	≤ 6ºC	None	7 days[8]	10 grams/1 L
CDD/CDFs[6] – Tissue – Field Preservation	Glass	≤ 6ºC	None	24 hours[8]	10 grams
CDD/CDFs[6] – Solids/Mixed Phase/Tissue - Lab Preservation	Glass	< -10ºC	None	1 year	10 grams/1 L
Polychlorinated Biphenyls (PCB Congeners): Aqueous: Field/Lab Preservation[9]	Glass	≤ 6ºC	0.008 % $Na_2S_2O_3$[5]	1 year	1 L
Polychlorinated Biphenyls (PCB Congeners): Solid/Mixed Phase– Field Preservation[9]	Glass	≤ 6ºC	None	1 year	10 grams/1 L
Polychlorinated Biphenyls (PCB Congeners): Tissue- Field Preservation[9]	Glass	≤ 6ºC	None	24 hours[8]	10 grams
Polychlorinated Biphenyls (PCB Congeners): Solid/Mixed Phase/Tissue – Lab Preservation[9]	Glass	< -10ºC	None	1 year	10 grams/1 L

Key to Table

1. Sample preservation should be performed immediately upon sample collection. For composite chemical samples, each aliquot should be preserved at the time of collection. When use of an automated sampler makes it impossible to preserve each aliquot, then chemical samples may be preserved by maintaining at ≤ 6°C until compositing and sample splitting is completed.
2. When any sample is to be shipped by common carrier or sent through the United States mails, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR Part 172). The person offering such material for transportation is responsible for ensuring compliance. For the preservation requirements of Table 6-8, the Office of Hazardous Materials, Materials Transportation Bureau, Department of Transportation has determined that the Hazardous Materials Regulations do not apply to the following materials: Hydrochloric acid, (HCl) in water, solutions at concentrations of 0.04% by

Key to Table

weight or less (pH about 1.96 or greater); Nitric acid (HNO_3) in water solutions at concentrations of 0.15% by weight or less (pH about 1.62 or greater); Sulfuric acid (H_2SO_4) in water solutions at concentrations of 0.35% by weight or less pH about 1.15 or greater); and Sodium hydroxide (NaOH) in water solutions at concentrations of 0.080% by weight or less (pH about 12.30 or less).

3. Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still be considered valid. Holding Times are determined from time of collection to time of analysis (See also Footnote 8).
4. With Teflon lined septum.
5. Should only be used in the presence of residual chlorine. Ascorbic may be used instead.
6. When the extractable analytes of concern fall within a single chemical category, the specified preservative and maximum holding times should be observed for optimum safeguard of sample integrity. When the analytes of concern fall within two or more categories, the sample may be preserved by cooling to $\leq$ 6°C reducing residual chlorine with 0.0008 % sodium thiosulfate, storing in the dark, and adjusting the pH to 6-9. Samples preserved in this manner may be held for 7 days before extraction and for 40 days after extraction. Exceptions to this optional preservation and holding time procedure are noted in footnote 5 (re the requirement for thiosulfate reduction of residual chlorine) and footnotes 10 and 11(re the analysis of Benzidine).
7. Aqueous samples must be preserved at ≤6 °C unless otherwise indicated, and should not be frozen unless data demonstrating that sample freezing does not adversely impact sample integrity is maintained on file and accepted as valid by the regulatory authority. Also, for purposes of NPDES monitoring, the specification of ‘‘≤ °C’’ is used in place of the ‘‘4 °C’’ and ‘‘<4 °C’’ sample temperature requirements listed in some methods.

8 Holding time from sampling field preservation at <6ºC to time of preservation at <-10ºC.

9 Polychlorinated biphenyls (PCB congeners) are in the proposed 40CFR Part 136 Rule September 23, 2010.

Table 22-4.
Holding Times, Preservation and Container Requirements: RCRA - Aqueous

PARAMETER	CONTAINER [1]	PRESERVATION[2,3] Temp.[9]	Chemical	HOLDING TIME[4]	SAMPLE VOLUME
Chloride	Plastic/Glass	4ºC	None	28 days	100 mL
Hydrogen Ion (pH)	Plastic/Glass	4ºC	None	24 hours[8]	100 mL
Nitrate	Plastic/Glass	4ºC	None	48 hours	28 days
Sulfate	Plastic/Glass	4ºC	None	28 days	400 mL
Mercury	Plastic/Glass	None	HNO_3 to pH<2	28 days	250 mL
Other Metals	Plastic/Glass	None	HNO_3 to pH<2	6 months	250 mL
Acrolein and Acrylonitrile	Glass[7]	4ºC	0.0008 % Na2S2O3[5] Adjust pH to 4-5[10]	14 days	1 L
Benzidines	Glass[7]	4ºC	0.0008 % $Na_2S_2O_3$[5]	7 days[6]	1 L
Chlorinated Hydrocarbons	Glass[7]	4ºC	0.0008 % $Na_2S_2O_3$[5]	7 days[6]	1 L
Dioxins and Furans	Glass[7]	4ºC	0.0008 % $Na_2S_2O_3$[5]	30 days[6]	1 L
Haloethers	Glass[7]	4ºC	0.0008 % $Na_2S_2O_3$[5]	7 days[6]	1 L
Nitroaromatics and cyclic ketones	Glass[7]	4ºC	0.0008 % $Na_2S_2O_3$[5], store in dark	7 days[6]	1 L
Nitrosamines	Glass[7]	4ºC	0.0008 % $Na_2S_2O_3$[5], store in dark	7 days[6]	1 L
PCBs	Glass[7]	4ºC	None	1 year[6]	1 L
Phenols	Glass[7]	4ºC	0.0008 % $Na_2S_2O_3$[5]	7 days[6]	1 L
Phthalate Esters	Glass[7]	4ºC	None	7 days[6]	1 L
Polynuclear Aromatic Hydrocarbons	Glass[7]	4ºC	0.0008 % $Na_2S_2O_3$[5], store in dark	7 days[6]	1 L
Purgeable Hydrocarbons	Glass[7]	4ºC	0.0008 % $Na_2S_2O_3$[5] Adjust pH <2[2]	14 days	40 mL
Purgeable Halocarbons	Glass[7]	4ºC	0.0008 % $Na_2S_2O_3$[5]	14 days	40 mL

Key to Table

1. Plastic should be Polyethylene.
2. Sample preservation should be performed immediately upon sample collection. For composite chemical samples, each aliquot should be preserved at the time of collection. When use of an automated sampler

Key to Table

makes it impossible to preserve each aliquot, then chemical samples may be preserved by maintaining at 4°C until compositing and sample splitting is completed.

3. When any sample is to be shipped by common carrier or sent through the United States mails, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR Part 172). The person offering such material for transportation is responsible for ensuring compliance. For the preservation requirements of Table 6-8, the Office of Hazardous Materials, Materials Transportation Bureau, Department of Transportation has determined that the Hazardous Materials Regulations do not apply to the following materials: Hydrochloric acid, (HCl) in water, solutions at concentrations of 0.04% by weight or less (pH about 1.96 or greater); Nitric acid (HNO_3) in water solutions at concentrations of 0.15% by weight or less (pH about 1.62 or greater); Sulfuric acid (H_2SO_4) in water solutions at concentrations of 0.35% by weight or less pH about 1.15 or greater); and Sodium hydroxide (NaOH) in water solutions at concentrations of 0.080% by weight or less (pH about 12.30 or less).
4. Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still be considered valid. Holding Times are determined from time of collection to time of preparation (or to time of analysis if there is no separate preparation step).
5. Free Chlorine must be removed by the appropriate addition of $Na_2S_2O_3$.
6. 7 days to extraction. 40 days from extraction to analysis. For Dioxins/Furans: 30 days to extraction 45 days from extraction to analysis. For PCBs, no holding time is specified in SW-846 Chapter 4.
7. With Teflon lined septum.
8. Holding Time is listed as “As Soon as Possible” in SW 846. Per EPA MICE, the recommended maximum holding time for pH in water is 24 hours and pH in soil is 7 days. There are no mandated regulatory requirements.
9. For samples with a temperature requirement of 4°C, a sample temperature of just above the water freezing temperature to $\leq$ 6°C is acceptable.

10 Based on guidance from EPA MICE, if samples are received without pH adjustment, the holding time is 7 days.

Table 22-5.
Holding Times, Preservation and Container Requirements: RCRA – Non-Aqueous

PARAMETER	CONTAINER [1]	PRESERVATION Temp.[7]	PRESERVATION Chemical	HOLDING TIME[2]	SAMPLE WEIGHT
Chloride	Glass	4ºC	None	28 days	50 g
Hydrogen Ion (pH)	Glass	4ºC	None	7 days[6]	50 g
Nitrate	Glass	4ºC	None	N/A	50 g
Mercury	Plastic/Glass	4ºC	None	28 days	50 g
Other Metals	Plastic/Glass	None	None	6 months	50 g
Acrolein and Acrylonitrile	Glass[4]	4ºC	None	14 days	50 g
Benzidines	Glass[4]	4ºC	None	14 days[3]	50 g
Chlorinated Hydrocarbons	Glass[4]	4ºC	None	14 days[3]	50 g
Dioxins and Furans	Glass[4]	4ºC	None	30 days[3]	50 g
Haloethers	Glass[4]	4ºC	None	14 days[3]	50 g
Nitroaromatics and cyclic ketones	Glass[4]	4ºC	None	14 days[3]	50 g
Nitrosamines	Glass[4]	4ºC	None	14 days[3]	50 g
PCBs	Glass[4]	4ºC	None	1 year[3]	50 g
Phenols	Glass[4]	4ºC	None	14 days[3]	50 g
Phthalate Esters	Glass[4]	4ºC	None	14 days[3]	50 g
Polynuclear Aromatic Hydrocarbons	Glass[4]	4ºC	None	14 days[3]	50 g
Purgeable Hydrocarbons	Glass[4]	4ºC	None	14 days[5]	50 g
Purgeable Halocarbons	Glass[4]	4ºC	None	14 days[5]	50 g

Key to Table

1. Plastic should be Polyethylene.
2. Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still be considered valid.
3. 14 days to extraction. 40 days from extraction to analysis. For Dioxins/Furans (Method 8290) in Matrices other than tissue: 30 days to extraction 45 days from extraction to analysis. For Dioxins/Furans (Method 8290) in Tissue: 30 days to extraction 45 days from collection to analysis. Holding Times are determined from time of collection to time of preparation (or to time of analysis if there is no separate preparation

step). For PCBs, no holding time is specified in SW-846 Chapter 4.

4. With Teflon Lined Septum
5. See Volatile SOP for more detailed preservation requirements.
6. Holding Time is listed as “As Soon as Possible” in SW 846. Per EPA MICE, the recommended maximum holding time for pH in water is 24 hours and pH in soil is 7 days. There are no mandated regulatory requirements.
7. For samples with a temperature requirement of $4^{o}C$, a sample temperature of just above the water freezing temperature to $\leq 6^{o}C$ is acceptable.

Table 22-6.
Holding Times, Preservation and Container Requirements: Air Samples[1]

PARAMETER	CONTAINER	PRESERVATION Temp.	PRESERVATION Chemical	HOLDING TIME[2]	SAMPLE WEIGHT
Volatile Organics (TO-15, TO-14A)	Summa Canister	None	None	30 days	6L or 1L
Volatile Organics (TO-15, TO-14A)	Tedlar Bag	None	None	72 hrs[3,4]	1 L
Polynuclear Aromatic Hydrocarbons (TO-13A)	PUF/XAD	4ºC[5]	None	7 days[6]	N/A
Organochlorine Pesticides/PCBs (TO-4A)	PUF/XAD	4ºC[5]	None	7 days[6]	N/A
Dioxins/Furans (TO-9A)	PUF/XAD	4ºC[5]	None	7 days[6]	N/A

Key to Table

1. For details on Source Air Emission Holding Times, Containers, and Preservation please contact the laboratory for method specific information.
2. Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still be considered valid. Holding Times are determined from time of collection to time of preparation (or to time of analysis if there is no separate preparation step).
3. Holding Time is based on SW 846 Method 0040 “SAMPLING OF PRINCIPAL ORGANIC HAZARDOUS CONSTITUENTS FROM COMBUSTION SOURCES USING TEDLAR® BAGS”. Some states specifically enforce this holding time (e.g. Florida, New Jersey) and others have not specified this information in their regulatory requirements.
4. The holding time is 72 hours unless the laboratory has a documented validation study that indicates a longer HT is acceptable for the analytes of interest. Alternatively, the sample may be transferred into a Summa Canister within 72 hours.
5 For samples with a temperature requirement of 4°C, a sample temperature of just above the water freezing temperature to ≤ 6°C is acceptable.
6 7 days from collection to extraction, 40 days from extraction to analysis.

SECTION 23

HANDLING OF SAMPLES

Sample management procedures at the laboratory ensure that sample integrity and custody are maintained and documented from sampling/receipt through disposal.

23.1 CHAIN OF CUSTODY (COC)

The COC form is the written documented history of any sample and is initiated at the time of sampling. This form is completed by the sampling personnel and accompanies the samples to the laboratory where it is received and stored under the laboratory's custody. The purpose of the COC form is to provide a legal written record of the handling of samples from the time of collection until they are received at the laboratory. It also serves as the primary written request for analyses from the client to the laboratory. The COC form acts as a purchase order for analytical services when no other contractual agreement is in effect. An example of a COC form is found in Figure 23-1.

23.1.1 Field Documentation

The information the sampler needs to provide at the time of sampling on the container label is:

- Sample identification
- Date and time
- Preservative

During the sampling process, the COC form is completed and must be legible (see Figure 23-1). This form includes information such as:

- Client name, address, phone number and fax number (if available)
- Project name and/or number
- The sample identification
- Date, time and location of sampling
- Sample collectors name
- The matrix description
- The container description
- The total number of each type of container
- Preservatives used
- Analysis requested
- Requested turnaround time (TAT)
- Any special instructions
- Purchase Order number or billing information (e.g. quote number) if available
- The date and time that each person received or relinquished the sample(s), including their signed name.

When the sampling personnel deliver the samples directly to TestAmerica personnel, the samples are stored in a cooler with ice, as applicable, and remain solely in the possession of the client's field technician until the samples are delivered to the laboratory. The sample collector must assure that each container is in his/her physical possession or in his/her view at all times, or stored in such a place and manner to preclude tampering. The field technician relinquishes the samples in writing on the COC form to the sample receiving personnel at the laboratory or to a TestAmerica courier. When sampling personnel deliver the samples through a common carrier (Fed-Ex, UPS), the COC relinquished date/time is completed by the field personnel and samples are released to the carrier. Samples are only considered to be received by lab when personnel at the fixed laboratory facility have physical contact with the samples.

Note: Independent couriers are not required to sign the COC form.

23.1.2 Legal / Evidentiary Chain-of-Custody

TestAmerica Knoxville provides internal sample chain-of-custody tracking. However, it does not provide chain-of-custody evidence for samples identified for legal/evidentiary purposes as defined by the 2003 NELAC Standard Section 5.4.12.

23.2 SAMPLE RECEIPT

Per State and/or Federal Regulation, the client is responsible to ensure that samples are shipped in accordance with DOT/IATA requirements, and that radioactive materials may only be delivered to licensed facilities. Any samples containing (or suspected to contain) Source, Byproduct, or Special Nuclear Material as defined by 10 CFR should be delivered directly to facilities licensed to handle such radioactive material. Natural material or ores containing naturally occurring radionuclides may be delivered to any TestAmerica facility or courier as long as the activity concentration of the material does not exceed 270 pCi/g alpha or 2700 pCi/g beta (49 CFR Part 173).

Samples are received at the laboratory by designated sample receiving personnel and a unique laboratory project identification number is assigned. Each sample container is assigned a unique sample identification number that is cross-referenced to the client identification number such that traceability of test samples is unambiguous and documented. Each sample container is affixed with a durable sample identification label. Sample acceptance, receipt, tracking and storage procedures are summarized in the following sections.

23.2.1 Laboratory Receipt

When samples arrive at the laboratory, sample receiving personnel inspect the coolers and samples. The integrity of each sample must be determined by comparing sample labels or tags with the COC and by visual checks of the container for possible damage. Any non-conformance, irregularity, or compromised sample receipt must be documented on a Condition Upon Receipt Variance Form (See Example form in Figure 23-3). Details on the receipt of samples are found in SOP KNOX-SC-0003, Sample Receipt and Log-in.

Note: North Carolina requires that they be notified when samples are processed that do not meet sample acceptance criteria.

23.2.1.1 Unique Sample Identification

All samples that are processed through the laboratory receive a unique sample identification to ensure that there can be no confusion regarding the identity of such samples at anytime. This system includes identification for all samples, subsamples and subsequent extracts and/or digestates.

The laboratory assigns a unique identification (e.g., Sample ID\) code to each sample container received at the laboratory. This Primary ID is made up of the following information (consisting of 4 components):

Example: XXX - 9608 - A - 1

Location ID (3-digit # for your lab) | Login ID | Container Occurrence | Sample Number

The above example states that TestAmerica <location> Laboratory (Location XXX). Login ID is 9608 (unique to a particular client/job occurrence). The container code indicates it is the first container ("A") of Sample #1.

If the primary container goes through a prep step that creates a "new" container, then the new container is considered secondary and gets another ID. An example of this being a client sample in a 1-Liter amber bottle is sent through a Liquid/Liquid Extraction and an extraction vial is created from this step. The vial would be a SECONDARY container. The secondary ID has 5 components.

Example: XXX - 9608 - A - 1 - **A** ← **Secondary Container Occurrence**

Example: 140-9608-A-1-A, would indicate the PRIMARY container listed above that went through a step that created the 1st occurrence of a Secondary container.

With this system, a client sample can literally be tracked throughout the laboratory in every step from receipt to disposal

23.3 SAMPLE ACCEPTANCE POLICY

The laboratory has a written sample acceptance policy (Figure 23-2) that clearly outlines the circumstances under which samples are accepted or rejected. These include:

1 a COC filled out completely;
2 samples must be properly labeled;
3 proper sample containers with adequate volume for the analysis and necessary QC;
4 samples must be preserved according to the requirements of the requested analytical method;

5 sample holding times must be adhered to;

6 the client is notified if any sample is received in damaged condition.

Data from samples which do not meet these criteria are flagged and the nature of the variation from policy is defined.

23.4 SAMPLE STORAGE

In order to avoid deterioration, contamination or damage to a sample during storage and handling, from the time of receipt until all analyses are complete, samples are stored in refrigerators, freezers or protected locations suitable for the sample matrix. Samples for methods that do not require refrigeration (e.g., aqueous samples for ICP metals analysis) are stored on shelves at ambient temperature. In addition, samples to be analyzed for volatile organic parameters are stored in separate refrigerators designated for volatile organic parameters only. Samples are never to be stored with reagents, standards or materials that may create contamination.

To ensure the integrity of the samples during storage, refrigerator blanks are maintained in the volatile sample refrigerators and analyzed every two weeks.

Laboratory Analysts retrieve the sample container(s) allocated to their analysis from the designated storage location, analyze the sample, and return the remaining sample to the storage location from which it originally came. Residual samples are maintained in the designated storage location until disposal at least thirty days after the report is issued. (Exception: TO-14A or TO-15 canister samples are subject to disposal two days after the report is issued.) Special arrangements are made to store samples for longer periods of time.

Access to the laboratory is controlled such that sample storage need not be locked at all times unless a project specifically demands it. Samples are accessible to laboratory personnel only. Visitors to the laboratory are prohibited from entering the refrigerator and laboratory areas unless accompanied by an employee of TestAmerica.

23.5 HAZARDOUS SAMPLES AND FOREIGN SOILS

All samples are assumed to be hazardous. All samples are either returned to the client or disposed of appropriately through a hazardous waste disposal firm. All soil samples are sent out for incineration by a USDA-approved waste disposal facility.

23.6 SAMPLE SHIPPING

In the event that the laboratory needs to ship samples, the samples are placed in a cooler with enough ice to ensure the samples remain just above freezing and at or below 6.0°C during transit. The samples are carefully surrounded by packing material to avoid breakage (yet maintain appropriate temperature). A trip blank is enclosed for those samples requiring water/solid volatile organic analyses. The chain-of-custody form is signed by the sample control technician and attached to the shipping paperwork. Samples are generally shipped overnight express or hand-delivered by a TestAmerica courier to maintain sample integrity. All personnel involved with shipping and receiving samples must be trained to maintain the proper chain-of-

custody documentation and to keep the samples intact and on ice. The Environmental, Health and Safety Manual contains additional shipping requirements.

Note: If a client does not request trip blank analysis on the COC or other paperwork, the laboratory will not analyze the trip blanks that were supplied. However, in the interest of good client service, the laboratory will advise the client at the time of sample receipt that it was noted that they did not request analysis of the trip blank; and that the laboratory is providing the notification to verify that they are not inadvertently omitting a key part of regulatory compliance testing.

23.7 SAMPLE DISPOSAL

Samples should be retained for a minimum of 30 days after the project report is sent, however, provisions may be made for earlier disposal of samples once the holding time is exceeded. Some samples are required to be held for longer periods based on regulatory or client requirements (e.g., 60 days after project report is sent). The laboratory must follow the longer sample retention requirements where required by regulation or client agreement. Several possibilities for sample disposal exist: the sample may be consumed completely during analysis, the sample may be returned to the customer or location of sampling for disposal, or the sample may be disposed of in accordance with the laboratory's waste disposal procedures (SOP: KNOX-SC-0005, Sample Disposal Return and Archive). All procedures in the laboratory Environmental, Health and Safety Manual are followed during disposal. Samples are normally maintained in the laboratory no longer than two months from receipt unless otherwise requested. Unused portions of samples found or suspected to be hazardous according to state or federal guidelines may be returned to the client upon completion of the analytical work. Waste disposal complies with all federal and state laws and regulations.

Figure 23-1. Example: Chain of Custody (COC)

TestAmerica Knoxville
5815 Middlebrook Pike
Knoxville, TN 37921

phone 865-291-3000

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Client Contact	**Project Manager:**	**Site Contact:**	**Date:**	COC No:
Company Name	**Tel/Fax:**	**Lab Contact:**	**Carrier:**	_____ of _____ COCs
Address	**Analysis Turnaround Time**			Job No.
City/State/Zip	Calendar (C) or Work Days (W) _____			
Phone	TAT if different from Below _____			
Project Name:	☐ 2 weeks			SDG No.
Site:	☐ 1 week			
P O #	☐ 2 days			
Sampler Name:	☐ 1 day			

Sample Identification	**Sample Date**	**Sample Time**	**Sample Type**	**Matrix**	**# of Cont.**	**Filtered Sample**																	Sample Specific Notes:

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other _____

Possible Hazard Identification
☐ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* ☐ *Poison B* ☐ *Unknown*

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For _____ Months*

Special Instructions/QC Requirements & Comments:

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:

Figure 23-2. Example: Sample Acceptance Policy

NELAC specifies requirements under which any NELAC accredited laboratory will accept or reject samples. TestAmerica Knoxville will review your sample shipment against those requirements listed below, and will communicate any discrepancies to you. Your project manager will assist you in the appropriate resolution of any issues related to sample receipt. Please contact your project manager with any questions.

When completing the chain of custody form, please do not forget to sign your name in the "relinquished by" box.

NELAC requirements are as follows:

- Proper, full and complete documentation, which includes sample identification, the location, date and time of collection, the collector's name, the preservation type, the sample matrix type, the requested testing method, and any special remarks concerning the samples shall be provided. (Chain of Custody filled out properly)

- Each sample shall be labeled with unique, durable and indelible identification, (See note below regarding SUMMA canisters and VOST tubes).

- The samples shall be collected in the appropriate sample containers.

- The samples shall arrive at the laboratory within the specified holding time for the analyses requested.

- Sufficient sample volume must be available to perform the requested analyses and associated quality control.

- All samples submitted for water/solid Volatile Organic analyses must have a Trip Blank submitted at the same time

- The laboratory will notify the client upon sample receipt if the samples exhibit obvious signs of damage, contamination or inadequate preservation. Also, if there is a breach in the chain-of-custody associated with the sample(s), the client will be notified to determine the disposition of the samples.

- Samples shall be rejected if they are received in broken containers or if they exceed the laboratory radiological license limits. The client will be notified to determine the disposition of the samples.

NOTE: Never affix a label directly on a SUMMA canister. A special tag is attached to each canister for this purpose. Never place a label on a VOST tube; use the external container for labeling.

NOTE: Canisters and flow controllers must be returned even if they were not used. Sampling equipment that is lost or not returned will be invoiced to the client at the replacement costs.

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Figure 23-3. Example: Condition Upon Receipt Form

Return to Forms Navigator

TESTAMERICA KNOXVILLE SAMPLE RECEIPT/CONDITION UPON RECEIPT ANOMALY CHECKLIST **Log In Number:**

Review Items	Yes	No	NA	If No, what was the problem?	Comments/Actions Taken
1. Are the shipping containers intact?				**Containers, Broken**	
2. Were ambient air containers received intact?				Checked in lab	
3. The coolers/containers custody seal if present, is it intact?				Yes NA	
4. Is the cooler temperature within limits? (> freezing temp. of water to 6 °C, VOST: 10°C) Thermometer ID :_____ Correction factor: _____				**Cooler Out of Temp, Client Contacted, Proceed/Cancel** **Cooler Out of Temp, Same Day Receipt**	
5. Were all of the sample containers received intact?				**Containers, Broken**	
6. Were samples received in appropriate containers?				**Containers, Improper; Client Contacted; Proceed/Cancel**	
7. Do sample container labels match COC? (IDs, Dates, Times)				**COC & Samples Do Not Match** **COC Incorrect/Incomplete** **COC Not Received**	
8. Were all of the samples listed on the COC received?				**Sample Received, Not on COC** **Sample on COC, Not Received**	
9. Is the date/time of sample collection noted?				**COC; No Date/Time; Client Contacted**	**Labeling Verified by:** **Date:**
10. Was the sampler identified on the COC?				**Sample Not Listed on COC**	
11. Is the client and project name/# identified?				**COC Incorrect/Incomplete**	**pH test strip lot number:**
12. Are tests/parameters listed for each sample?				**COC No tests on COC**	
13. Is the matrix of the samples noted?				**COC Incorrect/Incomplete**	
14. Was COC relinquished? (Signed/Dated/Timed)				**COC Incorrect/Incomplete**	Box 16A: pH Preservation / Box 18A: Residual Chlorine
15. Were samples received within holding time?				**Holding Time - Receipt**	Preservative: _____
16. Were samples received with correct chemical preservative (excluding Encore)?				**pH Adjusted, pH Included (See box 16A)** **Incorrect Preservative**	Lot Number: _____ Exp Date:_____ Analyst:_____
17. Were VOA samples received without headspace?				**Headspace (VOA only)**	Date:_____
18. Did you check for residual chlorine, if necessary? (e.g. 1613B, 1668) Chlorine test strip lot number:_____				**Residual Chlorine**	Time:_____
19. For 1613B water samples is pH<9?				If no, lab will adjust	
20. For rad samples was sample activity info. Provided?				Project missing info	

Project #: _____ PM Instructions: _____

Sample Receiving Associate: _____ Date:_____ QA026R30.doc, 080916

Section 24

ASSURING THE QUALITY OF TEST RESULTS

24.1 OVERVIEW

In order to assure our clients of the validity of their data, the laboratory continuously evaluates the quality of the analytical process. The analytical process is controlled not only by instrument calibration as discussed in Section 20, but also by routine process quality control measurements (e.g. Method Blanks, Laboratory Control Samples (LCS), Matrix Spikes (MS), duplicates (DUP), surrogates, Internal Standards (IS)). These quality control checks are performed as required by the method or regulations to assess precision and accuracy. In addition to the routine process quality control samples, Proficiency Testing (PT) Samples (concentrations unknown to laboratory) are analyzed to help ensure laboratory performance.

24.2 CONTROLS

Sample preparation or pre-treatment is commonly required before analysis. Typical preparation steps include homogenization, solvent extraction, sonication, acid digestion, distillation, evaporation, drying and ashing. During these pre-treatment steps, samples are arranged into discrete manageable groups referred to as preparation (prep) batches. Prep batches provide a means to control variability in sample treatment. Control samples are added to each prep batch to monitor method performance and are processed through the entire analytical procedure with investigative/field samples. Refer to the analytical SOPs for further information regarding the type, frequency and acceptance criteria for the control samples.

24.3 NEGATIVE CONTROLS

Table 24-1. Example – Negative Controls

Control Type	Details
Method Blank (MB)	Are used to assess preparation and analysis for possible contamination during the preparation and processing steps.
	The specific frequency of use for method blanks during the analytical sequence is defined in the specific standard operating procedure for each analysis. Generally it is 1 for each batch of samples; not to exceed 20 environmental samples.
	The method blank is prepared from a clean matrix similar to that of the associated samples that is free from target analytes (e.g., Reagent water, Ottawa sand, glass beads, etc.) and is processed along with and under the same conditions as the associated samples. The method blank goes through all of the steps of the process (including as necessary: filtration, clean-ups, etc.).
	Reanalyze or qualify associated sample results when the concentration of a targeted analyte in the method blank is at or above the reporting limit as established by the method or by regulation, AND is greater than 1/10 of the amount measured in the sample. (Ohio VAP method blanks must be <RL)
Calibration Blanks	Are prepared and analyzed along with calibration standards where applicable or injected at specified frequencies throughout an analytical sequence.. They are prepared using the same reagents that are used to prepare the standards. In some analyses the calibration blank is included in the calibration curve. These blanks are termed Initial Calibration Blanks (ICB) or Continuing Calibration Blanks (CCB)

Table 24-1. Example – Negative Controls

Control Type	Details
Instrument Blanks	Are reagents or reagent water that are processed during an analytical sequence in order to assess contamination in the analytical system. In general, instrument blanks are used to differentiate between contamination caused by the analytical system and that caused by the sample handling or sample prep process. Instrument blanks may also be inserted throughout the analytical sequence to minimize the effect of carryover from samples with high analyte content.
Trip Blanks [1]	Are required to be submitted by the client with each shipment of samples requiring aqueous and solid volatiles analyses (or as specified in the client's project plan). Additionally, trip blanks are prepared and analyzed for volatile analysis of air samples, when required by the client. A trip blank is purchased (certified clean) or is prepared by the laboratory by filling a clean container with pure deionized water that has been purged to remove any volatile compounds. Appropriate preservatives are also added to the container. The trip blank is sent with the bottle order and is intended to reflect the environment that the containers are subjected to throughout shipping and handling and help identify possible sources if contamination is found. The field sampler returns the trip blank in the cooler with the field samples.
Field Blanks [1]	Are sometimes used for specific projects by the field samplers. A field blank prepared in the field by filling a clean container with pure reagent water and appropriate preservative, if any, for the specific sampling activity being undertaken. (EPA OSWER)
Equipment Blanks [1]	Are also sometimes created in the field for specific projects. An equipment blank is a sample of analyte-free media which has been used to rinse common sampling equipment to check effectiveness of decontamination procedures. (TNI)
Holding Blanks	Also referred to as refrigerator or freezer blanks, are used to monitor the sample storage units for volatile organic compounds during the storage of VOA samples in the laboratory

[1] When known, these field QC samples are not selected for matrix QC as it does not provide information on the behavior of the target compounds in the field samples. Usually, the client sample ID will provide information to identify the field blanks with labels such as "FB", "EB", or "TB."

Evaluation criteria and corrective action for these controls are defined in the specific standard operating procedure for each analysis.

24.4 POSITIVE CONTROLS

Control samples (e.g., QC indicators) are analyzed with each batch of samples to evaluate data based upon (1) Method Performance (Laboratory Control Sample (LCS) or Blank Spike (BS)), which entails both the preparation and measurement steps; and (2) Matrix Effects (Matrix Spike (MS) (Matrix spikes are not applicable to air) or Sample Duplicate (MD, DUP), which evaluates field sampling accuracy, precision, representativeness, interferences, and the effect of the matrix on the method performed. Each regulatory program and each method within those programs specify the control samples that are prepared and/or analyzed with a specific batch.

Note that frequency of control samples vary with specific regulatory, methodology and project specific criteria. Complete details on method control samples are listed in each analytical SOP.

24.4.1 Method Performance Control - Laboratory Control Sample (LCS)

24.4.1.1 The LCS measures the accuracy of the method in a matrix and assesses method performance independent of potential field sample matrix affects in a laboratory batch.

24.4.1.2 The LCS is prepared from a clean matrix similar to that of the associated samples that is free from target analytes (for example: Reagent water, Ottawa sand, glass

beads, etc.) and is processed along with and under the same conditions as the associated samples. The LCS is spiked with verified known amounts of analytes or is made of a material containing known and verified amounts of analytes, and taken through all preparation and analysis steps along with the field samples. Where there is no preparation for an analysis (such as in aqueous volatiles), or when all samples and standards undergo the same preparation and analysis process (such as Phosphorus), a continuing calibration verification standard is reported as the LCS. In some instances (e.g., ICP metals in soil), aqueous LCS's are processed for solid matrices; final results are calculated as mg/kg or ug/kg, assuming 100% solids.

24.4.1.3 The specific frequency of use for LCS during the analytical sequence is defined in the specific standard operating procedure for each analysis. It is generally 1 for each batch of samples; not to exceed 20 environmental samples.

24.4.1.4 If the mandated or requested test method, or project requirements, do not specify the spiking components, the laboratory spikes all reportable components to be reported in the Laboratory Control Sample (and Matrix Spike) where applicable (e.g., no spike of pH). However, in cases where the components interfere with accurate assessment (such as simultaneously spiking chlordane, toxaphene and PCBs in Method 608), the test method has an extremely long list of components or components are incompatible, at a minimum, a representative number of the listed components (see below) are used to control the test method. The selected components of each spiking mix represent all chemistries, elution patterns and masses, permit specified analytes and other client requested components. However, the laboratory ensures that all reported components are used in the spike mixture within a two-year time period. Note: this section is not applicable to Ohio EPA VAP projects.

24.4.1.4.1 For methods that have 1-10 target analytes, spike all components.

24.4.1.4.2 For methods that include 11-20 target analytes, spike at least 10 or 80%, whichever is greater.

24.4.1.4.3 For methods with more than 20 target analytes, spike at least 16 components.

24.4.1.4.4 Exception: Due to analyte incompatibility in pesticides, Toxaphene and Chlordane are only spiked at client request based on specific project needs.

24.4.1.4.5 Exception: Due to analyte incompatibility between the various PCB Aroclors, Aroclors 1016 and 1260 are used for spiking as they cover the range of all of the Aroclors. Specific Aroclors may be used by request on a project specific basis.

24.5 SAMPLE MATRIX CONTROLS

Table 24-3. Sample Matrix Control

Control Type	Details	
Matrix Spikes (MS)	Use	Used to assess the effect sample matrix of the spiked sample has on the precision and accuracy of the results generated by the method used;
	Typical Frequency [1]	At a minimum, with each matrix-specific batch of samples processed, an MS is carried through the complete analytical procedure. Unless specified by the client, samples used for spiking are randomly selected and rotated between different client projects. If the mandated or requested test method does not specify the spiking components, the laboratory spikes all reportable components to be reported in the Laboratory Control Sample and Matrix Spike. Refer to the method SOP for complete details
	Description	essentially a sample fortified with a known amount of the test analyte(s).
Surrogate	Use	Measures method performance to sample matrix (organics only).
	Typical Frequency [1]	Are added to all samples, standards, and method blanks, for all organic chromatography methods except when the matrix precludes its use or when a surrogate is not available. The recovery of the surrogates is compared to the acceptance limits for the specific method. Poor surrogate recovery may indicate a problem with sample composition and is reported, with data qualifiers, to the client whose sample produced poor recovery.
	Description	Are similar to matrix spikes except the analytes are compounds with properties that mimic the analyte of interest and are unlikely to be found in environment samples.
Duplicates[2]	Use	For a measure of analytical precision, with each matrix-specific batch of samples processed, a matrix duplicate (MD or DUP) sample, matrix spike duplicate (MSD), or LCS duplicate (LCSD) is carried through the complete analytical procedure.
	Typical Frequency [1]	Duplicate samples are usually analyzed with methods that do not require matrix spike analysis.
	Description	Performed by analyzing two aliquots of the same field sample independently or an additional LCS.
Internal Standards	Use	Are spiked into all environmental and quality control samples (including the initial calibration standards) to monitor the qualitative aspect of organic and some inorganic analytical measurements.
	Typical Frequency [1]	All organic and ICP methods as required by the analytical method.
	Description	Used to correct for matrix effects and to help troubleshoot variability in analytical response and are assessed after data acquisition. Possible sources of poor internal standard response are sample matrix, poor analytical technique or instrument performance.

[1] See the specific analytical SOP for type and frequency of sample matrix control samples.

[2] LCSD's are normally not performed except when regulatory agencies or client specifications require them. The recoveries for the spiked duplicate samples must meet the same laboratory established recovery limits as the accuracy QC samples. If an LCSD is analyzed both the LCS and LCSD must meet the same recovery criteria and be included in the final report. The precision measurement is reported as "Relative Percent Difference" (RPD). Poor precision between duplicates (except LCS/LCSD) may indicate non-homogeneous matrix or sampling.

24.6 ACCEPTANCE CRITERIA (CONTROL LIMITS)

24.6.1 As mandated by the test method, each individual analyte in the LCS, MS, or Surrogate Spike are evaluated against the control limits as published in the test method. Where there are no established acceptance criteria, the laboratory calculates control limits with the use of control charts or, in some cases, utilizes client project specific control limits. When this occurs, the regulatory or project limits will supersede the laboratory's in-house limits.

Note: For methods, analytes and matrices with very limited data (e.g., unusual matrices not analyzed often), interim limits are established using available data or by analogy to similar methods or matrices.

24.6.2 Once control limits have been established, they are verified, reviewed, and updated if necessary on an annual basis unless the method requires more frequent updating. Control limits are established per method (as opposed to per instrument) regardless of the number of instruments utilized.

24.6.3 Laboratory generated % Recovery acceptance (control) limits are generally established by taking ± 3 Standard Deviations (99% confidence level) from the average recovery of a minimum of 20-30 data points (more points are preferred).

24.6.3.1 Regardless of the calculated limit, the limit should be no tighter than the Continuing Calibration Verification (CCV) limits (unless the analytical method specifies a tighter limit).

24.6.3.2 In-house limits cannot be any wider than those mandated in a regulated analytical method (e.g., SDWA Dioxin Method 1613B 2,3,7,8-TCDD on-going precision and recovery limits of 73% to 146% recovery). Client or contract required control limits are evaluated against the laboratory's statistically derived control limits to determine if the data quality objectives (DQOs) can be achieved. If laboratory control limits are not consistent with DQOs, then alternatives must be considered, such as method improvements or use of an alternate analytical method.

24.6.4 The lab must be able to generate a current listing of their control limits and track when the updates are performed. In addition, the laboratory must be able to recreate historical control limits.

24.6.4.1 Refer to SOP KNOX-QA-0004, Control Limits and Control Charting for details on the generation of control limits and the use of control charts at TestAmerica Knoxville.

24.6.5 A LCS that is within the acceptance criteria establishes that the analytical system is in control and is used to validate the process. Samples that are analyzed with an LCS with recoveries outside of the acceptance limits may be determined as out of control and should be reanalyzed if possible. If reanalysis is not possible, then the results for all affected analytes for samples within the same batch must be qualified when reported. The internal corrective action process (see Section 12) is also initiated if an LCS exceeds the acceptance limits. Sample results may be qualified and reported without reanalysis if:

24.6.5.1 The analyte results are below the reporting limit and the LCS is above the upper control limit.

24.6.5.2 If the analytical results are above the relevant regulatory limit and the LCS is below the lower control limit. (Note: This is not applicable to Ohio EPA VAP projects.)

24.6.5.3 For Department of Defense (DOD) and Department of Energy (DOE) work, there are an allowable number of Marginal Exceedances (ME). The use of allowable marginal exceedances may also be used for evaluation of LCS recoveries for TNI accredited

methods. Note: For Ohio EPA VAP, if an analyte is identified as a contaminant of interest, then the analyte must meet the LCS criteria and marginal exceedance limits are not applicable.

<11 analytes	0 marginal exceedances are allowed.
11 – 30 Analytes	1 marginal exceedance is allowed
31-50 Analytes	2 marginal exceedances are allowed
51-70 Analytes	3 marginal exceedances are allowed
71-90 Analytes	4 marginal exceedances are allowed
> 90 Analytes	5 marginal exceedances are allowed

24.6.5.3.1 Marginal exceedances are recovery exceedances between 3 SD and 4 SD from the mean recovery limit (TNI). (Note: The DOD/DOE QSM has defined limits for marginal exceedances. Refer to the DOD QSM SOP KNOX-QA-0021, DOD/DOE QSM Program Requirements.)

24.6.5.3.2 Marginal exceedances must be random. If the same analyte exceeds the LCS control limit repeatedly, it is an indication of a systematic problem. The source of the error must be located and corrective action taken. The laboratory has a system to monitor marginal exceedances to ensure that they are random. Refer to the DOD/DOE QSM SOP KNOX-QA-0021, DOD/DOE QSM Program Requirements for details on how the laboratory ensures that the marginal exceedences are random.

24.6.5.3.3 Though marginal exceedences may be allowed, the data must still be qualified to indicate it is outside of the normal limits.

24.6.6 If the MS/MSDs do not meet acceptance limits, the MS/MSD and the associated spiked sample is reported with a qualifier for those analytes that do not meet limits. If obvious preparation errors are suspected, or if requested by the client, unacceptable MS/MSDs are reprocessed and reanalyzed to prove matrix interference. A more detailed discussion of acceptance criteria and corrective action can be found in the analytical SOPs and in Section 12.

24.6.7 If a surrogate standard falls outside the acceptance limits, if there is not obvious chromatographic matrix interference, reanalyze the sample to confirm a possible matrix effect. If the recoveries confirm or there was obvious chromatographic interference, results are reported from the original analysis and a qualifier is added. If the reanalysis meets surrogate recovery criteria, the second run is reported (or both are reported if requested by the client).

24.7 ADDITIONAL PROCEDURES TO ASSURE QUALITY CONTROL

24.7.1 The laboratory has written and approved method SOPs to assure the accuracy of the test method including calibration (see Section 20), use of certified reference materials (see Section 21) and use of PT samples (see Section 15).

24.7.2 A discussion regarding MDLs, Limit of Detection (LOD) and Limit of Quantitation (LOQ) can be found in Section 19.

24.7.3 Use of formulae to reduce data is discussed in the method SOPs and in Section 20.

24.7.4 Selection of appropriate reagents and standards is included in Section 9 and 21.

24.7.5 A discussion on selectivity of the test is included in Section 5.

24.7.6 Constant and consistent test conditions are discussed in Section 18.

24.7.7 The laboratories sample acceptance policy is included in Section 23.

SECTION 25

REPORTING RESULTS

25.1 OVERVIEW

The results of each test are reported accurately, clearly, unambiguously, and objectively in accordance with State and Federal regulations as well as client requirements. Analytical results are issued in a format that is intended to satisfy customer and laboratory accreditation requirements as well as provide the end user with the information needed to properly evaluate the results. Where there is a conflict between the client requests and laboratory ethics or regulatory requirements, the laboratory's ethical and legal requirements are paramount, and the laboratory works with the client during project set up to develop and acceptable solution. Refer to Section 7.

A variety of report formats are available to meet specific needs.

In cases where a client asks for simplified reports, there must be a written request from the client. There still must be enough information that would show any analyses that were out of conformance (QC out of limits) and there should be a reference to a full report that is made available to the client.

Review of reported data is included in Section 19.

25.2 TEST REPORTS

Analytical results are reported in a format that is satisfactory to the client and meets all requirements of applicable accrediting authorities and agencies. A variety of report formats are available to meet specific needs. The report is printed on laboratory letterhead, reviewed, and signed by the appropriate project manager. At a minimum, the standard laboratory report contains the following information:

25.2.1 A report title (e.g., Analytical Report) on the cover page with a "Result" column header on the sample results page.

25.2.2 Each report cover page printed on company letterhead, which includes the laboratory name, address and telephone number.

25.2.3 A unique identification of the report (e.g., Lot Number) and on each page an identification in order to ensure the page is recognized as part of the report and a clear identification of the end.

Note: Page numbers of reports are represented on the upper right hand corner of each page. A table of contents precedes the cover page on each report which includes the page number of each section as well as the total number of pages.

25.2.4 A copy of the chain of custody (COC).

- Any COCs involved with Subcontracting are included.

25.2.5 The name and address of client and a project name/number, if applicable.

25.2.6 Client project manager or other contact.

25.2.7 Description and unambiguous identification of the tested sample(s) including the client identification code.

25.2.8 Date of receipt of sample, date and time of collection, and date(s) of test preparation and performance, and time of preparation or analysis if the required holding time for either activity is less than or equal to 72 hours. Both date and time of preparation and analysis are required to be included in the data report for work done in support of the DoD QSM; see SOP KNOX-QA-0021, "Department of Defense Quality Systems Manual Program Requirements."

25.2.9 Date reported or date of revision, if applicable.

25.2.10 Method of analysis including method code (EPA, Standard Methods, etc).

25.2.11 Reporting limit or Minimum Level.

25.2.12 Method detection limits or Estimated Detection Limits (if requested).

25.2.13 Definition of Data qualifiers and reporting acronyms (e.g. ND).

25.2.14 Sample results.

25.2.15 QC data consisting of method blank, surrogate, LCS, and MS/MSD (if applicable) recoveries and control limits.

25.2.16 Condition of samples at receipt including temperature. This may be accomplished in a narrative or by attaching sample login sheets. This is discussed in the narrative and a copy of the condition upon receipt form is included with the chain of custody.

25.2.17 A statement to the effect that the results relate only to the items tested and the sample as received by the laboratory.

25.2.18 A statement that the report shall not be reproduced except in full, without the written approval of the laboratory.

25.2.19 A signature and title of the person(s) accepting responsibility for the content of the report and date of issue. Authorized signatories are qualified Project Managers appointed by the Manager of Project Managers

25.2.20 When TNI accreditation is required, the lab certifies that the test results meet all requirements of TNI or provides reasons and/or justifications if they do not.

25.2.21 Where applicable, a narrative to the report that explains the issue(s) and corrective action(s) taken in the event that a specific accreditation or certification requirement was not met.

25.2.22 When soil samples are analyzed, a specific identification as to whether soils are reported on a "wet weight" or "dry weight" basis.

25.2.23 Appropriate laboratory certification number for the state of origin of the sample, if applicable.

25.2.24 If only part of the report is provided to the client (client requests some results before all of it is complete), it must be clearly indicated on the report (e.g., preliminary report), and that a complete report will follow once all of the work has been completed. A complete report must be sent once all of the work has been completed.

25.2.25 Any non-TestAmerica subcontracted analysis results are provided as a separate report on the official letterhead of the subcontractor. All TestAmerica subcontracting is clearly identified on the report as to which laboratory performed a specific analysis.

25.2.26 For Ohio EPA VAP work, a VAP affidavit must be completed and included with the report. Refer to the current Ohio Rules OAC 3745-300-04 and 3745-300-13(N) for additional details regarding Ohio EPA VAP affidavits.

25.2.27 A clear statement notifying the client that non-accredited tests were performed and directing the client to the laboratory's accreditation certificates of approval shall be provided when non-accredited tests are included in the report.

25.3 REPORTING LEVEL OR REPORT TYPE

TestAmerica Knoxville offers four standard types of data report format.

- A Standard Report is a report containing the items in Section 25.2 above.
- A CLP Forms Only Report is a standard report using CLP (or CLP like) report forms.
- An Expanded Deliverable Report is a Standard Report which includes the supporting raw data.
- A CLP Expanded Deliverable Report is an Expanded Deliverable report using CLP (or CLP-like) report forms.

Further details, including other specific reporting options, are defined in SOP KNOX-AD-0004, Data Reporting.

25.3.1 Electronic Data Deliverables (EDDs)

EDDs are routinely offered as part of TestAmerica's services in addition to the test report as described in section 25.2. When NELAP accreditation is required and both a test report and EDD are provided to the client, the official version of the test report will be the combined information of the report and the EDD. TestAmerica Knoxville offers a variety of EDD formats including industry standard and client specific electronic deliverables.

EDDs are subject to a review to ensure their accuracy and completeness. If EDD generation is automated, review may be reduced to periodic screening if the laboratory can demonstrate that it can routinely generate that EDD without errors. Any revisions to the EDD format must be reviewed until it is demonstrated that it can routinely be generated without errors. If the EDD can be reproduced accurately and if all subsequent EDDs can be produced error-free, each EDD does not necessarily require a review.

25.4 SUPPLEMENTAL INFORMATION FOR TEST

The lab identifies any unacceptable QC analyses or any other unusual circumstances or observations such as environmental conditions and any non-standard conditions that may have affected the quality of a result. This is typically in the form of a footnote or a qualifier and/or a narrative explaining the discrepancy in the front of the report. See Appendix 4 for example data qualifiers.

25.4.1 Numeric results with values outside of the calibration range, either high or low are qualified as 'estimated'.

25.4.2 Where quality system requirements are not met, a statement of compliance/non-compliance with requirements and/or specifications is required, including identification of test results derived from any sample that did not meet TNI sample acceptance requirements such as improper container, holding time, or temperature.

25.4.3 Where applicable, a statement on the estimated uncertainty of measurements is provided; information on uncertainty is needed when a client's instructions so require.

25.4.4 Opinions and Interpretations - The test report contains objective information, and generally does not contain subjective information such as opinions and interpretations. If such information is required by the client, the Laboratory Director will determine if a response can be prepared. If so, the Laboratory Director will designate the appropriate member of the management team to prepare a response. The response is fully documented, and reviewed by the Laboratory Director, before release to the client. There may be additional fees charged to the client at this time, as this is a non-routine function of the laboratory.

When opinions or interpretations are included in the report, the laboratory provides an explanation as to the basis upon which the opinions and interpretations have been made. Opinions and interpretations are clearly noted as such and where applicable, a comment should be added suggesting that the client verify the opinion or interpretation with their regulator.

25.5 ENVIRONMENTAL TESTING OBTAINED FROM SUBCONTRACTORS

If the laboratory is not able to provide the client the requested analysis, the samples would be subcontracted following the procedures outlined in the Corporate SOP on Subcontracting Procedures (SOP# CA-L-S-002).

Data reported from analyses performed by a subcontractor laboratory are clearly identified as such on the analytical report provided to the client. Results from a subcontract laboratory outside of TestAmerica are reported to the client as provided from the subcontract laboratory.

Note: For Ohio EPA VAP projects TestAmerica's affidavit must not attest that the data from the subcontract laboratory are certified. The subcontractor's affidavit must be included and the report must clearly state the test were subcontracted.

25.6 CLIENT CONFIDENTIALITY

In situations involving the transmission of environmental test results by telephone, facsimile or other electronic means, client confidentiality must be maintained.

TestAmerica will not intentionally divulge to any person (other than the Client or any other person designated by the Client in writing) any information regarding the services provided by TestAmerica or any information disclosed to TestAmerica by the Client. Furthermore, information known to be potentially endangering to national security or an entity's proprietary rights will not be released.

Note: This does not apply to the extent that the information is required to be disclosed by TestAmerica under the compulsion of legal process. TestAmerica will, to the extent feasible, provide reasonable notice to the client before disclosing the information.

Note: Authorized representatives of an accrediting authority are permitted to make copies of any analyses or records relevant to the accreditation process, and copies may be removed from the laboratory for purposes of assessment.

25.6.1 Report deliverable formats are discussed with each new client. If a client requests that reports be faxed or e-mailed, the reports are faxed with a cover sheet or e-mailed with the following note that includes a confidentiality statement similar to the following:

Confidentiality Notice: The information contained in this message is intended only for the use of the addressee, and may be confidential and/or privileged. If the reader of this message is not the intended recipient, or the employee or agent responsible to deliver it to the intended recipient, you are hereby notified that any dissemination, distribution or copying of this communication is strictly prohibited. If you have received this communication in error, please notify the sender immediately.

25.7 FORMAT OF REPORTS

The format of reports is designed to accommodate each type of environmental test carried out and to minimize the possibility of misunderstanding or misuse.

25.8 AMENDMENTS TO TEST REPORTS

Corrections, additions, or deletions to reports are only made when justification arises through supplemental documentation. Justification is documented using the laboratory's corrective action system (refer to Section 12).

The revised report is retained on the archive data server, as is the original report. The revised report is stored in the archive data server under the lot number followed by "rev". The revised report will have the word "revised" on the cover page.

When the report is re-issued, a notation of "Reissued Report" is placed on the cover/signature page of the report or at the top of the narrative page with a brief explanation of reason for the re-issue.

25.9 POLICIES ON CLIENT REQUESTS FOR AMENDMENTS

25.9.1 Policy on Data Omissions or Reporting Limit Increases

Fundamentally, our policy is simply to not omit previously reported results (including data qualifiers) or to not raise reporting limits and report sample results as ND. This policy has few exceptions. Exceptions are:

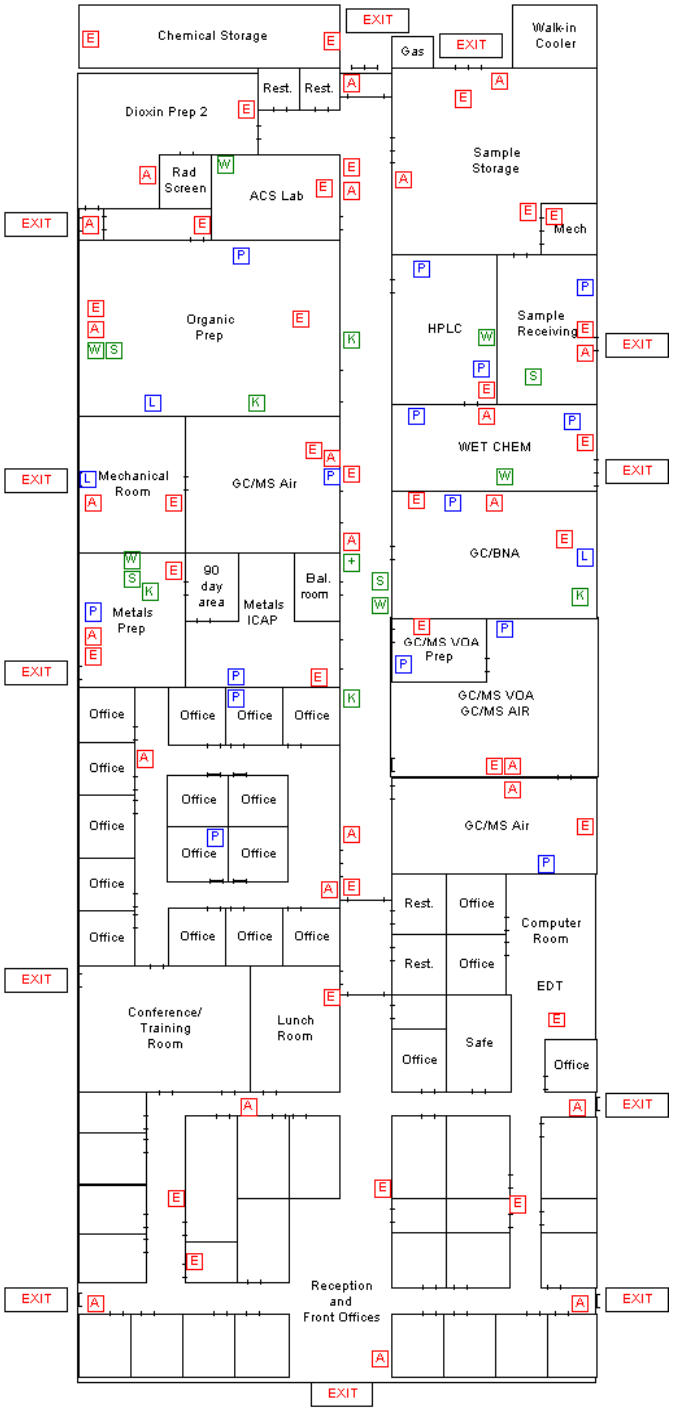
- Laboratory error.
- Sample identification is indeterminate (confusion between COC and sample labels).
- An incorrect analysis (not analyte) was requested (e.g., COC lists 8315 but client wanted 8310). A written request for the change is required.
- Incorrect limits reported based on regulatory requirements.
- The requested change has absolutely *no possible* impact on the interpretation of the analytical results and there is *no possibility* of the change being interpreted as misrepresentation by anyone inside or outside of our company.

25.9.2 Multiple Reports

TestAmerica does not issue multiple reports for the same work order where there is different information on each report (this does not refer to copies of the same report) unless required to meet regulatory needs and approved by QA.

Appendix 1. Laboratory Floor Plan

TestAmerica Knoxville Laboratory
Main Building - Figure 1



Safety Equipment Location

- E Fire Extinguisher
- A Fire Alarm or Siren
- + First Aid Kit
- S Safety Shower
- W Eye Wash Station
- K Emergency Spill Kit
- L Emergency Lighting - Wired
- P Emergency Lighting - Portable

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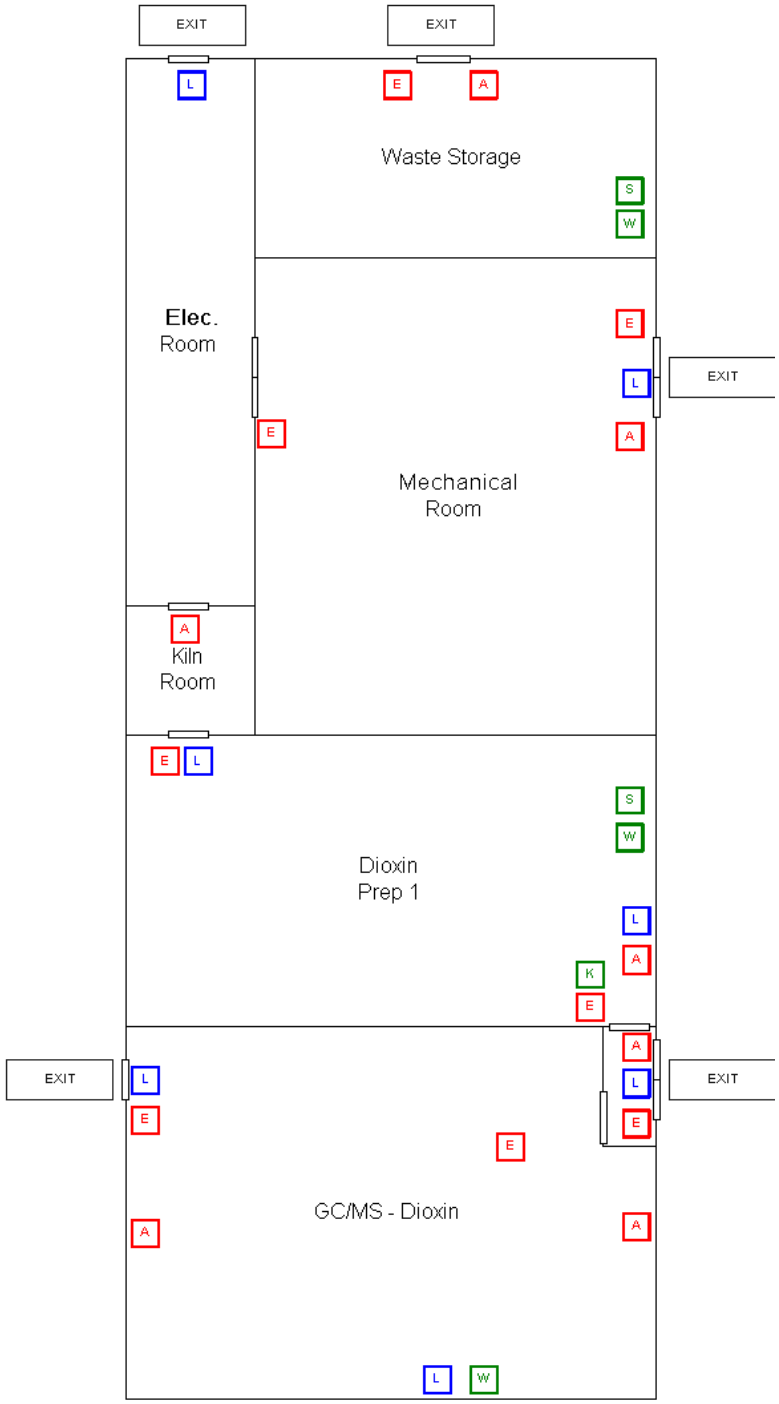
Appendix 1. Laboratory Floor Plan (continued)

TestAmerica Knoxville Laboratory
Building 2 - Dioxin Lab - Figure 2



Safety Equipment Location

- E — Fire Extingiusher
- A — Fire Alarm or Siren
- + — First Aid Kit
- S — Safety Shower
- W — Eye Wash Station
- K — Emergency Spill Kit
- L — Emergency Lighting - Wired
- P — Emergency Lighting - Portable

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Appendix 2. Glossary/Acronyms

Glossary:

Acceptance Criteria:
Specified limits placed on characteristics of an item, process, or service defined in requirement documents. (ASQC)

Accreditation:
The process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications or standards, thereby accrediting the laboratory.

Accuracy:
The degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator. (QAMS)

Analyst: [aka: Laboratory Analyst]
The designated individual who performs the "hands-on" analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality.

Analytical Uncertainty:
A subset of Measurement Uncertainty that includes all laboratory activities performed as part of the analysis. (TNI)

Anomaly:
A condition or event, other than a deficiency, that may affect the quality of the data, whether in the laboratory's control or not.

Assessment:
The evaluation process used to measure or establish the performance, effectiveness, and conformance of an organization and/or its systems to defined criteria (to the standards and requirements of laboratory accreditation). (TNI)

Audit:
A systematic and independent examination of facilities, equipment, personnel, training, procedures, record-keeping, data validation, data management, and reporting aspects of a system to determine whether QA/QC and technical activities are being conducted as planned and whether these activities will effectively achieve quality objectives. (TNI)

Batch:
Environmental samples which are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A preparation batch is composed of one to 20 environmental samples of the same matrix, meeting the above mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be 24

hours. An analytical batch is composed of prepared environmental samples (extracts, digestates or concentrates) which are analyzed together as a group An analytical batch can include prepared samples originating from various quality system matrices and can exceed twenty (20) samples. (TNI)

Bias:
The systematic or persistent distortion of a measurement process, which causes errors in one direction (i.e., the expected sample measurement is different from the sample's true value). (TNI)

Blank:
A sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results. (ASQC)

Calibration:

A set of operations that establish, under specified conditions, the relationship between values of quantities indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material, and the corresponding values realized by standards. (TNI)

1) In calibration of support equipment the values realized by standards are established through the use of reference standards that are traceable to the International System of Units (SI).

2) In calibration according to methods, the values realized by standards are typically established through the use of Reference Materials that are either purchased by the laboratory with a certificate of analysis or purity, or prepared by the laboratory using support equipment that has been calibrated or verified to meet specifications

Calibration Curve:
The mathematical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response. (TNI)

Calibration Standard:
A substance or reference material used to calibrate an instrument (QAMS)

Certified Reference Material (CRM):
A reference material, accompanied by a certificate, having a value, measurement uncertainty, and stated metrological traceability chain to a national metrology institute. (TNI)

Chain of Custody (COC) Form:
Record that documents the possession of the samples from the time of collection to receipt in the laboratory. This record generally includes: the number and types of containers; the mode of collection; the collector; time of collection; preservation; and requested analyses. (TNI)

Compromised Samples:
Those samples which are improperly sampled, insufficiently documented (chain of custody and other sample records and/or labels), improperly preserved, collected in improper containers, or exceeding holding times when delivered to a laboratory. Under normal conditions, compromised samples are not analyzed. If emergency situation require analysis, the results must be appropriately qualified.

Confidential Business Information (CBI):
Information that an organization designates as having the potential of providing a competitor with inappropriate insight into its management, operation or products. TNI and its representatives agree to safeguarding identified CBI and to maintain all information identified as such in full confidentiality.

Confirmation:
Verification of the identity of a component through the use of an approach with a different scientific principle from the original method. These may include, but are not limited toSecond column confirmation,Alternate wavelength,Derivatization,Mass spectral interpretation,Alternative detectors,or Additional Cleanup proceduresTNI

Conformance:
An affirmative indication or judgment that a product or service has met the requirements of the relevant specifications, contract, or regulation; also the state of meeting the requirements. (ANSI/ASQC E4-1994)

Corrective Action:
The action taken to eliminate the causes of an existing nonconformity, defect or other undesirable situation in order to prevent recurrence. (ISO 8402)

Data Audit:
A qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data re of acceptable quality (i.e., that they meet specified acceptance criteria).

Data Reduction:
The process of transforming the number of data items by arithmetic or statistical calculations, standard curves, and concentration factors, and collation into a more useable form. (TNI)

Deficiency:
An unauthorized deviation from acceptable procedures or practices, or a defect in an item. (ASQC), whether in the laboratory's control or not.

Demonstration of Capability:
A procedure to establish the ability of the analyst to generate analytical results of acceptable accuracy and precision. (TNI)

Document Control:
The act of ensuring that documents (and revisions thereto) are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly, and controlled to

ensure use of the correct version at the location where the prescribed activity if performed. (ASQC)

Duplicate Analyses:
The analyses or measurements of the variable of interest performed identically on two subsamples of the same sample. The results from duplicate analyses are used to evaluate analytical or measurement precision but not the precision of sampling, preservation or storage internal to the laboratory. (EPA-QAD)

Equipment Blank:
Sample of analyte-free media which has been used to rinse common sampling equipment to check effectiveness of decontamination procedures.

External Standard Calibration:
Calibrations for methods that do not utilize internal standards to compensate for changes in instrument conditions.

Field Blank:
Blank prepared in the field by filing a clean container with pure de-ionized water and appropriate preservative, if any, for the specific sampling activity being undertaken (EPA OSWER)

Field of Accreditation:
Those matrix, technology/method, and analyte combinations for which the accreditation body offers accreditation.

Holding Blank:
A blank matrix stored with field samples of a similar matrix (volatiles only) that measures storage contribution to any source of contamination.

Holding Times:
The maximum times that samples may be held prior to analyses and still be considered valid or not compromised. (40 CFR Part 136)

Internal Standard:
A known amount of standard added to a test portion of a sample as a reference for evaluating and controlling the precision and bias of the applied analytical test method. (TNI)

Internal Standard Calibration:
Calibrations for methods that utilize internal standards to compensate for changes in instrument conditions.

Instrument Blank:
A clean sample (e.g., distilled water) processed through the instrumental steps of the measurement process; used to determine instrument contamination. (EPA-QAD)

Instrument Detection Limit (IDL):
The minimum amount of a substance that can be measured with a specified degree of confidence that the amount is greater than zero using a specific instrument. The IDL is associated with the instrumental portion of a specific method only, and sample preparation

steps are not considered in its derivation. The IDL is a statistical estimation at a specified confidence interval of the concentration at which the relative uncertainty is ± 100%. The IDL represents a range where qualitative detection occurs on a specific instrument. Quantitative results are not produced in this range.

Laboratory Control Sample (however named, such as laboratory fortified blank, spiked blank, or QC check sample):
A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes, taken through all preparation and analysis steps of the procedure unless otherwise noted in a reference method. It is generally used to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system.

An LCS is prepared at a minimum of 1 per batch of 20 or less samples per matrix type per sample extraction or preparation method except for analytes for which spiking solutions are not available such as total suspended solids, total dissolved solids, total volatile solids, total solids, pH, color, odor, temperature, dissolved oxygen or turbidity. The results of these samples are used to determine batch acceptance.

Least Squares Regression (1st Order Curve):
The least squares regression is a mathematical calculation of a straight line over two axes. The y axis represents the instrument response (or Response ratio) of a standard or sample and the x axis represents the concentration. The regression calculation will generate a correlation coefficient (r) that is a measure of the "goodness of fit" of the regression line to the data. A value of 1.00 indicates a perfect fit. In order to be used for quantitative purposes, r must be greater than or equal to 0.99 for organics and 0.995 for inorganics.

Limit(s) of Detection (LOD): [a.k.a., Method Detection Limit (MDL)]:
A laboratory's estimate of the minimum amount of an analyte in a given matrix that an analytical process can reliably detect in their facility. (TNI)

LOD Verification [a.k.a., MDL Verification]:
A processed QC sample in the matrix of interest, spiked with the analyte at no more than 3X the LOD for single analyte tests and 4X the LOD for multiple analyte tests and processed through the entire analytical procedure.

Limit(s) of Quantitation (LOQ) [a.k.a., Reporting Limit]:
The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. (TNI)

(QS) Matrix:
The component or substrate that contains the analyte of interest. For purposes of batch and QC requirement determinations, the following matrix distinctions are used:

> Aqueous: Any aqueous sample excluded from the definition of Drinking Water matrix or Saline/Estuarine source. Includes surface water, groundwater, effluents, and TCLP or other extracts.

Drinking Water: any aqueous sample that has been designated as a potable or potential potable water source.

Saline/Estuarine: any aqueous sample from an ocean or estuary, or other salt water source such as the Great Salt Lake.

Non-aqueous Liquid: any organic liquid with <15% settleable solids.

Biological Tissue: any sample of a biological origin such as fish tissue, shellfish, or plant material. Such samples are grouped according to origin.

Solids: includes soils, sediments, sludges, and other matrices with >15% settleable solids.

Chemical Waste: a product or by-product of an industrial process that results in a matrix not previously defined.

Air & Emissions: whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas or vapor that are collected with a sorbant tube, impinger solution, filter, or other device. (TNI)

Matrix Spike (spiked sample or fortified sample):

A sample prepared, taken through all sample preparation and analytical steps of the procedure unless otherwise noted in a referenced method, by adding a known amount of target analyte to a specified amount of sample for which an independent test result of target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency.

Matrix Spike Duplicate (spiked sample or fortified sample duplicate):
A replicate matrix spike prepared and analyzed to obtain a measure of the precision of the recovery for each analyte.

Method Blank:
A sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses.

Method Detection Limit:
The minimum concentration of a substance (an analyte) that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. (40 CFR Part 136, Appendix B)

Negative Control:
Measures taken to ensure that a test, its components, or the environment do not cause undesired effects, or produce incorrect test results.

Non-conformance:
An indication, judgment, or state of not having met the requirements of the relevant specifications, contract, or regulation.

Observation:
A record of phenomena that (1) may assist in evaluation of the sample data; (2) may be of importance to the project manager and/or the client, and yet not at the time of the observation have any known effect on quality.

Performance Audit:
The routine comparison of independently obtained qualitative and quantitative measurement system data with routinely obtained data in order to evaluate the proficiency of an analyst or laboratory.

Positive Control:
Measures taken to ensure that a test and/or its components are working properly and producing correct or expected results from positive test subjects.

Precision:
The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms. (TNI)

Preservation:
Any conditions under which a sample must be kept in order to maintain chemical and/or biological integrity prior to analysis. (TNI)

Proficiency Testing:
A means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source. (TNI)

Proficiency Testing Program:
The aggregate of providing rigorously controlled and standardized environmental samples to a laboratory for analysis, reporting of results, statistical evaluation of the results and the collective demographics and results summary of all participating laboratories. (TNI)

Proficiency Test Sample (PT):
A sample, the composition of which is unknown to the laboratory and is provided to test whether the laboratory can produce analytical results within specified acceptance criteria. (TNI)

Quality Assurance:
An integrated system of management activities involving planning, implementation, assessment, reporting and quality improvement to ensure that a process, item, or service is of the type of quality needed and expected by the client. (TNI)

Quality Assurance [Project] Plan (QAPP):

A formal document describing the detailed quality control procedures by which the quality requirements defined for the data and decisions pertaining to a specific project are to be achieved. (EAP-QAD)

Quality Control:
The overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the customer; operational techniques and activities that are used to fulfill requirements for quality; also the system of activities and checks used to ensure that measurement systems are maintained within prescribed limits, providing protection against "out of control" conditions and ensuring that the results are of acceptable quality. (TNI)

Quality Control Sample:
A sample used to assess the performance of all or a portion of the measurement system. One of any number of samples, such as Certified Reference Materials, a quality system matrix fortified by spiking, or actual samples fortified by spiking, intended to demonstrate that a measurement system or activity is in control. (TNI)

Quality Manual:
A document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users. (TNI)

Quality System:
A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA and QC activities. (TNI)

Raw Data:
The documentation generated during sampling and analysis. This documentation includes, but is not limited to, field notes, electronic data, magnetic tapes, untabulated sample results, QC sample results, print outs of chromatograms, instrument outputs, and handwritten records. (TNI)

Record Retention:
The systematic collection, indexing and storing of documented information under secure conditions.

Reference Material:
Material or substance one or more properties of which are sufficiently homogenous and well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials. (TNI)

Reference Standard:
Standard used for the calibration of working measurement standards in a given organization or a given location. (TNI)

Sampling:
Activity related to obtaining a representative sample of the object of conformity assessment, according to a procedure.

Second Order Polynomial Curve (Quadratic):
The 2nd order curves are a mathematical calculation of a slightly curved line over two axis. The y axis represents the instrument response (or Response ratio) of a standard or sample and the x axis represents the concentration. The 2nd order regression will generate a coefficient of determination (COD or r^2) that is a measure of the "goodness of fit" of the quadratic curvature the data. A value of 1.00 indicates a perfect fit. In order to be used for quantitative purposes, r^2 must be greater than or equal to 0.99.

Selectivity:
The ability to analyze, distinguish, and determine a specific analyte or parameter from another component that may be a potential interferent or that may behave similarly to the target analyte or parameter within the measurement system. (TNI)

Sensitivity:
The capability of a method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest. (TNI)

Spike:
A known mass of target analyte added to a blank, sample or sub-sample; used to determine recovery efficiency or for other quality control purposes.

Standard:
The document describing the elements of laboratory accreditation that has been developed and established within the consensus principles of standard setting and meets the approval requirements of standard adoption organizations procedures and policies. (TNI)

Standard Operating Procedures (SOPs):
A written document which details the method for an operation, analysis, or action with thoroughly prescribed techniques and steps. SOPs are officially approved as the methods for performing certain routine or repetitive tasks. (TNI)

Storage Blank:
A blank matrix stored with field samples of a similar matrix (volatiles only) that measures storage contribution to any source of contamination.

Surrogate:
A substance with properties that mimic the analyte of interest. It is unlikely to be found in environment samples and is added to them for quality control purposes.

Surrogate compounds must be added to all samples, standards, and method blanks, for all organic chromatography methods except when the matrix precludes its use or when a surrogate is not available. Poor surrogate recovery may indicate a problem with sample composition and is reported to the client whose sample produced poor recovery. (QAMS)

Systems Audit (also Technical Systems Audit):

A thorough, systematic, qualitative on-site assessment of the facilities, equipment, personnel, training, procedures, record keeping, data validation, data management, and reporting aspects of a total measurement system. (EPA-QAD)

Technical Manager:
A member of the staff of an environmental laboratory who exercises actual day-to-day supervision of laboratory operations for the appropriate fields of accreditation and reporting of results

Technology:
A specific arrangement of analytical instruments, detection systems, and/or preparation techniques.

Traceability:
The ability to trace the history, application, or location of an entity by means of recorded identifications. In a calibration sense, traceability relates measuring equipment to national or international standards, primary standards, basic physical constants or properties, or reference materials. In a data collection sense, it relates calculations and data generated throughout the project back to the requirements for the quality of the project. (TNI)

Trip Blank:
A blank matrix placed in a sealed container at the laboratory that is shipped, held unopened in the field, and returned to the laboratory in the shipping container with the field samples.

Uncertainty:
A parameter associated with the result of a measurement that characterizes the dispersion of the value that could reasonably be attributed to the measured value.

Acronyms:

ANSI- American National Standards Institute
ASQC- American Society for Quality Control
CAR – Corrective Action Report
CCV – Continuing Calibration Verification
CF – Calibration Factor
CFR – Code of Federal Regulations
COC – Chain of Custody
DOC – Demonstration of Capability
DQO – Data Quality Objectives
DUP - Duplicate
EDL – Estimated Detection Limit (for Isotope Dilution Methods)
EHS – Environment, Health and Safety
EPA – Environmental Protection Agency
EPA-QAD- Quality Assurance Division
GC - Gas Chromatography
GC/MS - Gas Chromatography/Mass Spectrometry
HPLC - High Performance Liquid Chromatography
ICP - Inductively Coupled Plasma Atomic Emission Spectroscopy
ICP/MS – ICP/Mass Spectrometry
ICV – Initial Calibration Verification
IDL – Instrument Detection Limit
IH – Industrial Hygiene
IS – Internal Standard
LCS – Laboratory Control Sample
LCSD – Laboratory Control Sample Duplicate
LIMS – Laboratory Information Management System
LOD – Limit of Detection
LOQ – Limit of Quantitation
MDL – Method Detection Limit
MDLV – MDL Verification Check Standard
MRL – Method Reporting Limit Check Standard
MS – Matrix Spike
MSD – Matrix Spike Duplicate
SDS - Safety Data Sheet
NELAP - National Environmental Laboratory Accreditation Program
PT – Performance Testing
QAM – Quality Assurance Manual
QAMS- QAMS 005/80, Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans (EPA 1980)
QA/QC – Quality Assurance / Quality Control
QAPP – Quality Assurance Project Plan
RF – Response Factor
RPD – Relative Percent Difference
RSD – Relative Standard Deviation
SD – Standard Deviation
SOP: Standard Operating Procedure

TAT – Turn-Around-Time
TNI – The NELAC Institute
VOA – Volatiles
VOC – Volatile Organic Compound

Appendix 3.

Laboratory Certifications, Accreditations, Validations

TestAmerica Knoxville maintains accreditations, certifications, and approvals with numerous state and national entities. Programs vary but may include on-site audits, reciprocal agreements with another entity, performance testing evaluations, review of the Quality Assurance Manual, Standard Operating Procedures, Method Detection Limits, training records, etc. At the time of this QAM revision, the laboratory has accreditation/certification/licensing with the following organizations:

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Certifications

Laboratory	Program	Authority	Identification	Expiration Date
TestAmerica Knoxville	DoD ELAP	L-A-B	L2311	02/13/2019
TestAmerica Knoxville	Federal	USDA	P330-13-00262	08/20/2019
TestAmerica Knoxville	NELAP	Florida	E87177	06/30/2017
TestAmerica Knoxville	NELAP	Kansas	E-10349	10/31/2017
TestAmerica Knoxville	NELAP	Louisiana	83979	06/30/2017
TestAmerica Knoxville	NELAP	Louisiana (DW)	LA160005	12/31/2016
TestAmerica Knoxville	NELAP	New Jersey	TN001	06/30/2017
TestAmerica Knoxville	NELAP	New York	10781	03/31/2017
TestAmerica Knoxville	NELAP	Pennsylvania	68-00576	12/31/2016
TestAmerica Knoxville	NELAP	Texas	T104704380-16-9	08/31/2017
TestAmerica Knoxville	NELAP	Utah	TN00009	07/31/2016 *
TestAmerica Knoxville	NELAP	Virginia	460176	09/14/2017
TestAmerica Knoxville	State Program	Arkansas DEQ	88-0688	06/16/2017
TestAmerica Knoxville	State Program	California	2423	06/30/2018
TestAmerica Knoxville	State Program	Colorado	TN00009	02/28/2017
TestAmerica Knoxville	State Program	Connecticut	PH-0223	09/30/2017
TestAmerica Knoxville	State Program	Georgia	906	04/13/2017
TestAmerica Knoxville	State Program	Hawaii	N/A	04/13/2017
TestAmerica Knoxville	State Program	Kentucky (DW)	90101	12/31/2016
TestAmerica Knoxville	State Program	Maryland	277	03/31/2017
TestAmerica Knoxville	State Program	Michigan	9933	04/13/2017
TestAmerica Knoxville	State Program	Nevada	TN00009	07/31/2017
TestAmerica Knoxville	State Program	North Carolina (DW)	21705	07/31/2017
TestAmerica Knoxville	State Program	North Carolina (WW/SW)	64	12/31/2016
TestAmerica Knoxville	State Program	Ohio VAP	CL0059	01/16/2017
TestAmerica Knoxville	State Program	Oklahoma	9415	08/31/2017
TestAmerica Knoxville	State Program	South Carolina	84001	06/30/2017
TestAmerica Knoxville	State Program	Tennessee	2014	04/13/2017
TestAmerica Knoxville	State Program	Washington	C593	01/19/2017
TestAmerica Knoxville	State Program	West Virginia (DW)	9955C	12/31/2016
TestAmerica Knoxville	State Program	West Virginia DEP	345	04/30/2017
TestAmerica Knoxville	State Program	Wisconsin	998044300	08/31/2017

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* Certification Valid - Laboratory is Pending Renewal with the Program Authority

For more information, or to contact a local TestAmerica representative nearest you, please visit our website at www.testamericainc.com

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The certificates and parameter lists for each organization may be found on the corporate web site, and on the local server in a protected QA share.

* The Agency assigned Laboratory ID number is listed where provided. Otherwise the number corresponds to the Agency Certificate ID where provided.

Appendix 4. Example Data Qualifiers (Standard Flagging Suite)[1]

Qualifier	Footnote
!	Laboratory is not accredited for this parameter.
*	RPD of the LCS and LCSD exceeds the control limits
*	LCS or LCSD is outside acceptance limits
>	The analyte exceeded the indicated concentration
^	Instrument related QC is outside acceptance limits
4	MS,MSD: The analyte present in the original sample is greater than 4 times the matrix spike concentration; therefore control limits are not applicable
AP	Altered Pattern
B	Compound was found in the blank and sample
B7	Target analyte detected in the method blank at or above method reporting limit. Concentration found in sample was at 10X the concentration found in the blank
c	Compound falls outside routine control limits, but is within acceptable client specific calibration criteria
cn	Refer to Case Narrative for further detail
D	Sample results are obtained from a dilution; the surrogate or matrix spike recoveries reported are calculated from diluted samples
D	Surrogate or matrix spike recoveries were not obtained because the extract was diluted for analysis; also compounds analyzed at a dilution may be flagged with a D
D	Sample results are obtained from a dilution; the surrogate or matrix spike recoveries reported are calculated from diluted samples.
DW	Result has been dry weight corrected
E	Result exceeded calibration range.
F1	MS and/or MSD Recovery is outside acceptance limits.
F2	MS/MSD RPD exceeds control limits
F3	Duplicate RPD exceeds the control limit
F4	MS/MSD RPD exceeds control limits due to sample size difference.
F5	Duplicate RPD exceeds limit, and one or both sample results are less than 5 times RL. The data are considered valid because the absolute difference is less than the RL.
H	Sample was prepped or analyzed beyond the specified holding time
h	Alternate peak selection upon analytical review.
I	Indicates the presence of an interference, recovery is not calculated.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
NC	Not Confirmed
p	The %RPD between the primary and confirmation column/detector is >40%. The lower value has been reported.
P	The %RPD between the primary and confirmation column/detector is >40%. The higher value has been reported
Q	Result was qualitatively confirmed, but not quantitated.
q	The reported result is the estimated maximum possible concentration of this analyte, quantitated using the theoretical ion ratio. The measured ion ratio does not meet qualitative identification criteria and indicates a possible interference.

S	Ion suppression
U	Indicates the analyte was analyzed for but not detected.
V	Serial Dilution exceeds the control limits
W	PS: Post-digestion spike was outside control limits
X	Surrogate is outside control limits

1 – This is a standard list of qualifiers commonly used. Other qualifiers are available in LIMS.

OREGON

Environmental Laboratory Accreditation Program

NELAP Recognized

TestAmerica Sacramento

4040

880 Riverside Parkway

West Sacramento, CA 95605

IS GRANTED APPROVAL BY ORELAP UNDER THE 2009 TNI STANDARDS, TO PERFORM ANALYSES ON ENVIRONMENTAL SAMPLES IN MATRICES AS LISTED BELOW :

Air	*Drinking Water*	*Non Potable Water*	*Solids and Chem. Waste*	*Tissue*
Chemistry	Chemistry	Chemistry	Chemistry	Chemistry

AND AS RECORDED IN THE LIST OF APPROVED ANALYTES, METHODS, ANALYTICAL TECHNIQUES, AND FIELDS OF TESTING ISSUED CONCURRENTLY WITH THIS CERTIFICATE AND REVISED AS NECESSARY.

ACCREDITED STATUS DEPENDS ON SUCCESSFUL ONGOING PARTICIPATION IN THE PROGRAM AND CONTINUED COMPLIANCE WITH THE STANDARDS.

CUSTOMERS ARE URGED TO VERIFY THE LABORATORY'S CURRENT ACCREDITATION STATUS IN OREGON.

Christopher L. Redman

Christopher L. Redman, BA
Oregon State Public Health Laboratory
ORELAP Program Manager
7202 NE Evergreen Parkway, Suite 100
Hillsboro, OR 97124

EFFECTIVE DATE : 01/30/2018

EXPIRATION DATE : 01/29/2019

Certificate No : 4040 - 009

OREGON

Environmental Laboratory Accreditation Program

ORELAP Fields of Accreditation

ORELAP ID: 4040

TestAmerica Sacramento

EPA CODE: CA00044

880 Riverside Parkway

Certificate: 4040 - 010

West Sacramento, CA 95605

Issue Date: 1/30/2018 Expiration Date: 1/29/2019

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MATRIX	Reference	Code	Analyte	Code	Description
Air					
	ASTM D1946-90			30024465	Reformed Gas by Gas Chromatography
		4836	1-Propene (Propylene)		
		3755	Carbon dioxide		
		3780	Carbon monoxide		
		4747	Ethane		
		4752	Ethene		
		1767	Helium		
		1772	Hydrogen		
		4926	Methane		
		1843	Nitrogen		
		5029	n-Propane		
		3895	Oxygen		
	EPA 3050B			10135601	Acid Digestion of Sediments, Sludges, and soils
		8031	Extraction/Preparation		
	EPA 3620B			10145809	Florisil Cleanup
		8031	Extraction/Preparation		
	EPA 3C			10247708	Fixed Gasses by GC/TCD
		3755	Carbon dioxide		
		4926	Methane		
		1843	Nitrogen		
		3895	Oxygen		
	EPA 6020			10156000	Inductively Coupled Plasma-Mass Spectrometry
		1000	Aluminum		
		1005	Antimony		
		1010	Arsenic		
		1015	Barium		
		1020	Beryllium		
		1030	Cadmium		
		1035	Calcium		
		1040	Chromium		
		1050	Cobalt		
		1055	Copper		
		1070	Iron		
		1075	Lead		
		1080	Lithium		
		1085	Magnesium		
		1090	Manganese		

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EPA 6020	1100	Molybdenum	
	1105	Nickel	
	1910	Phosphorus, total	
	1125	Potassium	
	1140	Selenium	
	1150	Silver	
	1155	Sodium	
	1160	Strontium	
	1165	Thallium	
	1175	Tin	
	1180	Titanium	
	3035	Uranium	
	1185	Vanadium	
	1190	Zinc	
EPA 6020A 1			10156419 Inductively Coupled Plasma -Mass Spectrometry
	1000	Aluminum	
	1005	Antimony	
	1010	Arsenic	
	1015	Barium	
	1020	Beryllium	
	1030	Cadmium	
	1035	Calcium	
	1040	Chromium	
	1050	Cobalt	
	1055	Copper	
	1070	Iron	
	1075	Lead	
	1080	Lithium	
	1085	Magnesium	
	1090	Manganese	
	1100	Molybdenum	
	1105	Nickel	
	1125	Potassium	
	1140	Selenium	
	1150	Silver	
	1155	Sodium	
	1160	Strontium	
	1165	Thallium	
	1175	Tin	
	1180	Titanium	
	3035	Uranium	
	1185	Vanadium	
	1190	Zinc	

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Air

EPA Method 15			10402207	Hydrogen sulfide (H2S), carbonyl sulfide (COS) and carbon disulfide (CS2)emissions from stationary sources
	3840	Hydrogen sulfide		
	3845	Hydrogen sulfide, carbonyl sulfide, carbon disulfide		
EPA Method 16			10402401	Semicontinuous Determination Of Sulfur Emissions from Stationary Sources
	3830	H2S, methyl mercaptan, dimethyl sulfide, dimethyl disulfide		
	3840	Hydrogen sulfide		
EPA Method 26A 2000			10403200	Determination of Hydrogen Halides and Halogen Emissions From Stationary Sources - Isokinetic Method
	1541	Bromine		
	1580	Chlorine		
	1768	Hydrobromic Acid (Hydrogen Bromide)		
	1770	Hydrochloric acid (Hydrogen chloride (gas only))		
	1775	Hydrogen fluoride (Hydrofluoric acid)		
EPA Method 29			10403722	Determination of Metals Emissions from Stationary Sources
	1005	Antimony		
	1010	Arsenic		
	1015	Barium		
	1020	Beryllium		
	1030	Cadmium		
	1040	Chromium		
	1050	Cobalt		
	1055	Copper		
	1075	Lead		
	1090	Manganese		
	1095	Mercury		
	1105	Nickel		
	1910	Phosphorus, total		
	1140	Selenium		
	1150	Silver		
	1165	Thallium		
	1190	Zinc		
EPA TO-10A (GC/ECD)			10247504	Pesticides and PCBs with LV PUF by GC/ECD
	7355	4,4'-DDD		
	7360	4,4'-DDE		
	7365	4,4'-DDT		
	7025	Aldrin		
	7110	alpha-BHC (alpha-Hexachlorocyclohexane)		

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EPA TO-10A (GC/ECD)	7240	alpha-Chlordane	
	8880	Aroclor-1016 (PCB-1016)	
	8885	Aroclor-1221 (PCB-1221)	
	8890	Aroclor-1232 (PCB-1232)	
	8895	Aroclor-1242 (PCB-1242)	
	8900	Aroclor-1248 (PCB-1248)	
	8905	Aroclor-1254 (PCB-1254)	
	8910	Aroclor-1260 (PCB-1260)	
	8913	Aroclor-1268 (PCB-1268)	
	7115	beta-BHC (beta-Hexachlorocyclohexane)	
	7250	Chlordane (tech.)	
	7105	delta-BHC	
	7470	Dieldrin	
	7510	Endosulfan I	
	7515	Endosulfan II	
	7520	Endosulfan sulfate	
	7540	Endrin	
	7530	Endrin aldehyde	
	7535	Endrin ketone	
	7120	gamma-BHC (Lindane, gamma-HexachlorocyclohexanE)	
	7245	gamma-Chlordane	
	7685	Heptachlor	
	7690	Heptachlor epoxide	
	7810	Methoxychlor	
	8250	Toxaphene (Chlorinated camphene)	
EPA TO-13A			10248405 Polycyclic Aromatic Hydrocarbons in Ambient Air by GC/MS
	5155	1,2,4-Trichlorobenzene	
	4610	1,2-Dichlorobenzene	
	4615	1,3-Dichlorobenzene	
	4620	1,4-Dichlorobenzene	
	9546	1,4-Dithiane	
	4659	2,2-Oxybis(1-chloropropane)	
	6735	2,3,4,6-Tetrachlorophenol	
	6835	2,4,5-Trichlorophenol	
	6840	2,4,6-Trichlorophenol	
	6000	2,4-Dichlorophenol	
	6130	2,4-Dimethylphenol	
	6175	2,4-Dinitrophenol	
	6185	2,4-Dinitrotoluene (2,4-DNT)	
	6190	2,6-Dinitrotoluene (2,6-DNT)	
	5795	2-Chloronaphthalene	

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Air	EPA TO-13A	5800	2-Chlorophenol
		6360	2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2 -methylphenol)
		6385	2-Methylnaphthalene
		6400	2-Methylphenol (o-Cresol)
		6460	2-Nitroaniline
		6490	2-Nitrophenol
		6412	3 & 4 Methylphenol
		5945	3,3'-Dichlorobenzidine
		6465	3-Nitroaniline
		5660	4-Bromophenyl phenyl ether (BDE-3)
		5700	4-Chloro-3-methylphenol
		5745	4-Chloroaniline
		5825	4-Chlorophenyl phenylether
		6470	4-Nitroaniline
		6500	4-Nitrophenol
		5500	Acenaphthene
		5505	Acenaphthylene
		5545	Aniline
		5555	Anthracene
		5575	Benzo(a)anthracene
		5580	Benzo(a)pyrene
		5605	Benzo(e)pyrene
		5590	Benzo(g,h,i)perylene
		5600	Benzo(k)fluoranthene
		5585	Benzo[b]fluoranthene
		5610	Benzoic acid
		5630	Benzyl alcohol
		5760	bis(2-Chloroethoxy)methane
		5765	bis(2-Chloroethyl) ether
		5670	Butyl benzyl phthalate
		5680	Carbazole
		5855	Chrysene
		6065	Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate, DEHP)
		5895	Dibenz(a,h) anthracene
		5905	Dibenzofuran
		6070	Diethyl phthalate
		6135	Dimethyl phthalate
		5925	Di-n-butyl phthalate
		6200	Di-n-octyl phthalate
		6265	Fluoranthene
		6270	Fluorene
		6275	Hexachlorobenzene

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EPA TO-13A	4835	Hexachlorobutadiene		
	6285	Hexachlorocyclopentadiene		
	4840	Hexachloroethane		
	6315	Indeno(1,2,3-cd) pyrene		
	6320	Isophorone		
	5005	Naphthalene		
	5015	Nitrobenzene		
	6530	n-Nitrosodimethylamine		
	6545	n-Nitrosodi-n-propylamine		
	6535	n-Nitrosodiphenylamine		
	6605	Pentachlorophenol		
	6615	Phenanthrene		
	6625	Phenol		
	9551	p-Oxathiane (1,4-Oxathiane)		
	6665	Pyrene		
	9577	Thiodiglycol		
EPA TO-13A SIM			10248449	Polycyclic Aromatic Hydrocarbons in Ambient Air by GC/MS SIM
	6380	1-Methylnaphthalene		
	6385	2-Methylnaphthalene		
	5500	Acenaphthene		
	5505	Acenaphthylene		
	5555	Anthracene		
	5575	Benzo(a)anthracene		
	5580	Benzo(a)pyrene		
	5590	Benzo(g,h,i)perylene		
	5600	Benzo(k)fluoranthene		
	5585	Benzo[b]fluoranthene		
	5855	Chrysene		
	5895	Dibenz(a,h) anthracene		
	6265	Fluoranthene		
	6270	Fluorene		
	6315	Indeno(1,2,3-cd) pyrene		
	5005	Naphthalene		
	6615	Phenanthrene		
	6665	Pyrene		
EPA TO-14A			10248609	Volatile Organic Compounds with SUMMA canister and GC/MS
	5160	1,1,1-Trichloroethane		
	5110	1,1,2,2-Tetrachloroethane		
	5195	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)		
	5165	1,1,2-Trichloroethane		
	4630	1,1-Dichloroethane		

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Air	EPA TO-14A	4640	1,1-Dichloroethylene
		5180	1,2,3-Trichloropropane
		5155	1,2,4-Trichlorobenzene
		5210	1,2,4-Trimethylbenzene
		4585	1,2-Dibromoethane (EDB, Ethylene dibromide)
		4695	1,2-Dichloro-1,1,2,2-tetrafluoroethane (Freon-114)
		4610	1,2-Dichlorobenzene
		4635	1,2-Dichloroethane (Ethylene dichloride)
		4655	1,2-Dichloropropane
		5215	1,3,5-Trimethylbenzene
		9318	1,3-Butadiene
		4615	1,3-Dichlorobenzene
		4660	1,3-Dichloropropane
		4620	1,4-Dichlorobenzene
		4735	1,4-Dioxane (1,4- Diethyleneoxide)
		4410	2-Butanone (Methyl ethyl ketone, MEK)
		4860	2-Hexanone (MBK)
		4995	4-Methyl-2-pentanone (MIBK)
		4315	Acetone
		4375	Benzene
		5635	Benzyl chloride
		4385	Bromobenzene
		4395	Bromodichloromethane
		4400	Bromoform
		4450	Carbon disulfide
		4455	Carbon tetrachloride
		4475	Chlorobenzene
		4575	Chlorodibromomethane
		4485	Chloroethane (Ethyl chloride)
		4505	Chloroform
		4705	cis & trans-1,2-Dichloroethene
		4645	cis-1,2-Dichloroethylene
		4680	cis-1,3-Dichloropropene
		4555	Cyclohexane
		4625	Dichlorodifluoromethane (Freon-12)
		4755	Ethyl acetate
		4765	Ethylbenzene
		4835	Hexachlorobutadiene
		4895	Isopropyl alcohol (2-Propanol, Isopropanol)
		4900	Isopropylbenzene (Cumene)
		5240	m+p-xylene

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EPA TO-14A	4950	Methyl bromide (Bromomethane)	
	4960	Methyl chloride (Chloromethane)	
	5000	Methyl tert-butyl ether (MTBE)	
	4975	Methylene chloride (Dichloromethane)	
	4825	n-Heptane	
	4855	n-Hexane	
	5027	n-Octane	
	5090	n-Propylbenzene	
	5250	o-Xylene	
	5100	Styrene	
	5115	Tetrachloroethylene (Perchloroethylene)	
	5140	Toluene	
	4700	trans-1,2-Dichloroethylene	
	4685	trans-1,3-Dichloropropylene	
	5170	Trichloroethene (Trichloroethylene)	
	5175	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	
	5235	Vinyl chloride	
	5260	Xylene (total)	
EPA TO-15		10248803	VOCs collected in Canisters by GC/MS
	5105	1,1,1,2-Tetrachloroethane	
	5160	1,1,1-Trichloroethane	
	5110	1,1,2,2-Tetrachloroethane	
	5195	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	
	5165	1,1,2-Trichloroethane	
	4630	1,1-Dichloroethane	
	4640	1,1-Dichloroethylene	
	4670	1,1-Dichloropropene	
	5180	1,2,3-Trichloropropane	
	5155	1,2,4-Trichlorobenzene	
	5210	1,2,4-Trimethylbenzene	
	4570	1,2-Dibromo-3-chloropropane (DBCP)	
	4585	1,2-Dibromoethane (EDB, Ethylene dibromide)	
	4695	1,2-Dichloro-1,1,2,2-tetrafluoroethane (Freon-114)	
	4610	1,2-Dichlorobenzene	
	4635	1,2-Dichloroethane (Ethylene dichloride)	
	4655	1,2-Dichloropropane	
	5215	1,3,5-Trimethylbenzene	
	9318	1,3-Butadiene	
	4615	1,3-Dichlorobenzene	
	4660	1,3-Dichloropropane	

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Air	EPA TO-15	4620	1,4-Dichlorobenzene
		4735	1,4-Dioxane (1,4- Diethyleneoxide)
		4836	1-Propene (Propylene)
		5220	2,2,4-Trimethylpentane
		4665	2,2-Dichloropropane
		4410	2-Butanone (Methyl ethyl ketone, MEK)
		4535	2-Chlorotoluene
		4860	2-Hexanone (MBK)
		4942	2-methylpropane (Isobutane)
		4542	4-Ethyltoluene
		4910	4-Isopropyltoluene (p-Cymene)
		4995	4-Methyl-2-pentanone (MIBK)
		4315	Acetone
		4320	Acetonitrile
		4325	Acrolein (Propenal)
		4340	Acrylonitrile
		4355	Allyl chloride (3-Chloropropene)
		4357	alpha-Methylstyrene
		4375	Benzene
		5635	Benzyl chloride
		4385	Bromobenzene
		4395	Bromodichloromethane
		4400	Bromoform
		4450	Carbon disulfide
		4455	Carbon tetrachloride
		4475	Chlorobenzene
		4575	Chlorodibromomethane
		4577	Chlorodifluoromethane (Freon-22)
		4485	Chloroethane (Ethyl chloride)
		4505	Chloroform
		4705	cis & trans-1,2-Dichloroethene
		4645	cis-1,2-Dichloroethylene
		4680	cis-1,3-Dichloropropene
		4555	Cyclohexane
		4595	Dibromomethane (Methylene bromide)
		4625	Dichlorodifluoromethane (Freon-12)
		4627	Dichlorofluoromethane (Freon 21)
		4725	Diethyl ether
		9375	Di-isopropylether (DIPE)
		4750	Ethanol
		4755	Ethyl acetate
		4765	Ethylbenzene
		4770	Ethyl-t-butylether (ETBE) (2-Ethoxy-2-methylpropane)

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Environmental Laboratory Accreditation Program

ORELAP Fields of Accreditation

ORELAP ID: 4040

TestAmerica Sacramento

EPA CODE: CA00044

880 Riverside Parkway

Certificate: 4040 - 010

West Sacramento, CA 95605 Issue Date: 1/30/2018 Expiration Date: 1/29/2019

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Air

EPA TO-15	9408	Gasoline range organics (GRO)	
	4835	Hexachlorobutadiene	
	4895	Isopropyl alcohol (2-Propanol, Isopropanol)	
	4900	Isopropylbenzene (Cumene)	
	5240	m+p-xylene	
	4950	Methyl bromide (Bromomethane)	
	4960	Methyl chloride (Chloromethane)	
	4990	Methyl methacrylate	
	5000	Methyl tert-butyl ether (MTBE)	
	4975	Methylene chloride (Dichloromethane)	
	5005	Naphthalene	
	5007	n-Butane	
	4435	n-Butylbenzene	
	4825	n-Heptane	
	4855	n-Hexane	
	5026	n-Nonane	
	5027	n-Octane	
	5028	n-Pentane	
	5029	n-Propane	
	5090	n-Propylbenzene	
	5250	o-Xylene	
	4440	sec-Butylbenzene	
	5100	Styrene	
	4370	T-amylmethylether (TAME)	
	4420	tert-Butyl alcohol	
	4445	tert-Butylbenzene	
	5115	Tetrachloroethylene (Perchloroethylene)	
	5120	Tetrahydrofuran (THF)	
	5140	Toluene	
	4700	trans-1,2-Dichloroethylene	
	4685	trans-1,3-Dichloropropylene	
	5170	Trichloroethene (Trichloroethylene)	
	5175	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	
	5225	Vinyl acetate	
	5230	Vinyl bromide (Bromoethane)	
	5235	Vinyl chloride	
	5260	Xylene (total)	
EPA TO-15 GC/MS SIM			10248858 VOCs collected in Canisters by GC/MS SIM
	5160	1,1,1-Trichloroethane	
	5110	1,1,2,2-Tetrachloroethane	
	5195	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	

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Air	EPA TO-15 GC/MS SIM	5165	1,1,2-Trichloroethane
		4630	1,1-Dichloroethane
		4640	1,1-Dichloroethylene
		5180	1,2,3-Trichloropropane
		5155	1,2,4-Trichlorobenzene
		5210	1,2,4-Trimethylbenzene
		4585	1,2-Dibromoethane (EDB, Ethylene dibromide)
		4695	1,2-Dichloro-1,1,2,2-tetrafluoroethane (Freon-114)
		4610	1,2-Dichlorobenzene
		4635	1,2-Dichloroethane (Ethylene dichloride)
		4655	1,2-Dichloropropane
		5215	1,3,5-Trimethylbenzene
		9318	1,3-Butadiene
		4615	1,3-Dichlorobenzene
		4620	1,4-Dichlorobenzene
		4735	1,4-Dioxane (1,4- Diethyleneoxide)
		4836	1-Propene (Propylene)
		4410	2-Butanone (Methyl ethyl ketone, MEK)
		4860	2-Hexanone (MBK)
		4542	4-Ethyltoluene
		4995	4-Methyl-2-pentanone (MIBK)
		4315	Acetone
		4320	Acetonitrile
		4325	Acrolein (Propenal)
		4340	Acrylonitrile
		4375	Benzene
		5635	Benzyl chloride
		4395	Bromodichloromethane
		4400	Bromoform
		4455	Carbon tetrachloride
		4475	Chlorobenzene
		4575	Chlorodibromomethane
		4485	Chloroethane (Ethyl chloride)
		4505	Chloroform
		4645	cis-1,2-Dichloroethylene
		4680	cis-1,3-Dichloropropene
		4555	Cyclohexane
		4625	Dichlorodifluoromethane (Freon-12)
		4755	Ethyl acetate
		4765	Ethylbenzene
		4835	Hexachlorobutadiene

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Air	EPA TO-15 GC/MS SIM	4895	Isopropyl alcohol (2-Propanol, Isopropanol)		
		5240	m+p-xylene		
		4950	Methyl bromide (Bromomethane)		
		4960	Methyl chloride (Chloromethane)		
		5000	Methyl tert-butyl ether (MTBE)		
		4975	Methylene chloride (Dichloromethane)		
		5005	Naphthalene		
		4825	n-Heptane		
		4855	n-Hexane		
		5250	o-Xylene		
		5100	Styrene		
		5115	Tetrachloroethylene (Perchloroethylene)		
		5120	Tetrahydrofuran (THF)		
		5140	Toluene		
		4700	trans-1,2-Dichloroethylene		
		4685	trans-1,3-Dichloropropylene		
		5170	Trichloroethene (Trichloroethylene)		
		5175	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)		
		5225	Vinyl acetate		
		5235	Vinyl chloride		
		5260	Xylene (total)		
	EPA TO-4A			10249204	Pesticides and PCBs by HV PUF GC
		7355	4,4'-DDD		
		7240	alpha-Chlordane		
		8912	Aroclor-1262 (PCB-1262)		
		8913	Aroclor-1268 (PCB-1268)		
		7115	beta-BHC (beta-Hexachlorocyclohexane)		
		7105	delta-BHC		
		7470	Dieldrin		
		7510	Endosulfan I		
		7515	Endosulfan II		
		7520	Endosulfan sulfate		
		7540	Endrin		
		7530	Endrin aldehyde		
		7535	Endrin ketone		
		7120	gamma-BHC (Lindane, gamma-HexachlorocyclohexanE)		
		7245	gamma-Chlordane		
		7685	Heptachlor		
		7690	Heptachlor epoxide		
		7810	Methoxychlor		

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Air

EPA TO-4A	8250	Toxaphene (Chlorinated camphene)		
EPA TO-4A EPA TO-4A			10249204	Pesticides and PCBs by HV PUF GC
	7360	4,4'-DDE		
	7365	4,4'-DDT		
	7025	Aldrin		
	7110	alpha-BHC (alpha-Hexachlorocyclohexane)		
	8880	Aroclor-1016 (PCB-1016)		
	8885	Aroclor-1221 (PCB-1221)		
	8890	Aroclor-1232 (PCB-1232)		
	8895	Aroclor-1242 (PCB-1242)		
	8900	Aroclor-1248 (PCB-1248)		
	8905	Aroclor-1254 (PCB-1254)		
	8910	Aroclor-1260 (PCB-1260)		
	7250	Chlordane (tech.)		
EPA TO-9A			10249408	Polychlorinated Dibenzodioxins in Ambient Air by GC/HRMS
	9516	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)		
	9519	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)		
	9420	1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)		
	9426	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)		
	9423	1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)		
	9471	1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-Hxcdf)		
	9453	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd)		
	9474	1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf)		
	9456	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,6,7,8-Hxcdd)		
	9477	1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf)		
	9459	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd)		
	9543	1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf)		
	9540	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd)		
	9480	2,3,4,6,7,8-Hexachlorodibenzofuran		
	9549	2,3,4,7,8-Pentachlorodibenzofuran		
	9618	2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD)		

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Air	EPA TO-9A	9612	2,3,7,8-Tetrachlorodibenzofuran		
Biological Tissue	EPA 1613B			10120602	Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope Dilution GC/HRMS
		9516	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)		
		9519	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)		
		9420	1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)		
		9426	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)		
		9423	1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)		
		9471	1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-Hxcdf)		
		9453	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd)		
		9474	1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf)		
		9456	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,6,7,8-Hxcdd)		
		9477	1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf)		
		9459	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd)		
		9543	1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf)		
		9540	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd)		
		9480	2,3,4,6,7,8-Hexachlorodibenzofuran		
		9549	2,3,4,7,8-Pentachlorodibenzofuran		
		9618	2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD)		
		9612	2,3,7,8-Tetrachlorodibenzofuran		
		9438	Hpcdd, total		
		9444	Hpcdf, total		
		9468	Hxcdd, total		
		9483	Hxcdf, total		
		9555	Pecdd, total		
		9552	Pecdf, total		
		9609	TCDD, total		
		9615	TCDF, total		

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Biological Tissue	EPA 1668A EPA 1668A		10262029	Chlorinated Biphenyl Cogeners in Water, Soil, Sediment, and Tissue by GC-HRMS
		9095 2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ-206)		
		9090 2,2',3,3',4,4',5,5'-Octachlorobiphenyl (BZ-194)		
		9101 2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl (BZ-207)		
		9103 2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ-195)		
		9102 2,2',3,3',4,4',5,6'-Octachlorobiphenyl (BZ-196)		
		9065 2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ-170)		
		9104 2,2',3,3',4,4',6,6'-Octachlorobiphenyl (BZ-197)		
		9106 2,2',3,3',4,4',6-Heptachlorobiphenyl (BZ-171)		
		9020 2,2',3,3',4,4'-Hexachlorobiphenyl (BZ-128)		
		9107 2,2',3,3',4,5,5',6,6'-Nonachlorobiphenyl (BZ-208)		
		9109 2,2',3,3',4,5,5',6-Octachlorobiphenyl (BZ-198)		
		9108 2,2',3,3',4,5,5',6'-Octachlorobiphenyl (BZ-199)		
		9110 2,2',3,3',4,5,5'-Heptachlorobiphenyl (BZ-172)		
		9111 2,2',3,3',4,5,6,6'-Octachlorobiphenyl (BZ-200)		
		9112 2,2',3,3',4,5',6,6'-Octachlorobiphenyl (BZ-201)		
		9113 2,2',3,3',4,5,6-Heptachlorobiphenyl (BZ-173)		
		9116 2,2',3,3',4,5,6'-Heptachlorobiphenyl (BZ-174)		
		9115 2,2',3,3',4,5',6-Heptachlorobiphenyl (BZ-175)		
		9114 2,2',3,3',4,5',6'-Heptachlorobiphenyl (BZ-177)		
		9118 2,2',3,3',4,5-Hexachlorobiphenyl (BZ-129)		
		9117 2,2',3,3',4,5'-Hexachlorobiphenyl (BZ-130)		
		9119 2,2',3,3',4,6,6'-Heptachlorobiphenyl (BZ-176)		
		9121 2,2',3,3',4,6-Hexachlorobiphenyl (BZ-131)		
		9120 2,2',3,3',4,6'-Hexachlorobiphenyl (BZ-132)		

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Biological Tissue	EPA 1668A	9122	2,2',3,3',4-Pentachlorobiphenyl (BZ-82)
	EPA 1668A	9123	2,2',3,3',5,5',6,6'-Octachlorobiphenyl (BZ-202)
		9124	2,2',3,3',5,5',6-Heptachlorobiphenyl (BZ-178)
		9125	2,2',3,3',5,5'-Hexachlorobiphenyl (BZ-133)
		9126	2,2',3,3',5,6,6'-Heptachlorobiphenyl (BZ-179)
		9128	2,2',3,3',5,6-Hexachlorobiphenyl (BZ-134)
		9127	2,2',3,3',5,6'-Hexachlorobiphenyl (BZ-135)
		9129	2,2',3,3',5-Pentachlorobiphenyl (BZ-83)
		9130	2,2',3,3',6,6'-Hexachlorobiphenyl (BZ-136)
		9131	2,2',3,3',6-Pentachlorobiphenyl (BZ-84)
		9132	2,2',3,3'-Tetrachlorobiphenyl (BZ-40)
		9133	2,2',3,4,4',5,5',6-Octachlorobiphenyl (BZ-203)
		9134	2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ-180)
		9135	2,2',3,4,4',5,6,6'-Octachlorobiphenyl (BZ-204)
		9137	2,2',3,4,4',5,6-Heptachlorobiphenyl (BZ-181)
		9136	2,2',3,4,4',5,6'-Heptachlorobiphenyl (BZ-182)
		9075	2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ-183)
		9138	2,2',3,4,4',5-Hexachlorobiphenyl (BZ-137)
		9025	2,2',3,4,4',5'-Hexachlorobiphenyl (BZ-138)
		9139	2,2',3,4,4',6,6'-Heptachlorobiphenyl (BZ-184)
		9141	2,2',3,4,4',6-Hexachlorobiphenyl (BZ-139)
		9140	2,2',3,4,4',6'-Hexachlorobiphenyl (BZ-140)
		9142	2,2',3,4,4'-Pentachlorobiphenyl (BZ-85)
		9143	2,2',3,4,5,5',6-Heptachlorobiphenyl (BZ-185)
		9080	2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ-187)
		9030	2,2',3,4,5,5'-Hexachlorobiphenyl (BZ-141)
		9144	2,2',3,4',5,5'-Hexachlorobiphenyl (BZ-146)

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		9146	2,2',3,4',5,6,6'-Heptachlorobiphenyl (BZ-188)
		9148	2,2',3,4,5,6-Hexachlorobiphenyl (BZ-142)
		9152	2,2',3,4,5,6'-Hexachlorobiphenyl (BZ-143)
		9150	2,2',3,4,5',6-Hexachlorobiphenyl (BZ-144)
		9149	2,2',3,4',5,6-Hexachlorobiphenyl (BZ-147)
		9147	2,2',3,4',5,6'-Hexachlorobiphenyl (BZ-148)
		9151	2,2',3,4',5',6-Hexachlorobiphenyl (BZ-149)
		9153	2,2',3,4,5-Pentachlorobiphenyl (BZ-86)
		8975	2,2',3,4,5'-Pentachlorobiphenyl (BZ-87)
		9155	2,2',3,4',5-Pentachlorobiphenyl (BZ-90)
		9154	2,2',3,4',5'-Pentachlorobiphenyl (BZ-97)
		9156	2,2',3,4,6,6'-Hexachlorobiphenyl (BZ-145)
		9157	2,2',3,4',6,6'-Hexachlorobiphenyl (BZ-150)
		9158	2,2',3,4,6-Pentachlorobiphenyl (BZ-88)
		9161	2,2',3,4,6'-Pentachlorobiphenyl (BZ-89)
		9160	2,2',3,4',6-Pentachlorobiphenyl (BZ-91)
		9159	2,2',3,4',6'-Pentachlorobiphenyl (BZ-98)
		9163	2,2',3,4-Tetrachlorobiphenyl (BZ-41)
		9162	2,2',3,4'-Tetrachlorobiphenyl (BZ-42)
		9035	2,2',3,5,5',6-Hexachlorobiphenyl (BZ-151)
		9164	2,2',3,5,5'-Pentachlorobiphenyl (BZ-92)
		9165	2,2',3,5,6,6'-Hexachlorobiphenyl (BZ-152)
		9168	2,2',3,5,6-Pentachlorobiphenyl (BZ-93)
		9167	2,2',3,5,6'-Pentachlorobiphenyl (BZ-94)
		9166	2,2',3,5',6-Pentachlorobiphenyl (BZ-95)
		9169	2,2',3,5-Tetrachlorobiphenyl (BZ-43)
		8945	2,2',3,5'-Tetrachlorobiphenyl (BZ-44)
		9170	2,2',3,6,6'-Pentachlorobiphenyl (BZ-96)
		9172	2,2',3,6-Tetrachlorobiphenyl (BZ-45)
		9171	2,2',3,6'-Tetrachlorobiphenyl (BZ-46)
		9173	2,2',3-Trichlorobiphenyl (BZ-16)
		9040	2,2',4,4',5,5'-Hexachlorobiphenyl (BZ-153)

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Biological Tissue	EPA 1668A EPA 1668A	9174	2,2',4,4',5,6'-Hexachlorobiphenyl (BZ-154)
		9175	2,2',4,4',5-Pentachlorobiphenyl (BZ-99)
		9176	2,2',4,4',6,6'-Hexachlorobiphenyl (BZ-155)
		9177	2,2',4,4',6-Pentachlorobiphenyl (BZ-100)
		9178	2,2',4,4'-Tetrachlorobiphenyl (BZ-47)
		8980	2,2',4,5,5'-Pentachlorobiphenyl (BZ-101)
		9180	2,2',4,5,6'-Pentachlorobiphenyl (BZ-102)
		9179	2,2',4,5',6-Pentachlorobiphenyl (BZ-103)
		9181	2,2',4,5-Tetrachlorobiphenyl (BZ-48)
		8950	2,2',4,5'-Tetrachlorobiphenyl (BZ-49)
		9182	2,2',4,6,6'-Pentachlorobiphenyl (BZ-104)
		9184	2,2',4,6-Tetrachlorobiphenyl (BZ-50)
		9183	2,2',4,6'-Tetrachlorobiphenyl (BZ-51)
		9185	2,2',4-Trichlorobiphenyl (BZ-17)
		8955	2,2',5,5'-Tetrachlorobiphenyl (BZ-52)
		9186	2,2',5,6'-Tetrachlorobiphenyl (BZ-53)
		8930	2,2',5-Trichlorobiphenyl (BZ-18)
		9187	2,2',6,6'-Tetrachlorobiphenyl (BZ-54)
		9188	2,2',6-Trichlorobiphenyl (BZ-19)
		9189	2,2'-Dichlorobiphenyl (BZ-4)
		9190	2,3,3',4,4',5,5',6-Octachlorobiphenyl (BZ-205)
		9085	2,3,3',4,4',5,5'-Heptachlorobiphenyl (BZ-189)
		9191	2,3,3',4,4',5,6-Heptachlorobiphenyl (BZ-190)
		9192	2,3,3',4,4',5',6-Heptachlorobiphenyl (BZ-191)
		9050	2,3,3',4,4',5-Hexachlorobiphenyl (BZ-156)
		9045	2,3,3',4,4',5'-Hexachlorobiphenyl (BZ-157)
		9193	2,3,3',4,4',6-Hexachlorobiphenyl (BZ-158)
		8985	2,3,3',4,4'-Pentachlorobiphenyl (BZ-105)
		9194	2,3,3',4,5,5',6-Heptachlorobiphenyl (BZ-192)
		9195	2,3,3',4',5,5',6-Heptachlorobiphenyl (BZ-193)
		9196	2,3,3',4,5,5'-Hexachlorobiphenyl (BZ-159)

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Biological Tissue	EPA 1668A EPA 1668A	9197	2,3,3',4',5,5'-Hexachlorobiphenyl (BZ-162)
		9198	2,3,3',4,5,6-Hexachlorobiphenyl (BZ-160)
		9199	2,3,3',4',5,6-Hexachlorobiphenyl (BZ-163)
		9201	2,3,3',4',5',6-Hexachlorobiphenyl (BZ-164)
		9200	2,3,3',4,5',6-Hexachlorobiphenyl (BZ-161)
		9204	2,3,3',4,5-Pentachlorobiphenyl (BZ-106)
		9205	2,3,3',4',5-Pentachlorobiphenyl (BZ-107)
		9203	2,3,3',4,5'-Pentachlorobiphenyl (BZ-108)
		9202	2,3,3',4',5'-Pentachlorobiphenyl (BZ-122)
		9206	2,3,3',4,6-Pentachlorobiphenyl (BZ-109)
		8990	2,3,3',4',6-Pentachlorobiphenyl (BZ-110)
		9208	2,3,3',4-Tetrachlorobiphenyl (BZ-55)
		9207	2,3,3',4'-Tetrachlorobiphenyl (BZ-56)
		9209	2,3,3',5,5',6-Hexachlorobiphenyl (BZ-165)
		9210	2,3,3',5,5'-Pentachlorobiphenyl (BZ-111)
		9211	2,3,3',5,6-Pentachlorobiphenyl (BZ-112)
		9212	2,3,3',5',6-Pentachlorobiphenyl (BZ-113)
		9214	2,3,3',5-Tetrachlorobiphenyl (BZ-57)
		9213	2,3,3',5'-Tetrachlorobiphenyl (BZ-58)
		9215	2,3,3',6-Tetrachlorobiphenyl (BZ-59)
		9216	2,3,3'-Trichlorobiphenyl (BZ-20)
		9055	2,3',4,4',5,5'-Hexachlorobiphenyl (BZ-167)
		9217	2,3,4,4',5,6-Hexachlorobiphenyl (BZ-166)
		9218	2,3',4,4',5',6-Hexachlorobiphenyl (BZ-168)
		9005	2,3,4,4',5-Pentachlorobiphenyl (BZ-114)
		8995	2,3',4,4',5-Pentachlorobiphenyl (BZ-118)
		9011	2,3',4,4',5'-Pentachlorobiphenyl (BZ-123)
		9219	2,3,4,4',6-Pentachlorobiphenyl (BZ-115)

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Biological Tissue	EPA 1668A	9220	2,3',4,4',6-Pentachlorobiphenyl (BZ-119)
	EPA 1668A	9221	2,3,4,4'-Tetrachlorobiphenyl (BZ-60)
		8960	2,3',4,4'-Tetrachlorobiphenyl (BZ-66)
		9223	2,3',4,5,5'-Pentachlorobiphenyl (BZ-120)
		9222	2,3',4',5,5'-Pentachlorobiphenyl (BZ-124)
		9225	2,3,4,5,6-Pentachlorobiphenyl (BZ-116)
		9227	2,3,4',5,6-Pentachlorobiphenyl (BZ-117)
		9226	2,3',4,5',6-Pentachlorobiphenyl (BZ-121)
		9224	2,3',4',5',6-Pentachlorobiphenyl (BZ-125)
		9228	2,3,4,5-Tetrachlorobiphenyl (BZ-61)
		9233	2,3,4',5-Tetrachlorobiphenyl (BZ-63)
		9231	2,3',4,5'-Tetrachlorobiphenyl (BZ-68)
		9230	2,3',4',5-Tetrachlorobiphenyl (BZ-70)
		9229	2,3',4',5'-Tetrachlorobiphenyl (BZ-76)
		9232	2,3',4,5-Tetrachlorobiphenyl (BZ-67)
		9234	2,3,4,6-Tetrachlorobiphenyl (BZ-62)
		9236	2,3,4',6-Tetrachlorobiphenyl (BZ-64)
		9235	2,3',4,6-Tetrachlorobiphenyl (BZ-69)
		9237	2,3',4',6-Tetrachlorobiphenyl (BZ-71)
		9238	2,3,4-Trichlorobiphenyl (BZ-21)
		9241	2,3,4'-Trichlorobiphenyl (BZ-22)
		9240	2,3',4-Trichlorobiphenyl (BZ-25)
		9239	2,3',4'-Trichlorobiphenyl (BZ-33)
		9242	2,3',5,5'-Tetrachlorobiphenyl (BZ-72)
		9243	2,3,5,6-Tetrachlorobiphenyl (BZ-65)
		9244	2,3',5',6-Tetrachlorobiphenyl (BZ-73)
		9245	2,3,5-Trichlorobiphenyl (BZ-23)
		8935	2,3',5-Trichlorobiphenyl (BZ-26)
		9246	2,3',5'-Trichlorobiphenyl (BZ-34)
		9247	2,3,6-Trichlorobiphenyl (BZ-24)
		9248	2,3',6-Trichlorobiphenyl (BZ-27)
		8920	2,3-Dichlorobiphenyl (BZ-5)
		9249	2,3'-Dichlorobiphenyl (BZ-6)
		9250	2,4,4',5-Tetrachlorobiphenyl (BZ-74)
		9251	2,4,4',6-Tetrachlorobiphenyl (BZ-75)
		9252	2,4,4'-Trichlorobiphenyl (BZ-28)
		9253	2,4,5-Trichlorobiphenyl (BZ-29)
		8940	2,4',5-Trichlorobiphenyl (BZ-31)
		9254	2,4,6-Trichlorobiphenyl (BZ-30)

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Biological Tissue	EPA 1668A EPA 1668A	9255	2,4',6-Trichlorobiphenyl (BZ-32)		
		9257	2,4-Dichlorobiphenyl (BZ-7)		
		9256	2,4'-Dichlorobiphenyl (BZ-8)		
		9258	2,5-Dichlorobiphenyl (BZ-9)		
		9259	2,6-Dichlorobiphenyl (BZ-10)		
		8915	2-Chlorobiphenyl (BZ-1)		
		9060	3,3',4,4',5,5'-Hexachlorobiphenyl (BZ-169)		
		9015	3,3',4,4',5-Pentachlorobiphenyl (BZ-126)		
		8965	3,3',4,4'-Tetrachlorobiphenyl (BZ-77)		
		9260	3,3',4,5,5'-Pentachlorobiphenyl (BZ-127)		
		9262	3,3',4,5-Tetrachlorobiphenyl (BZ-78)		
		9261	3,3',4,5'-Tetrachlorobiphenyl (BZ-79)		
		9263	3,3',4-Trichlorobiphenyl (BZ-35)		
		9264	3,3',5,5'-Tetrachlorobiphenyl (BZ-80)		
		9265	3,3',5-Trichlorobiphenyl (BZ-36)		
		8925	3,3'-Dichlorobiphenyl (BZ-11)		
		8970	3,4,4',5-Tetrachlorobiphenyl (BZ-81)		
		9266	3,4,4'-Trichlorobiphenyl (BZ-37)		
		9267	3,4,5-Trichlorobiphenyl (BZ-38)		
		9268	3,4',5-Trichlorobiphenyl (BZ-39)		
		9270	3,4-Dichlorobiphenyl (BZ-12)		
		9269	3,4'-Dichlorobiphenyl (BZ-13)		
		9271	3,5-Dichlorobiphenyl (BZ-14)		
		9272	3-Chlorobiphenyl (BZ-2)		
		9273	4,4'-Dichlorobiphenyl (BZ-15)		
		9274	4-Chlorobiphenyl (BZ-3)		
		9105	Decachlorobiphenyl (BZ-209)		
		8876	Total Dichlorobiphenyls		
		8877	Total Heptachlorobiphenyls		
		8888	Total Hexachlorobiphenyls		
		8889	Total Monochlorobiphenyls		
		8891	Total Nonachlorobiphenyls		
		8892	Total Octachlorobiphenyls		
		8896	Total Pentachlorobiphenyls		
		8893	Total Tetrachlorobiphenyls		
		8894	Total Trichlorobiphenyls		
	EPA 1668C EPA 1668C			10262109	Chlorinated Biphenyl Cogeners in Water, Soil, Sediment, and Tissue by GC-HRMS
		9095	2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ-206)		
		9090	2,2',3,3',4,4',5,5'-Octachlorobiphenyl (BZ-194)		

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Biological Tissue	EPA 1668C EPA 1668C	9101	2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl (BZ-207)
		9103	2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ-195)
		9102	2,2',3,3',4,4',5,6'-Octachlorobiphenyl (BZ-196)
		9065	2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ-170)
		9104	2,2',3,3',4,4',6,6'-Octachlorobiphenyl (BZ-197)
		9106	2,2',3,3',4,4',6-Heptachlorobiphenyl (BZ-171)
		9020	2,2',3,3',4,4'-Hexachlorobiphenyl (BZ-128)
		9107	2,2',3,3',4,5,5',6,6'-Nonachlorobiphenyl (BZ-208)
		9109	2,2',3,3',4,5,5',6-Octachlorobiphenyl (BZ-198)
		9108	2,2',3,3',4,5,5',6'-Octachlorobiphenyl (BZ-199)
		9110	2,2',3,3',4,5,5'-Heptachlorobiphenyl (BZ-172)
		9111	2,2',3,3',4,5,6,6'-Octachlorobiphenyl (BZ-200)
		9112	2,2',3,3',4,5',6,6'-Octachlorobiphenyl (BZ-201)
		9113	2,2',3,3',4,5,6-Heptachlorobiphenyl (BZ-173)
		9116	2,2',3,3',4,5,6'-Heptachlorobiphenyl (BZ-174)
		9115	2,2',3,3',4,5',6-Heptachlorobiphenyl (BZ-175)
		9114	2,2',3,3',4,5',6'-Heptachlorobiphenyl (BZ-177)
		9118	2,2',3,3',4,5-Hexachlorobiphenyl (BZ-129)
		9117	2,2',3,3',4,5'-Hexachlorobiphenyl (BZ-130)
		9119	2,2',3,3',4,6,6'-Heptachlorobiphenyl (BZ-176)
		9121	2,2',3,3',4,6-Hexachlorobiphenyl (BZ-131)
		9120	2,2',3,3',4,6'-Hexachlorobiphenyl (BZ-132)
		9122	2,2',3,3',4-Pentachlorobiphenyl (BZ-82)
		9123	2,2',3,3',5,5',6,6'-Octachlorobiphenyl (BZ-202)
		9124	2,2',3,3',5,5',6-Heptachlorobiphenyl (BZ-178)
		9125	2,2',3,3',5,5'-Hexachlorobiphenyl (BZ-133)

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Biological Tissue	EPA 1668C EPA 1668C	9126	2,2',3,3',5,6,6'-Heptachlorobiphenyl (BZ-179)
		9128	2,2',3,3',5,6-Hexachlorobiphenyl (BZ-134)
		9127	2,2',3,3',5,6'-Hexachlorobiphenyl (BZ-135)
		9129	2,2',3,3',5-Pentachlorobiphenyl (BZ-83)
		9130	2,2',3,3',6,6'-Hexachlorobiphenyl (BZ-136)
		9131	2,2',3,3',6-Pentachlorobiphenyl (BZ-84)
		9132	2,2',3,3'-Tetrachlorobiphenyl (BZ-40)
		9133	2,2',3,4,4',5,5',6-Octachlorobiphenyl (BZ-203)
		9134	2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ-180)
		9135	2,2',3,4,4',5,6,6'-Octachlorobiphenyl (BZ-204)
		9137	2,2',3,4,4',5,6-Heptachlorobiphenyl (BZ-181)
		9136	2,2',3,4,4',5,6'-Heptachlorobiphenyl (BZ-182)
		9075	2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ-183)
		9138	2,2',3,4,4',5-Hexachlorobiphenyl (BZ-137)
		9025	2,2',3,4,4',5'-Hexachlorobiphenyl (BZ-138)
		9139	2,2',3,4,4',6,6'-Heptachlorobiphenyl (BZ-184)
		9141	2,2',3,4,4',6-Hexachlorobiphenyl (BZ-139)
		9140	2,2',3,4,4',6'-Hexachlorobiphenyl (BZ-140)
		9142	2,2',3,4,4'-Pentachlorobiphenyl (BZ-85)
		9143	2,2',3,4,5,5',6-Heptachlorobiphenyl (BZ-185)
		9080	2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ-187)
		9030	2,2',3,4,5,5'-Hexachlorobiphenyl (BZ-141)
		9144	2,2',3,4',5,5'-Hexachlorobiphenyl (BZ-146)
		9145	2,2',3,4,5,6,6'-Heptachlorobiphenyl (BZ-186)
		9146	2,2',3,4',5,6,6'-Heptachlorobiphenyl (BZ-188)
		9148	2,2',3,4,5,6-Hexachlorobiphenyl (BZ-142)
		9152	2,2',3,4,5,6'-Hexachlorobiphenyl (BZ-143)

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Biological Tissue	EPA 1668C EPA 1668C	9150	2,2',3,4,5',6-Hexachlorobiphenyl (BZ-144)
		9149	2,2',3,4',5,6-Hexachlorobiphenyl (BZ-147)
		9147	2,2',3,4',5,6'-Hexachlorobiphenyl (BZ-148)
		9151	2,2',3,4',5',6-Hexachlorobiphenyl (BZ-149)
		9153	2,2',3,4,5-Pentachlorobiphenyl (BZ-86)
		8975	2,2',3,4,5'-Pentachlorobiphenyl (BZ-87)
		9155	2,2',3,4',5-Pentachlorobiphenyl (BZ-90)
		9154	2,2',3,4',5'-Pentachlorobiphenyl (BZ-97)
		9156	2,2',3,4,6,6'-Hexachlorobiphenyl (BZ-145)
		9157	2,2',3,4',6,6'-Hexachlorobiphenyl (BZ-150)
		9158	2,2',3,4,6-Pentachlorobiphenyl (BZ-88)
		9161	2,2',3,4,6'-Pentachlorobiphenyl (BZ-89)
		9160	2,2',3,4',6-Pentachlorobiphenyl (BZ-91)
		9159	2,2',3,4',6'-Pentachlorobiphenyl (BZ-98)
		9163	2,2',3,4-Tetrachlorobiphenyl (BZ-41)
		9162	2,2',3,4'-Tetrachlorobiphenyl (BZ-42)
		9035	2,2',3,5,5',6-Hexachlorobiphenyl (BZ-151)
		9164	2,2',3,5,5'-Pentachlorobiphenyl (BZ-92)
		9165	2,2',3,5,6,6'-Hexachlorobiphenyl (BZ-152)
		9168	2,2',3,5,6-Pentachlorobiphenyl (BZ-93)
		9167	2,2',3,5,6'-Pentachlorobiphenyl (BZ-94)
		9166	2,2',3,5',6-Pentachlorobiphenyl (BZ-95)
		9169	2,2',3,5-Tetrachlorobiphenyl (BZ-43)
		8945	2,2',3,5'-Tetrachlorobiphenyl (BZ-44)
		9170	2,2',3,6,6'-Pentachlorobiphenyl (BZ-96)
		9172	2,2',3,6-Tetrachlorobiphenyl (BZ-45)
		9171	2,2',3,6'-Tetrachlorobiphenyl (BZ-46)
		9173	2,2',3-Trichlorobiphenyl (BZ-16)
		9040	2,2',4,4',5,5'-Hexachlorobiphenyl (BZ-153)
		9174	2,2',4,4',5,6'-Hexachlorobiphenyl (BZ-154)
		9175	2,2',4,4',5-Pentachlorobiphenyl (BZ-99)
		9176	2,2',4,4',6,6'-Hexachlorobiphenyl (BZ-155)
		9177	2,2',4,4',6-Pentachlorobiphenyl (BZ-100)
		9178	2,2',4,4'-Tetrachlorobiphenyl (BZ-47)

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Biological Tissue	EPA 1668C EPA 1668C	8980	2,2',4,5,5'-Pentachlorobiphenyl (BZ-101)
		9180	2,2',4,5,6'-Pentachlorobiphenyl (BZ-102)
		9179	2,2',4,5',6-Pentachlorobiphenyl (BZ-103)
		9181	2,2',4,5-Tetrachlorobiphenyl (BZ-48)
		8950	2,2',4,5'-Tetrachlorobiphenyl (BZ-49)
		9182	2,2',4,6,6'-Pentachlorobiphenyl (BZ-104)
		9184	2,2',4,6-Tetrachlorobiphenyl (BZ-50)
		9183	2,2',4,6'-Tetrachlorobiphenyl (BZ-51)
		9185	2,2',4-Trichlorobiphenyl (BZ-17)
		8955	2,2',5,5'-Tetrachlorobiphenyl (BZ-52)
		9186	2,2',5,6'-Tetrachlorobiphenyl (BZ-53)
		8930	2,2',5-Trichlorobiphenyl (BZ-18)
		9187	2,2',6,6'-Tetrachlorobiphenyl (BZ-54)
		9188	2,2',6-Trichlorobiphenyl (BZ-19)
		9189	2,2'-Dichlorobiphenyl (BZ-4)
		9190	2,3,3',4,4',5,5',6-Octachlorobiphenyl (BZ-205)
		9085	2,3,3',4,4',5,5'-Heptachlorobiphenyl (BZ-189)
		9191	2,3,3',4,4',5,6-Heptachlorobiphenyl (BZ-190)
		9192	2,3,3',4,4',5',6-Heptachlorobiphenyl (BZ-191)
		9050	2,3,3',4,4',5-Hexachlorobiphenyl (BZ-156)
		9045	2,3,3',4,4',5'-Hexachlorobiphenyl (BZ-157)
		9193	2,3,3',4,4',6-Hexachlorobiphenyl (BZ-158)
		8985	2,3,3',4,4'-Pentachlorobiphenyl (BZ-105)
		9194	2,3,3',4,5,5',6-Heptachlorobiphenyl (BZ-192)
		9195	2,3,3',4',5,5',6-Heptachlorobiphenyl (BZ-193)
		9196	2,3,3',4,5,5'-Hexachlorobiphenyl (BZ-159)
		9197	2,3,3',4',5,5'-Hexachlorobiphenyl (BZ-162)
		9198	2,3,3',4,5,6-Hexachlorobiphenyl (BZ-160)
		9199	2,3,3',4',5,6-Hexachlorobiphenyl (BZ-163)
		9201	2,3,3',4',5',6-Hexachlorobiphenyl (BZ-164)

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		9204	2,3,3',4,5-Pentachlorobiphenyl (BZ-106)
		9205	2,3,3',4',5-Pentachlorobiphenyl (BZ-107)
		9203	2,3,3',4,5'-Pentachlorobiphenyl (BZ-108)
		9202	2,3,3',4',5'-Pentachlorobiphenyl (BZ-122)
		9206	2,3,3',4,6-Pentachlorobiphenyl (BZ-109)
		8990	2,3,3',4',6-Pentachlorobiphenyl (BZ-110)
		9208	2,3,3',4-Tetrachlorobiphenyl (BZ-55)
		9207	2,3,3',4'-Tetrachlorobiphenyl (BZ-56)
		9209	2,3,3',5,5',6-Hexachlorobiphenyl (BZ-165)
		9210	2,3,3',5,5'-Pentachlorobiphenyl (BZ-111)
		9211	2,3,3',5,6-Pentachlorobiphenyl (BZ-112)
		9212	2,3,3',5',6-Pentachlorobiphenyl (BZ-113)
		9214	2,3,3',5-Tetrachlorobiphenyl (BZ-57)
		9213	2,3,3',5'-Tetrachlorobiphenyl (BZ-58)
		9215	2,3,3',6-Tetrachlorobiphenyl (BZ-59)
		9216	2,3,3'-Trichlorobiphenyl (BZ-20)
		9055	2,3',4,4',5,5'-Hexachlorobiphenyl (BZ-167)
		9217	2,3,4,4',5,6-Hexachlorobiphenyl (BZ-166)
		9218	2,3',4,4',5',6-Hexachlorobiphenyl (BZ-168)
		9005	2,3,4,4',5-Pentachlorobiphenyl (BZ-114)
		8995	2,3',4,4',5-Pentachlorobiphenyl (BZ-118)
		9011	2,3',4,4',5'-Pentachlorobiphenyl (BZ-123)
		9219	2,3,4,4',6-Pentachlorobiphenyl (BZ-115)
		9220	2,3',4,4',6-Pentachlorobiphenyl (BZ-119)
		9221	2,3,4,4'-Tetrachlorobiphenyl (BZ-60)
		8960	2,3',4,4'-Tetrachlorobiphenyl (BZ-66)
		9223	2,3',4,5,5'-Pentachlorobiphenyl (BZ-120)
		9222	2,3',4',5,5'-Pentachlorobiphenyl (BZ-124)

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Biological Tissue	EPA 1668C EPA 1668C	9225	2,3,4,5,6-Pentachlorobiphenyl (BZ-116)
		9227	2,3,4',5,6-Pentachlorobiphenyl (BZ-117)
		9226	2,3',4,5',6-Pentachlorobiphenyl (BZ-121)
		9224	2,3',4',5',6-Pentachlorobiphenyl (BZ-125)
		9228	2,3,4,5-Tetrachlorobiphenyl (BZ-61)
		9233	2,3,4',5-Tetrachlorobiphenyl (BZ-63)
		9231	2,3',4,5'-Tetrachlorobiphenyl (BZ-68)
		9230	2,3',4',5-Tetrachlorobiphenyl (BZ-70)
		9229	2,3',4',5'-Tetrachlorobiphenyl (BZ-76)
		9232	2,3',4,5-Tetrachlorobiphenyl (BZ-67)
		9234	2,3,4,6-Tetrachlorobiphenyl (BZ-62)
		9236	2,3,4',6-Tetrachlorobiphenyl (BZ-64)
		9235	2,3',4,6-Tetrachlorobiphenyl (BZ-69)
		9237	2,3',4',6-Tetrachlorobiphenyl (BZ-71)
		9238	2,3,4-Trichlorobiphenyl (BZ-21)
		9241	2,3,4'-Trichlorobiphenyl (BZ-22)
		9240	2,3',4-Trichlorobiphenyl (BZ-25)
		9239	2,3',4'-Trichlorobiphenyl (BZ-33)
		9242	2,3',5,5'-Tetrachlorobiphenyl (BZ-72)
		9243	2,3,5,6-Tetrachlorobiphenyl (BZ-65)
		9244	2,3',5',6-Tetrachlorobiphenyl (BZ-73)
		9245	2,3,5-Trichlorobiphenyl (BZ-23)
		8935	2,3',5-Trichlorobiphenyl (BZ-26)
		9246	2,3',5'-Trichlorobiphenyl (BZ-34)
		9247	2,3,6-Trichlorobiphenyl (BZ-24)
		9248	2,3',6-Trichlorobiphenyl (BZ-27)
		8920	2,3-Dichlorobiphenyl (BZ-5)
		9249	2,3'-Dichlorobiphenyl (BZ-6)
		9250	2,4,4',5-Tetrachlorobiphenyl (BZ-74)
		9251	2,4,4',6-Tetrachlorobiphenyl (BZ-75)
		9252	2,4,4'-Trichlorobiphenyl (BZ-28)
		9253	2,4,5-Trichlorobiphenyl (BZ-29)
		8940	2,4',5-Trichlorobiphenyl (BZ-31)
		9254	2,4,6-Trichlorobiphenyl (BZ-30)
		9255	2,4',6-Trichlorobiphenyl (BZ-32)
		9257	2,4-Dichlorobiphenyl (BZ-7)
		9256	2,4'-Dichlorobiphenyl (BZ-8)
		9258	2,5-Dichlorobiphenyl (BZ-9)
		9259	2,6-Dichlorobiphenyl (BZ-10)
		8915	2-Chlorobiphenyl (BZ-1)

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Biological Tissue	EPA 1668C EPA 1668C	9060	3,3',4,4',5,5'-Hexachlorobiphenyl (BZ-169)		
		9015	3,3',4,4',5-Pentachlorobiphenyl (BZ-126)		
		8965	3,3',4,4'-Tetrachlorobiphenyl (BZ-77)		
		9260	3,3',4,5,5'-Pentachlorobiphenyl (BZ-127)		
		9262	3,3',4,5-Tetrachlorobiphenyl (BZ-78)		
		9261	3,3',4,5'-Tetrachlorobiphenyl (BZ-79)		
		9263	3,3',4-Trichlorobiphenyl (BZ-35)		
		9264	3,3',5,5'-Tetrachlorobiphenyl (BZ-80)		
		9265	3,3',5-Trichlorobiphenyl (BZ-36)		
		8925	3,3'-Dichlorobiphenyl (BZ-11)		
		8970	3,4,4',5-Tetrachlorobiphenyl (BZ-81)		
		9266	3,4,4'-Trichlorobiphenyl (BZ-37)		
		9267	3,4,5-Trichlorobiphenyl (BZ-38)		
		9268	3,4',5-Trichlorobiphenyl (BZ-39)		
		9270	3,4-Dichlorobiphenyl (BZ-12)		
		9269	3,4'-Dichlorobiphenyl (BZ-13)		
		9271	3,5-Dichlorobiphenyl (BZ-14)		
		9272	3-Chlorobiphenyl (BZ-2)		
		9273	4,4'-Dichlorobiphenyl (BZ-15)		
		9274	4-Chlorobiphenyl (BZ-3)		
		9105	Decachlorobiphenyl (BZ-209)		
		8876	Total Dichlorobiphenyls		
		8877	Total Heptachlorobiphenyls		
		8888	Total Hexachlorobiphenyls		
		8889	Total Monochlorobiphenyls		
		8891	Total Nonachlorobiphenyls		
		8892	Total Octachlorobiphenyls		
		8896	Total Pentachlorobiphenyls		
		8893	Total Tetrachlorobiphenyls		
		8894	Total Trichlorobiphenyls		
	EPA 537 - Modified 1.1			971	Perfluorinated Alkyl Acids in Drinking Water by SPE and LC/MS/MS
		4846	2-(N-Ethyl-perfluorooctane sufonamido) acetic acid (EtFOSAA)		
		4847	2-(N-Methyl-perfluorooctane sulfonamido) acetic acid (MeFOSAA)		
		6457	6:2 Fluorotelomersulfonate (6:2FTS)		
		6461	8:2 Fluorotelomersulfonate (8:2FTS)		
		6911	Perfluorobutane Sulfonate (PFBS)		
		6915	Perfluorobutyric acid (PFBA)		
		9562	Perfluorodecane Sulfonate (PFDS)		
		6905	Perfluorodecanoic acid (PFDA)		

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Biological Tissue	EPA 537 - Modified 1.1	6903	Perfluorododecanoic (PFDDA)		
		9470	Perfluoroheptanesulfonic acid (PFHpS)		
		6908	Perfluoroheptanoic acid (PFHpA)		
		6901	Perfluorohexadecanoic acid (PFHxDA)		
		6910	Perfluorohexane Sulfonate (PFHS)		
		6913	Perfluorohexanoic acid (PFHXA)		
		6906	Perfluorononanoic acid (PFNA)		
		6916	Perfluorooctadecanoic acid (PFODA)		
		6917	Perfluorooctane Sulfonamide (PFOSA)		
		6912	Perfluorooctanoic acid		
		6909	Perfluorooctanoic Sulfonate (PFOS)		
		6914	Perfluoropentanoic acid (PFPEA)		
		6902	Perfluorotetradecanoic acid (PFTDA)		
		9563	Perfluorotridecanoic (PFTRIA)		
		6904	Perfluoroundecanoic acid (PFUDA)		
Drinking Water	EPA 1613B			10120602	Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope Dilution GC/HRMS
		9618	2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD)		
	EPA 331.0 1.0			10059708	Determination of Perchlorate in Drinking Water by Liquid Chromatography Electrospray Mass Spectrometry (LC/ESI/MS)
		1895	Perchlorate		
	EPA 537 1.1			10091675	Perfluorinated Alkyl Acids in Drinking Water by SPE and LC/MS/MS
		6911	Perfluorobutane Sulfonate (PFBS)		
		6908	Perfluoroheptanoic acid (PFHpA)		
		6910	Perfluorohexane Sulfonate (PFHS)		
		6906	Perfluorononanoic acid (PFNA)		
		6912	Perfluorooctanoic acid		
		6909	Perfluorooctanoic Sulfonate (PFOS)		
Non-Potable Water	AK101 GRO-MS			90015159	Determination of Gasoline Range Organics by GC/MS - Alaska Department of Environmental Conservation
		9408	Gasoline range organics (GRO)		
	AK102 DRO			90015206	Determination of Diesel Range Organics - Alaska Department of Environmental Conservation
		9369	Diesel range organics (DRO)		
	AK102 DRO-SV			90015228	Determination of Diesel Range Organics Small Volume - Alaska DEC
		9369	Diesel range organics (DRO)		

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AK103 RRO			90015400	Determination of Residual Range Organics - Alaska Department of Environmental Conservation
	9499	Motor Oil		
EPA 1311			10118806	Toxicity Characteristic Leaching Procedure
	8031	Extraction/Preparation		
EPA 1312			10119003	Synthetic Precipitation Leaching Procedure
	8031	Extraction/Preparation		
EPA 1613B			10120602	Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope Dilution GC/HRMS
	9516	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)		
	9519	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)		
	9420	1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)		
	9426	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)		
	9423	1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)		
	9471	1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-Hxcdf)		
	9453	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd)		
	9474	1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf)		
	9456	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,6,7,8-Hxcdd)		
	9477	1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf)		
	9459	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd)		
	9543	1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf)		
	9540	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd)		
	9480	2,3,4,6,7,8-Hexachlorodibenzofuran		
	9549	2,3,4,7,8-Pentachlorodibenzofuran		
	9618	2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD)		
	9612	2,3,7,8-Tetrachlorodibenzofuran		
	9438	Hpcdd, total		
	9444	Hpcdf, total		
	9468	Hxcdd, total		
	9483	Hxcdf, total		
	9555	Pecdd, total		
	9552	Pecdf, total		

Non-Potable Water

EPA 1613B	9609	TCDD, total		
	9615	TCDF, total		
EPA 1668A EPA 1668A			10262029	Chlorinated Biphenyl Cogeners in Water, Soil, Sediment, and Tissue by GC-HRMS
	9095	2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ-206)		
	9090	2,2',3,3',4,4',5,5'-Octachlorobiphenyl (BZ-194)		
	9101	2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl (BZ-207)		
	9103	2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ-195)		
	9102	2,2',3,3',4,4',5,6'-Octachlorobiphenyl (BZ-196)		
	9065	2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ-170)		
	9104	2,2',3,3',4,4',6,6'-Octachlorobiphenyl (BZ-197)		
	9106	2,2',3,3',4,4',6-Heptachlorobiphenyl (BZ-171)		
	9020	2,2',3,3',4,4'-Hexachlorobiphenyl (BZ-128)		
	9107	2,2',3,3',4,5,5',6,6'-Nonachlorobiphenyl (BZ-208)		
	9109	2,2',3,3',4,5,5',6-Octachlorobiphenyl (BZ-198)		
	9108	2,2',3,3',4,5,5',6'-Octachlorobiphenyl (BZ-199)		
	9110	2,2',3,3',4,5,5'-Heptachlorobiphenyl (BZ-172)		
	9111	2,2',3,3',4,5,6,6'-Octachlorobiphenyl (BZ-200)		
	9112	2,2',3,3',4,5',6,6'-Octachlorobiphenyl (BZ-201)		
	9113	2,2',3,3',4,5,6-Heptachlorobiphenyl (BZ-173)		
	9116	2,2',3,3',4,5,6'-Heptachlorobiphenyl (BZ-174)		
	9115	2,2',3,3',4,5',6-Heptachlorobiphenyl (BZ-175)		
	9114	2,2',3,3',4,5',6'-Heptachlorobiphenyl (BZ-177)		
	9118	2,2',3,3',4,5-Hexachlorobiphenyl (BZ-129)		
	9117	2,2',3,3',4,5'-Hexachlorobiphenyl (BZ-130)		
	9119	2,2',3,3',4,6,6'-Heptachlorobiphenyl (BZ-176)		
	9121	2,2',3,3',4,6-Hexachlorobiphenyl (BZ-131)		

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		9122	2,2',3,3',4-Pentachlorobiphenyl (BZ-82)
		9123	2,2',3,3',5,5',6,6'-Octachlorobiphenyl (BZ-202)
		9124	2,2',3,3',5,5',6-Heptachlorobiphenyl (BZ-178)
		9125	2,2',3,3',5,5'-Hexachlorobiphenyl (BZ-133)
		9126	2,2',3,3',5,6,6'-Heptachlorobiphenyl (BZ-179)
		9128	2,2',3,3',5,6-Hexachlorobiphenyl (BZ-134)
		9127	2,2',3,3',5,6'-Hexachlorobiphenyl (BZ-135)
		9129	2,2',3,3',5-Pentachlorobiphenyl (BZ-83)
		9130	2,2',3,3',6,6'-Hexachlorobiphenyl (BZ-136)
		9131	2,2',3,3',6-Pentachlorobiphenyl (BZ-84)
		9132	2,2',3,3'-Tetrachlorobiphenyl (BZ-40)
		9133	2,2',3,4,4',5,5',6-Octachlorobiphenyl (BZ-203)
		9134	2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ-180)
		9135	2,2',3,4,4',5,6,6'-Octachlorobiphenyl (BZ-204)
		9137	2,2',3,4,4',5,6-Heptachlorobiphenyl (BZ-181)
		9136	2,2',3,4,4',5,6'-Heptachlorobiphenyl (BZ-182)
		9075	2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ-183)
		9138	2,2',3,4,4',5-Hexachlorobiphenyl (BZ-137)
		9025	2,2',3,4,4',5'-Hexachlorobiphenyl (BZ-138)
		9139	2,2',3,4,4',6,6'-Heptachlorobiphenyl (BZ-184)
		9141	2,2',3,4,4',6-Hexachlorobiphenyl (BZ-139)
		9140	2,2',3,4,4',6'-Hexachlorobiphenyl (BZ-140)
		9142	2,2',3,4,4'-Pentachlorobiphenyl (BZ-85)
		9143	2,2',3,4,5,5',6-Heptachlorobiphenyl (BZ-185)
		9080	2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ-187)
		9030	2,2',3,4,5,5'-Hexachlorobiphenyl (BZ-141)

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	EPA 1668A	9144	2,2',3,4',5,5'-Hexachlorobiphenyl (BZ-146)
	EPA 1668A	9145	2,2',3,4,5,6,6'-Heptachlorobiphenyl (BZ-186)
		9146	2,2',3,4',5,6,6'-Heptachlorobiphenyl (BZ-188)
		9148	2,2',3,4,5,6-Hexachlorobiphenyl (BZ-142)
		9152	2,2',3,4,5,6'-Hexachlorobiphenyl (BZ-143)
		9150	2,2',3,4,5',6-Hexachlorobiphenyl (BZ-144)
		9149	2,2',3,4',5,6-Hexachlorobiphenyl (BZ-147)
		9147	2,2',3,4',5,6'-Hexachlorobiphenyl (BZ-148)
		9151	2,2',3,4',5',6-Hexachlorobiphenyl (BZ-149)
		9153	2,2',3,4,5-Pentachlorobiphenyl (BZ-86)
		8975	2,2',3,4,5'-Pentachlorobiphenyl (BZ-87)
		9155	2,2',3,4',5-Pentachlorobiphenyl (BZ-90)
		9154	2,2',3,4',5'-Pentachlorobiphenyl (BZ-97)
		9156	2,2',3,4,6,6'-Hexachlorobiphenyl (BZ-145)
		9157	2,2',3,4',6,6'-Hexachlorobiphenyl (BZ-150)
		9158	2,2',3,4,6-Pentachlorobiphenyl (BZ-88)
		9161	2,2',3,4,6'-Pentachlorobiphenyl (BZ-89)
		9160	2,2',3,4',6-Pentachlorobiphenyl (BZ-91)
		9159	2,2',3,4',6'-Pentachlorobiphenyl (BZ-98)
		9163	2,2',3,4-Tetrachlorobiphenyl (BZ-41)
		9162	2,2',3,4'-Tetrachlorobiphenyl (BZ-42)
		9035	2,2',3,5,5',6-Hexachlorobiphenyl (BZ-151)
		9164	2,2',3,5,5'-Pentachlorobiphenyl (BZ-92)
		9165	2,2',3,5,6,6'-Hexachlorobiphenyl (BZ-152)
		9168	2,2',3,5,6-Pentachlorobiphenyl (BZ-93)
		9167	2,2',3,5,6'-Pentachlorobiphenyl (BZ-94)
		9166	2,2',3,5',6-Pentachlorobiphenyl (BZ-95)
		9169	2,2',3,5-Tetrachlorobiphenyl (BZ-43)
		8945	2,2',3,5'-Tetrachlorobiphenyl (BZ-44)
		9170	2,2',3,6,6'-Pentachlorobiphenyl (BZ-96)
		9172	2,2',3,6-Tetrachlorobiphenyl (BZ-45)
		9171	2,2',3,6'-Tetrachlorobiphenyl (BZ-46)
		9173	2,2',3-Trichlorobiphenyl (BZ-16)

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		9174	2,2',4,4',5,6'-Hexachlorobiphenyl (BZ-154)
		9175	2,2',4,4',5-Pentachlorobiphenyl (BZ-99)
		9176	2,2',4,4',6,6'-Hexachlorobiphenyl (BZ-155)
		9177	2,2',4,4',6-Pentachlorobiphenyl (BZ-100)
		9178	2,2',4,4'-Tetrachlorobiphenyl (BZ-47)
		8980	2,2',4,5,5'-Pentachlorobiphenyl (BZ-101)
		9180	2,2',4,5,6'-Pentachlorobiphenyl (BZ-102)
		9179	2,2',4,5',6-Pentachlorobiphenyl (BZ-103)
		9181	2,2',4,5-Tetrachlorobiphenyl (BZ-48)
		8950	2,2',4,5'-Tetrachlorobiphenyl (BZ-49)
		9182	2,2',4,6,6'-Pentachlorobiphenyl (BZ-104)
		9184	2,2',4,6-Tetrachlorobiphenyl (BZ-50)
		9183	2,2',4,6'-Tetrachlorobiphenyl (BZ-51)
		9185	2,2',4-Trichlorobiphenyl (BZ-17)
		8955	2,2',5,5'-Tetrachlorobiphenyl (BZ-52)
		9186	2,2',5,6'-Tetrachlorobiphenyl (BZ-53)
		8930	2,2',5-Trichlorobiphenyl (BZ-18)
		9187	2,2',6,6'-Tetrachlorobiphenyl (BZ-54)
		9188	2,2',6-Trichlorobiphenyl (BZ-19)
		9189	2,2'-Dichlorobiphenyl (BZ-4)
		9190	2,3,3',4,4',5,5',6-Octachlorobiphenyl (BZ-205)
		9085	2,3,3',4,4',5,5'-Heptachlorobiphenyl (BZ-189)
		9191	2,3,3',4,4',5,6-Heptachlorobiphenyl (BZ-190)
		9192	2,3,3',4,4',5',6-Heptachlorobiphenyl (BZ-191)
		9050	2,3,3',4,4',5-Hexachlorobiphenyl (BZ-156)
		9045	2,3,3',4,4',5'-Hexachlorobiphenyl (BZ-157)
		9193	2,3,3',4,4',6-Hexachlorobiphenyl (BZ-158)
		8985	2,3,3',4,4'-Pentachlorobiphenyl (BZ-105)
		9194	2,3,3',4,5,5',6-Heptachlorobiphenyl (BZ-192)
		9195	2,3,3',4',5,5',6-Heptachlorobiphenyl (BZ-193)

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Non-Potable Water	EPA 1668A EPA 1668A	9196	2,3,3',4,5,5'-Hexachlorobiphenyl (BZ-159)
		9197	2,3,3',4',5,5'-Hexachlorobiphenyl (BZ-162)
		9198	2,3,3',4,5,6-Hexachlorobiphenyl (BZ-160)
		9199	2,3,3',4',5,6-Hexachlorobiphenyl (BZ-163)
		9201	2,3,3',4',5',6-Hexachlorobiphenyl (BZ-164)
		9200	2,3,3',4,5',6-Hexachlorobiphenyl (BZ-161)
		9204	2,3,3',4,5-Pentachlorobiphenyl (BZ-106)
		9205	2,3,3',4',5-Pentachlorobiphenyl (BZ-107)
		9203	2,3,3',4,5'-Pentachlorobiphenyl (BZ-108)
		9202	2,3,3',4',5'-Pentachlorobiphenyl (BZ-122)
		9206	2,3,3',4,6-Pentachlorobiphenyl (BZ-109)
		8990	2,3,3',4',6-Pentachlorobiphenyl (BZ-110)
		9208	2,3,3',4-Tetrachlorobiphenyl (BZ-55)
		9207	2,3,3',4'-Tetrachlorobiphenyl (BZ-56)
		9209	2,3,3',5,5',6-Hexachlorobiphenyl (BZ-165)
		9210	2,3,3',5,5'-Pentachlorobiphenyl (BZ-111)
		9211	2,3,3',5,6-Pentachlorobiphenyl (BZ-112)
		9212	2,3,3',5',6-Pentachlorobiphenyl (BZ-113)
		9214	2,3,3',5-Tetrachlorobiphenyl (BZ-57)
		9213	2,3,3',5'-Tetrachlorobiphenyl (BZ-58)
		9215	2,3,3',6-Tetrachlorobiphenyl (BZ-59)
		9216	2,3,3'-Trichlorobiphenyl (BZ-20)
		9055	2,3',4,4',5,5'-Hexachlorobiphenyl (BZ-167)
		9217	2,3,4,4',5,6-Hexachlorobiphenyl (BZ-166)
		9218	2,3',4,4',5',6-Hexachlorobiphenyl (BZ-168)
		9005	2,3,4,4',5-Pentachlorobiphenyl (BZ-114)
		8995	2,3',4,4',5-Pentachlorobiphenyl (BZ-118)
		9011	2,3',4,4',5'-Pentachlorobiphenyl (BZ-123)

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	EPA 1668A	9219	2,3,4,4',6-Pentachlorobiphenyl (BZ-115)
	EPA 1668A	9220	2,3',4,4',6-Pentachlorobiphenyl (BZ-119)
		9221	2,3,4,4'-Tetrachlorobiphenyl (BZ-60)
		8960	2,3',4,4'-Tetrachlorobiphenyl (BZ-66)
		9223	2,3',4,5,5'-Pentachlorobiphenyl (BZ-120)
		9222	2,3',4',5,5'-Pentachlorobiphenyl (BZ-124)
		9225	2,3,4,5,6-Pentachlorobiphenyl (BZ-116)
		9227	2,3,4',5,6-Pentachlorobiphenyl (BZ-117)
		9226	2,3',4,5',6-Pentachlorobiphenyl (BZ-121)
		9224	2,3',4',5',6-Pentachlorobiphenyl (BZ-125)
		9228	2,3,4,5-Tetrachlorobiphenyl (BZ-61)
		9233	2,3,4',5-Tetrachlorobiphenyl (BZ-63)
		9231	2,3',4,5'-Tetrachlorobiphenyl (BZ-68)
		9230	2,3',4',5-Tetrachlorobiphenyl (BZ-70)
		9229	2,3',4',5'-Tetrachlorobiphenyl (BZ-76)
		9232	2,3',4,5-Tetrachlorobiphenyl (BZ-67)
		9234	2,3,4,6-Tetrachlorobiphenyl (BZ-62)
		9236	2,3,4',6-Tetrachlorobiphenyl (BZ-64)
		9235	2,3',4,6-Tetrachlorobiphenyl (BZ-69)
		9237	2,3',4',6-Tetrachlorobiphenyl (BZ-71)
		9238	2,3,4-Trichlorobiphenyl (BZ-21)
		9241	2,3,4'-Trichlorobiphenyl (BZ-22)
		9240	2,3',4-Trichlorobiphenyl (BZ-25)
		9239	2,3',4'-Trichlorobiphenyl (BZ-33)
		9242	2,3',5,5'-Tetrachlorobiphenyl (BZ-72)
		9243	2,3,5,6-Tetrachlorobiphenyl (BZ-65)
		9244	2,3',5',6-Tetrachlorobiphenyl (BZ-73)
		9245	2,3,5-Trichlorobiphenyl (BZ-23)
		8935	2,3',5-Trichlorobiphenyl (BZ-26)
		9246	2,3',5'-Trichlorobiphenyl (BZ-34)
		9247	2,3,6-Trichlorobiphenyl (BZ-24)
		9248	2,3',6-Trichlorobiphenyl (BZ-27)
		8920	2,3-Dichlorobiphenyl (BZ-5)
		9249	2,3'-Dichlorobiphenyl (BZ-6)
		9250	2,4,4',5-Tetrachlorobiphenyl (BZ-74)
		9251	2,4,4',6-Tetrachlorobiphenyl (BZ-75)
		9252	2,4,4'-Trichlorobiphenyl (BZ-28)
		9253	2,4,5-Trichlorobiphenyl (BZ-29)

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EPA 1668A	8940	2,4',5-Trichlorobiphenyl (BZ-31)
EPA 1668A	9254	2,4,6-Trichlorobiphenyl (BZ-30)
	9255	2,4',6-Trichlorobiphenyl (BZ-32)
	9257	2,4-Dichlorobiphenyl (BZ-7)
	9256	2,4'-Dichlorobiphenyl (BZ-8)
	9258	2,5-Dichlorobiphenyl (BZ-9)
	9259	2,6-Dichlorobiphenyl (BZ-10)
	8915	2-Chlorobiphenyl (BZ-1)
	9060	3,3',4,4',5,5'-Hexachlorobiphenyl (BZ-169)
	9015	3,3',4,4',5-Pentachlorobiphenyl (BZ-126)
	8965	3,3',4,4'-Tetrachlorobiphenyl (BZ-77)
	9260	3,3',4,5,5'-Pentachlorobiphenyl (BZ-127)
	9262	3,3',4,5-Tetrachlorobiphenyl (BZ-78)
	9261	3,3',4,5'-Tetrachlorobiphenyl (BZ-79)
	9263	3,3',4-Trichlorobiphenyl (BZ-35)
	9264	3,3',5,5'-Tetrachlorobiphenyl (BZ-80)
	9265	3,3',5-Trichlorobiphenyl (BZ-36)
	8925	3,3'-Dichlorobiphenyl (BZ-11)
	8970	3,4,4',5-Tetrachlorobiphenyl (BZ-81)
	9266	3,4,4'-Trichlorobiphenyl (BZ-37)
	9267	3,4,5-Trichlorobiphenyl (BZ-38)
	9268	3,4',5-Trichlorobiphenyl (BZ-39)
	9270	3,4-Dichlorobiphenyl (BZ-12)
	9269	3,4'-Dichlorobiphenyl (BZ-13)
	9271	3,5-Dichlorobiphenyl (BZ-14)
	9272	3-Chlorobiphenyl (BZ-2)
	9273	4,4'-Dichlorobiphenyl (BZ-15)
	9274	4-Chlorobiphenyl (BZ-3)
	9105	Decachlorobiphenyl (BZ-209)
	8876	Total Dichlorobiphenyls
	8877	Total Heptachlorobiphenyls
	8888	Total Hexachlorobiphenyls
	8889	Total Monochlorobiphenyls
	8891	Total Nonachlorobiphenyls
	8892	Total Octachlorobiphenyls
	8896	Total Pentachlorobiphenyls
	8893	Total Tetrachlorobiphenyls
	8894	Total Trichlorobiphenyls

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Non-Potable Water	EPA 1668C EPA 1668C		10262109	Chlorinated Biphenyl Cogeners in Water, Soil, Sediment, and Tissue by GC-HRMS
	9095	2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ-206)		
	9090	2,2',3,3',4,4',5,5'-Octachlorobiphenyl (BZ-194)		
	9101	2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl (BZ-207)		
	9103	2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ-195)		
	9102	2,2',3,3',4,4',5,6'-Octachlorobiphenyl (BZ-196)		
	9065	2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ-170)		
	9104	2,2',3,3',4,4',6,6'-Octachlorobiphenyl (BZ-197)		
	9106	2,2',3,3',4,4',6-Heptachlorobiphenyl (BZ-171)		
	9020	2,2',3,3',4,4'-Hexachlorobiphenyl (BZ-128)		
	9107	2,2',3,3',4,5,5',6,6'-Nonachlorobiphenyl (BZ-208)		
	9109	2,2',3,3',4,5,5',6-Octachlorobiphenyl (BZ-198)		
	9108	2,2',3,3',4,5,5',6'-Octachlorobiphenyl (BZ-199)		
	9110	2,2',3,3',4,5,5'-Heptachlorobiphenyl (BZ-172)		
	9111	2,2',3,3',4,5,6,6'-Octachlorobiphenyl (BZ-200)		
	9112	2,2',3,3',4,5',6,6'-Octachlorobiphenyl (BZ-201)		
	9113	2,2',3,3',4,5,6-Heptachlorobiphenyl (BZ-173)		
	9116	2,2',3,3',4,5,6'-Heptachlorobiphenyl (BZ-174)		
	9115	2,2',3,3',4,5',6-Heptachlorobiphenyl (BZ-175)		
	9114	2,2',3,3',4,5',6'-Heptachlorobiphenyl (BZ-177)		
	9118	2,2',3,3',4,5-Hexachlorobiphenyl (BZ-129)		
	9117	2,2',3,3',4,5'-Hexachlorobiphenyl (BZ-130)		
	9119	2,2',3,3',4,6,6'-Heptachlorobiphenyl (BZ-176)		
	9121	2,2',3,3',4,6-Hexachlorobiphenyl (BZ-131)		
	9120	2,2',3,3',4,6'-Hexachlorobiphenyl (BZ-132)		

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EPA 1668C	9122	2,2',3,3',4-Pentachlorobiphenyl (BZ-82)
EPA 1668C	9123	2,2',3,3',5,5',6,6'-Octachlorobiphenyl (BZ-202)
	9124	2,2',3,3',5,5',6-Heptachlorobiphenyl (BZ-178)
	9125	2,2',3,3',5,5'-Hexachlorobiphenyl (BZ-133)
	9126	2,2',3,3',5,6,6'-Heptachlorobiphenyl (BZ-179)
	9128	2,2',3,3',5,6-Hexachlorobiphenyl (BZ-134)
	9127	2,2',3,3',5,6'-Hexachlorobiphenyl (BZ-135)
	9129	2,2',3,3',5-Pentachlorobiphenyl (BZ-83)
	9130	2,2',3,3',6,6'-Hexachlorobiphenyl (BZ-136)
	9131	2,2',3,3',6-Pentachlorobiphenyl (BZ-84)
	9132	2,2',3,3'-Tetrachlorobiphenyl (BZ-40)
	9133	2,2',3,4,4',5,5',6-Octachlorobiphenyl (BZ-203)
	9134	2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ-180)
	9135	2,2',3,4,4',5,6,6'-Octachlorobiphenyl (BZ-204)
	9137	2,2',3,4,4',5,6-Heptachlorobiphenyl (BZ-181)
	9136	2,2',3,4,4',5,6'-Heptachlorobiphenyl (BZ-182)
	9075	2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ-183)
	9138	2,2',3,4,4',5-Hexachlorobiphenyl (BZ-137)
	9025	2,2',3,4,4',5'-Hexachlorobiphenyl (BZ-138)
	9139	2,2',3,4,4',6,6'-Heptachlorobiphenyl (BZ-184)
	9141	2,2',3,4,4',6-Hexachlorobiphenyl (BZ-139)
	9140	2,2',3,4,4',6'-Hexachlorobiphenyl (BZ-140)
	9142	2,2',3,4,4'-Pentachlorobiphenyl (BZ-85)
	9143	2,2',3,4,5,5',6-Heptachlorobiphenyl (BZ-185)
	9080	2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ-187)
	9030	2,2',3,4,5,5'-Hexachlorobiphenyl (BZ-141)
	9144	2,2',3,4',5,5'-Hexachlorobiphenyl (BZ-146)

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EPA 1668C	9145	2,2',3,4,5,6,6'-Heptachlorobiphenyl (BZ-186)
EPA 1668C	9146	2,2',3,4',5,6,6'-Heptachlorobiphenyl (BZ-188)
	9148	2,2',3,4,5,6-Hexachlorobiphenyl (BZ-142)
	9152	2,2',3,4,5,6'-Hexachlorobiphenyl (BZ-143)
	9150	2,2',3,4,5',6-Hexachlorobiphenyl (BZ-144)
	9149	2,2',3,4',5,6-Hexachlorobiphenyl (BZ-147)
	9147	2,2',3,4',5,6'-Hexachlorobiphenyl (BZ-148)
	9151	2,2',3,4',5',6-Hexachlorobiphenyl (BZ-149)
	9153	2,2',3,4,5-Pentachlorobiphenyl (BZ-86)
	8975	2,2',3,4,5'-Pentachlorobiphenyl (BZ-87)
	9155	2,2',3,4',5-Pentachlorobiphenyl (BZ-90)
	9154	2,2',3,4',5'-Pentachlorobiphenyl (BZ-97)
	9156	2,2',3,4,6,6'-Hexachlorobiphenyl (BZ-145)
	9157	2,2',3,4',6,6'-Hexachlorobiphenyl (BZ-150)
	9158	2,2',3,4,6-Pentachlorobiphenyl (BZ-88)
	9161	2,2',3,4,6'-Pentachlorobiphenyl (BZ-89)
	9160	2,2',3,4',6-Pentachlorobiphenyl (BZ-91)
	9159	2,2',3,4',6'-Pentachlorobiphenyl (BZ-98)
	9163	2,2',3,4-Tetrachlorobiphenyl (BZ-41)
	9162	2,2',3,4'-Tetrachlorobiphenyl (BZ-42)
	9035	2,2',3,5,5',6-Hexachlorobiphenyl (BZ-151)
	9164	2,2',3,5,5'-Pentachlorobiphenyl (BZ-92)
	9165	2,2',3,5,6,6'-Hexachlorobiphenyl (BZ-152)
	9168	2,2',3,5,6-Pentachlorobiphenyl (BZ-93)
	9167	2,2',3,5,6'-Pentachlorobiphenyl (BZ-94)
	9166	2,2',3,5',6-Pentachlorobiphenyl (BZ-95)
	9169	2,2',3,5-Tetrachlorobiphenyl (BZ-43)
	8945	2,2',3,5'-Tetrachlorobiphenyl (BZ-44)
	9170	2,2',3,6,6'-Pentachlorobiphenyl (BZ-96)
	9172	2,2',3,6-Tetrachlorobiphenyl (BZ-45)
	9171	2,2',3,6'-Tetrachlorobiphenyl (BZ-46)
	9173	2,2',3-Trichlorobiphenyl (BZ-16)
	9040	2,2',4,4',5,5'-Hexachlorobiphenyl (BZ-153)

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9174	2,2',4,4',5,6'-Hexachlorobiphenyl (BZ-154)
9175	2,2',4,4',5-Pentachlorobiphenyl (BZ-99)
9176	2,2',4,4',6,6'-Hexachlorobiphenyl (BZ-155)
9177	2,2',4,4',6-Pentachlorobiphenyl (BZ-100)
9178	2,2',4,4'-Tetrachlorobiphenyl (BZ-47)
8980	2,2',4,5,5'-Pentachlorobiphenyl (BZ-101)
9180	2,2',4,5,6'-Pentachlorobiphenyl (BZ-102)
9179	2,2',4,5',6-Pentachlorobiphenyl (BZ-103)
9181	2,2',4,5-Tetrachlorobiphenyl (BZ-48)
8950	2,2',4,5'-Tetrachlorobiphenyl (BZ-49)
9182	2,2',4,6,6'-Pentachlorobiphenyl (BZ-104)
9184	2,2',4,6-Tetrachlorobiphenyl (BZ-50)
9183	2,2',4,6'-Tetrachlorobiphenyl (BZ-51)
9185	2,2',4-Trichlorobiphenyl (BZ-17)
8955	2,2',5,5'-Tetrachlorobiphenyl (BZ-52)
9186	2,2',5,6'-Tetrachlorobiphenyl (BZ-53)
8930	2,2',5-Trichlorobiphenyl (BZ-18)
9187	2,2',6,6'-Tetrachlorobiphenyl (BZ-54)
9188	2,2',6-Trichlorobiphenyl (BZ-19)
9189	2,2'-Dichlorobiphenyl (BZ-4)
9190	2,3,3',4,4',5,5',6-Octachlorobiphenyl (BZ-205)
9085	2,3,3',4,4',5,5'-Heptachlorobiphenyl (BZ-189)
9191	2,3,3',4,4',5,6-Heptachlorobiphenyl (BZ-190)
9192	2,3,3',4,4',5',6-Heptachlorobiphenyl (BZ-191)
9050	2,3,3',4,4',5-Hexachlorobiphenyl (BZ-156)
9045	2,3,3',4,4',5'-Hexachlorobiphenyl (BZ-157)
9193	2,3,3',4,4',6-Hexachlorobiphenyl (BZ-158)
8985	2,3,3',4,4'-Pentachlorobiphenyl (BZ-105)
9194	2,3,3',4,5,5',6-Heptachlorobiphenyl (BZ-192)
9195	2,3,3',4',5,5',6-Heptachlorobiphenyl (BZ-193)
9196	2,3,3',4,5,5'-Hexachlorobiphenyl (BZ-159)

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Non-Potable Water	EPA 1668C EPA 1668C	9197	2,3,3',4',5,5'-Hexachlorobiphenyl (BZ-162)
		9198	2,3,3',4,5,6-Hexachlorobiphenyl (BZ-160)
		9199	2,3,3',4',5,6-Hexachlorobiphenyl (BZ-163)
		9201	2,3,3',4',5',6-Hexachlorobiphenyl (BZ-164)
		9200	2,3,3',4,5',6-Hexachlorobiphenyl (BZ-161)
		9204	2,3,3',4,5-Pentachlorobiphenyl (BZ-106)
		9205	2,3,3',4',5-Pentachlorobiphenyl (BZ-107)
		9203	2,3,3',4,5'-Pentachlorobiphenyl (BZ-108)
		9202	2,3,3',4',5'-Pentachlorobiphenyl (BZ-122)
		9206	2,3,3',4,6-Pentachlorobiphenyl (BZ-109)
		8990	2,3,3',4',6-Pentachlorobiphenyl (BZ-110)
		9208	2,3,3',4-Tetrachlorobiphenyl (BZ-55)
		9207	2,3,3',4'-Tetrachlorobiphenyl (BZ-56)
		9209	2,3,3',5,5',6-Hexachlorobiphenyl (BZ-165)
		9210	2,3,3',5,5'-Pentachlorobiphenyl (BZ-111)
		9211	2,3,3',5,6-Pentachlorobiphenyl (BZ-112)
		9212	2,3,3',5',6-Pentachlorobiphenyl (BZ-113)
		9214	2,3,3',5-Tetrachlorobiphenyl (BZ-57)
		9213	2,3,3',5'-Tetrachlorobiphenyl (BZ-58)
		9215	2,3,3',6-Tetrachlorobiphenyl (BZ-59)
		9216	2,3,3'-Trichlorobiphenyl (BZ-20)
		9055	2,3',4,4',5,5'-Hexachlorobiphenyl (BZ-167)
		9217	2,3,4,4',5,6-Hexachlorobiphenyl (BZ-166)
		9218	2,3',4,4',5',6-Hexachlorobiphenyl (BZ-168)
		9005	2,3,4,4',5-Pentachlorobiphenyl (BZ-114)
		8995	2,3',4,4',5-Pentachlorobiphenyl (BZ-118)
		9011	2,3',4,4',5'-Pentachlorobiphenyl (BZ-123)
		9219	2,3,4,4',6-Pentachlorobiphenyl (BZ-115)

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EPA 1668C
EPA 1668C

9220	2,3',4,4',6-Pentachlorobiphenyl (BZ-119)
9221	2,3,4,4'-Tetrachlorobiphenyl (BZ-60)
8960	2,3',4,4'-Tetrachlorobiphenyl (BZ-66)
9223	2,3',4,5,5'-Pentachlorobiphenyl (BZ-120)
9222	2,3',4',5,5'-Pentachlorobiphenyl (BZ-124)
9225	2,3,4,5,6-Pentachlorobiphenyl (BZ-116)
9227	2,3,4',5,6-Pentachlorobiphenyl (BZ-117)
9226	2,3',4,5',6-Pentachlorobiphenyl (BZ-121)
9224	2,3',4',5',6-Pentachlorobiphenyl (BZ-125)
9228	2,3,4,5-Tetrachlorobiphenyl (BZ-61)
9233	2,3,4',5-Tetrachlorobiphenyl (BZ-63)
9231	2,3',4,5'-Tetrachlorobiphenyl (BZ-68)
9230	2,3',4',5-Tetrachlorobiphenyl (BZ-70)
9229	2,3',4',5'-Tetrachlorobiphenyl (BZ-76)
9232	2,3',4,5-Tetrachlorobiphenyl (BZ-67)
9234	2,3,4,6-Tetrachlorobiphenyl (BZ-62)
9236	2,3,4',6-Tetrachlorobiphenyl (BZ-64)
9235	2,3',4,6-Tetrachlorobiphenyl (BZ-69)
9237	2,3',4',6-Tetrachlorobiphenyl (BZ-71)
9238	2,3,4-Trichlorobiphenyl (BZ-21)
9241	2,3,4'-Trichlorobiphenyl (BZ-22)
9240	2,3',4-Trichlorobiphenyl (BZ-25)
9239	2,3',4'-Trichlorobiphenyl (BZ-33)
9242	2,3',5,5'-Tetrachlorobiphenyl (BZ-72)
9243	2,3,5,6-Tetrachlorobiphenyl (BZ-65)
9244	2,3',5',6-Tetrachlorobiphenyl (BZ-73)
9245	2,3,5-Trichlorobiphenyl (BZ-23)
8935	2,3',5-Trichlorobiphenyl (BZ-26)
9246	2,3',5'-Trichlorobiphenyl (BZ-34)
9247	2,3,6-Trichlorobiphenyl (BZ-24)
9248	2,3',6-Trichlorobiphenyl (BZ-27)
8920	2,3-Dichlorobiphenyl (BZ-5)
9249	2,3'-Dichlorobiphenyl (BZ-6)
9250	2,4,4',5-Tetrachlorobiphenyl (BZ-74)
9251	2,4,4',6-Tetrachlorobiphenyl (BZ-75)
9252	2,4,4'-Trichlorobiphenyl (BZ-28)
9253	2,4,5-Trichlorobiphenyl (BZ-29)
8940	2,4',5-Trichlorobiphenyl (BZ-31)
9254	2,4,6-Trichlorobiphenyl (BZ-30)

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EPA 1668C	9255	2,4',6-Trichlorobiphenyl (BZ-32)		
EPA 1668C	9257	2,4-Dichlorobiphenyl (BZ-7)		
	9256	2,4'-Dichlorobiphenyl (BZ-8)		
	9258	2,5-Dichlorobiphenyl (BZ-9)		
	9259	2,6-Dichlorobiphenyl (BZ-10)		
	8915	2-Chlorobiphenyl (BZ-1)		
	9060	3,3',4,4',5,5'-Hexachlorobiphenyl (BZ-169)		
	9015	3,3',4,4',5-Pentachlorobiphenyl (BZ-126)		
	8965	3,3',4,4'-Tetrachlorobiphenyl (BZ-77)		
	9260	3,3',4,5,5'-Pentachlorobiphenyl (BZ-127)		
	9262	3,3',4,5-Tetrachlorobiphenyl (BZ-78)		
	9261	3,3',4,5'-Tetrachlorobiphenyl (BZ-79)		
	9263	3,3',4-Trichlorobiphenyl (BZ-35)		
	9264	3,3',5,5'-Tetrachlorobiphenyl (BZ-80)		
	9265	3,3',5-Trichlorobiphenyl (BZ-36)		
	8925	3,3'-Dichlorobiphenyl (BZ-11)		
	8970	3,4,4',5-Tetrachlorobiphenyl (BZ-81)		
	9266	3,4,4'-Trichlorobiphenyl (BZ-37)		
	9267	3,4,5-Trichlorobiphenyl (BZ-38)		
	9268	3,4',5-Trichlorobiphenyl (BZ-39)		
	9270	3,4-Dichlorobiphenyl (BZ-12)		
	9269	3,4'-Dichlorobiphenyl (BZ-13)		
	9271	3,5-Dichlorobiphenyl (BZ-14)		
	9272	3-Chlorobiphenyl (BZ-2)		
	9273	4,4'-Dichlorobiphenyl (BZ-15)		
	9274	4-Chlorobiphenyl (BZ-3)		
	9105	Decachlorobiphenyl (BZ-209)		
	8876	Total Dichlorobiphenyls		
	8877	Total Heptachlorobiphenyls		
	8888	Total Hexachlorobiphenyls		
	8889	Total Monochlorobiphenyls		
	8891	Total Nonachlorobiphenyls		
	8892	Total Octachlorobiphenyls		
	8896	Total Pentachlorobiphenyls		
	8893	Total Tetrachlorobiphenyls		
	8894	Total Trichlorobiphenyls		
EPA 200.7 4.4			10013806	ICP - metals
	1000	Aluminum		
	1005	Antimony		
	1010	Arsenic		
	1015	Barium		

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EPA 200.7 4.4			
	1020	Beryllium	
	1025	Boron	
	1030	Cadmium	
	1035	Calcium	
	1040	Chromium	
	1050	Cobalt	
	1055	Copper	
	1760	Hardness (calc.)	
	1070	Iron	
	1075	Lead	
	1085	Magnesium	
	1090	Manganese	
	1100	Molybdenum	
	1105	Nickel	
	1125	Potassium	
	1140	Selenium	
	1990	Silica as SiO2	
	1150	Silver	
	1155	Sodium	
	1160	Strontium	
	1165	Thallium	
	1175	Tin	
	1180	Titanium	
	1185	Vanadium	
	1190	Zinc	
EPA 200.8 5.4		10014605	Metals by ICP-MS
	1000	Aluminum	
	1005	Antimony	
	1010	Arsenic	
	1015	Barium	
	1020	Beryllium	
	1030	Cadmium	
	1035	Calcium	
	1040	Chromium	
	1050	Cobalt	
	1055	Copper	
	1070	Iron	
	1075	Lead	
	1080	Lithium	
	1085	Magnesium	
	1090	Manganese	
	1100	Molybdenum	
	1105	Nickel	

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EPA 200.8 5.4	1125	Potassium		
	1140	Selenium		
	1150	Silver		
	1155	Sodium		
	1160	Strontium		
	1165	Thallium		
	1175	Tin		
	1180	Titanium		
	3035	Uranium		
	1185	Vanadium		
	1190	Zinc		
EPA 300.0			10053006	Ion chromatography - anions.
	1540	Bromide		
	1575	Chloride		
	1730	Fluoride		
	1810	Nitrate as N		
	1820	Nitrate-nitrite		
	1835	Nitrite		
	1870	Orthophosphate as P		
	2000	Sulfate		
EPA 3005A			10133207	Acid Digestion of waters for Total Recoverable or Dissolved Metals
	8031	Extraction/Preparation		
EPA 3010A			10133605	Acid Digestion of Aqueous samples and Extracts for Total Metals
	8031	Extraction/Preparation		
EPA 314.0			10055400	Perchlorate in Drinking Water by Ion Chromatography
	1895	Perchlorate		
EPA 3510C			10138202	Separatory Funnel Liquid-liquid extraction
	8031	Extraction/Preparation		
EPA 353.2			10067206	Nitrate/Nitrite Nitrogen - Automated, Cadmium
	1820	Nitrate-nitrite		
	1840	Nitrite as N		
EPA 3535			10139205	Solid-Phase Extraction (SPE)
	8031	Extraction/Preparation		
EPA 3580A			10143007	Waste Dilution
	8031	Extraction/Preparation		
EPA 3620B			10145809	Florisil Cleanup
	8031	Extraction/Preparation		

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EPA 3630C			10146802	Silica gel cleanup
	8031	Extraction/Preparation		
EPA 3640A			10147203	Gel Preparation Cleanup
	8031	Extraction/Preparation		
EPA 3660B			10148400	Sulfur cleanup
	8031	Extraction/Preparation		
EPA 410.4			10077006	Chemical Oxygen Demand - Colorimetric, Automated.
	1565	Chemical oxygen demand		
EPA 5030B			10153409	Purge and trap for aqueous samples
	8031	Extraction/Preparation		
EPA 537 - Modified 1.1			971	Perfluorinated Alkyl Acids in Drinking Water by SPE and LC/MS/MS
	4846	2-(N-Ethyl-perfluorooctane sufonamido) acetic acid (EtFOSAA)		
	4847	2-(N-Methyl-perfluorooctane sulfonamido) acetic acid (MeFOSAA)		
	6457	6:2 Fluorotelomersulfonate (6:2FTS)		
	6461	8:2 Fluorotelomersulfonate (8:2FTS)		
	6911	Perfluorobutane Sulfonate (PFBS)		
	6915	Perfluorobutyric acid (PFBA)		
	9562	Perfluorodecane Sulfonate (PFDS)		
	6905	Perfluorodecanoic acid (PFDA)		
	6903	Perfluorododecanoic (PFDDA)		
	9470	Perfluoroheptanesulfonic acid (PFHpS)		
	6908	Perfluoroheptanoic acid (PFHpA)		
	6901	Perfluorohexadecanoic acid (PFHxDA)		
	6910	Perfluorohexane Sulfonate (PFHS)		
	6913	Perfluorohexanoic acid (PFHXA)		
	6906	Perfluorononanoic acid (PFNA)		
	6916	Perfluorooctadecanoic acid (PFODA)		
	6917	Perfluorooctane Sulfonamide (PFOSA)		
	6912	Perfluorooctanoic acid		
	6909	Perfluorooctanoic Sulfonate (PFOS)		
	6914	Perfluoropentanoic acid (PFPEA)		
	6902	Perfluorotetradecanoic acid (PFTDA)		
	9563	Perfluorotridecanoic (PFTRIA)		
	6904	Perfluoroundecanoic acid (PFUDA)		
EPA 6010B			10155609	ICP - AES
	1000	Aluminum		
	1005	Antimony		
	1010	Arsenic		
	1015	Barium		

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EPA 6010B	1020	Beryllium	
	1025	Boron	
	1030	Cadmium	
	1035	Calcium	
	1040	Chromium	
	1050	Cobalt	
	1055	Copper	
	1070	Iron	
	1075	Lead	
	1085	Magnesium	
	1090	Manganese	
	1100	Molybdenum	
	1105	Nickel	
	1910	Phosphorus, total	
	1125	Potassium	
	1140	Selenium	
	1990	Silica as SiO2	
	1150	Silver	
	1155	Sodium	
	1160	Strontium	
	1165	Thallium	
	1175	Tin	
	1180	Titanium	
	1185	Vanadium	
	1190	Zinc	
EPA 6010C 3		10155905	Inductively Coupled Plasma - Atomic Emission Spectrometry
	1000	Aluminum	
	1005	Antimony	
	1010	Arsenic	
	1015	Barium	
	1020	Beryllium	
	1025	Boron	
	1030	Cadmium	
	1035	Calcium	
	1040	Chromium	
	1050	Cobalt	
	1055	Copper	
	1070	Iron	
	1075	Lead	
	1085	Magnesium	
	1090	Manganese	
	1100	Molybdenum	
	1105	Nickel	

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Non-Potable Water

EPA 6010C 3	1910	Phosphorus, total		
	1125	Potassium		
	1140	Selenium		
	1990	Silica as SiO2		
	1150	Silver		
	1155	Sodium		
	1160	Strontium		
	1165	Thallium		
	1175	Tin		
	1180	Titanium		
	1185	Vanadium		
	1190	Zinc		
EPA 6020			10156000	Inductively Coupled Plasma-Mass Spectrometry
	1000	Aluminum		
	1005	Antimony		
	1010	Arsenic		
	1015	Barium		
	1020	Beryllium		
	1030	Cadmium		
	1035	Calcium		
	1040	Chromium		
	1050	Cobalt		
	1055	Copper		
	1070	Iron		
	1075	Lead		
	1080	Lithium		
	1085	Magnesium		
	1090	Manganese		
	1100	Molybdenum		
	1105	Nickel		
	1910	Phosphorus, total		
	1125	Potassium		
	1140	Selenium		
	1150	Silver		
	1155	Sodium		
	1160	Strontium		
	1165	Thallium		
	1175	Tin		
	1180	Titanium		
	3035	Uranium		
	1185	Vanadium		
	1190	Zinc		

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EPA 6020A 1			10156419	Inductively Coupled Plasma -Mass Spectrometry
	1000	Aluminum		
	1005	Antimony		
	1010	Arsenic		
	1015	Barium		
	1020	Beryllium		
	1030	Cadmium		
	1035	Calcium		
	1040	Chromium		
	1050	Cobalt		
	1055	Copper		
	1070	Iron		
	1075	Lead		
	1080	Lithium		
	1085	Magnesium		
	1090	Manganese		
	1100	Molybdenum		
	1105	Nickel		
	1910	Phosphorus, total		
	1125	Potassium		
	1140	Selenium		
	1150	Silver		
	1155	Sodium		
	1160	Strontium		
	1165	Thallium		
	1175	Tin		
	1180	Titanium		
	3035	Uranium		
	1185	Vanadium		
	1190	Zinc		
EPA 624			10107207	Volatile Organic Compounds by purge and trap GC/MS
	5160	1,1,1-Trichloroethane		
	5110	1,1,2,2-Tetrachloroethane		
	5195	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)		
	5165	1,1,2-Trichloroethane		
	4630	1,1-Dichloroethane		
	4640	1,1-Dichloroethylene		
	4610	1,2-Dichlorobenzene		
	4635	1,2-Dichloroethane (Ethylene dichloride)		
	4655	1,2-Dichloropropane		
	4615	1,3-Dichlorobenzene		

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EPA 624	4620	1,4-Dichlorobenzene		
	4410	2-Butanone (Methyl ethyl ketone, MEK)		
	4500	2-Chloroethyl vinyl ether		
	4860	2-Hexanone (MBK)		
	4995	4-Methyl-2-pentanone (MIBK)		
	4315	Acetone		
	4325	Acrolein (Propenal)		
	4340	Acrylonitrile		
	4375	Benzene		
	4395	Bromodichloromethane		
	4400	Bromoform		
	4450	Carbon disulfide		
	4455	Carbon tetrachloride		
	4475	Chlorobenzene		
	4575	Chlorodibromomethane		
	4485	Chloroethane (Ethyl chloride)		
	4505	Chloroform		
	4645	cis-1,2-Dichloroethylene		
	4680	cis-1,3-Dichloropropene		
	4595	Dibromomethane (Methylene bromide)		
	4625	Dichlorodifluoromethane (Freon-12)		
	4750	Ethanol		
	4765	Ethylbenzene		
	5240	m+p-xylene		
	4950	Methyl bromide (Bromomethane)		
	4960	Methyl chloride (Chloromethane)		
	4975	Methylene chloride (Dichloromethane)		
	5250	o-Xylene		
	5100	Styrene		
	5115	Tetrachloroethylene (Perchloroethylene)		
	5140	Toluene		
	4700	trans-1,2-Dichloroethylene		
	4685	trans-1,3-Dichloropropylene		
	5170	Trichloroethene (Trichloroethylene)		
	5175	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)		
	5225	Vinyl acetate		
	5235	Vinyl chloride		
	5260	Xylene (total)		
EPA 6850			10304606	Perchlorate in Water, Soils and Solid Wastes Using High Performance Liquid Chromatography/Electrospray Ionization/Mass Spectrometry
	1895	Perchlorate		

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EPA 7196A			10162400	Chromium Hexavalent colorimetric
	1045	Chromium VI		
EPA 7470A			10165807	Mercury in Liquid Waste by Cold Vapor Atomic Absorption
	1095	Mercury		
EPA 8015B			10173601	Non-halogenated organics using GC/FID
	9369	Diesel range organics (DRO)		
	9499	Motor Oil		
EPA 8015C			10173805	Non-halogenated organics using GC/FID
	9369	Diesel range organics (DRO)		
	9499	Motor Oil		
EPA 8081A			10178606	Organochlorine Pesticides by GC/ECD
	7355	4,4'-DDD		
	7360	4,4'-DDE		
	7365	4,4'-DDT		
	7025	Aldrin		
	7110	alpha-BHC (alpha-Hexachlorocyclohexane)		
	7240	alpha-Chlordane		
	7115	beta-BHC (beta-Hexachlorocyclohexane)		
	7250	Chlordane (tech.)		
	7260	Chlorobenzilate		
	7105	delta-BHC		
	7405	Diallate		
	7470	Dieldrin		
	7510	Endosulfan I		
	7515	Endosulfan II		
	7520	Endosulfan sulfate		
	7540	Endrin		
	7530	Endrin aldehyde		
	7535	Endrin ketone		
	7120	gamma-BHC (Lindane, gamma-HexachlorocyclohexanE)		
	7245	gamma-Chlordane		
	7685	Heptachlor		
	7690	Heptachlor epoxide		
	7725	Isodrin		
	7810	Methoxychlor		
	8250	Toxaphene (Chlorinated camphene)		
EPA 8081B			10178800	Organochlorine Pesticides by GC/ECD
	7355	4,4'-DDD		

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EPA 8081B	7360	4,4'-DDE		
	7365	4,4'-DDT		
	7025	Aldrin		
	7110	alpha-BHC (alpha-Hexachlorocyclohexane)		
	7240	alpha-Chlordane		
	7115	beta-BHC (beta-Hexachlorocyclohexane)		
	7250	Chlordane (tech.)		
	7260	Chlorobenzilate		
	7105	delta-BHC		
	7405	Diallate		
	7470	Dieldrin		
	7510	Endosulfan I		
	7515	Endosulfan II		
	7520	Endosulfan sulfate		
	7540	Endrin		
	7530	Endrin aldehyde		
	7535	Endrin ketone		
	7120	gamma-BHC (Lindane, gamma-HexachlorocyclohexanE)		
	7245	gamma-Chlordane		
	7685	Heptachlor		
	7690	Heptachlor epoxide		
	7725	Isodrin		
	7810	Methoxychlor		
	8250	Toxaphene (Chlorinated camphene)		
EPA 8082			10179007	Polychlorinated Biphenyls (PCBs) by GC/ECD
	8880	Aroclor-1016 (PCB-1016)		
	8885	Aroclor-1221 (PCB-1221)		
	8890	Aroclor-1232 (PCB-1232)		
	8895	Aroclor-1242 (PCB-1242)		
	8900	Aroclor-1248 (PCB-1248)		
	8905	Aroclor-1254 (PCB-1254)		
	8910	Aroclor-1260 (PCB-1260)		
	8912	Aroclor-1262 (PCB-1262)		
	8913	Aroclor-1268 (PCB-1268)		
EPA 8082A			10179201	Polychlorinated Biphenyls (PCBs) by GC/ECD
	8880	Aroclor-1016 (PCB-1016)		
	8885	Aroclor-1221 (PCB-1221)		
	8890	Aroclor-1232 (PCB-1232)		
	8895	Aroclor-1242 (PCB-1242)		
	8900	Aroclor-1248 (PCB-1248)		

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EPA 8082A	8905	Aroclor-1254 (PCB-1254)	
	8910	Aroclor-1260 (PCB-1260)	
	8912	Aroclor-1262 (PCB-1262)	
	8913	Aroclor-1268 (PCB-1268)	
EPA 8260B			10184802 Volatile Organic Compounds by purge and trap GC/MS
	5105	1,1,1,2-Tetrachloroethane	
	5160	1,1,1-Trichloroethane	
	5110	1,1,2,2-Tetrachloroethane	
	5195	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	
	5165	1,1,2-Trichloroethane	
	4630	1,1-Dichloroethane	
	4640	1,1-Dichloroethylene	
	4670	1,1-Dichloropropene	
	5150	1,2,3-Trichlorobenzene	
	5180	1,2,3-Trichloropropane	
	5155	1,2,4-Trichlorobenzene	
	5210	1,2,4-Trimethylbenzene	
	4585	1,2-Dibromoethane (EDB, Ethylene dibromide)	
	4610	1,2-Dichlorobenzene	
	4635	1,2-Dichloroethane (Ethylene dichloride)	
	4655	1,2-Dichloropropane	
	5215	1,3,5-Trimethylbenzene	
	4615	1,3-Dichlorobenzene	
	4660	1,3-Dichloropropane	
	4620	1,4-Dichlorobenzene	
	4735	1,4-Dioxane (1,4- Diethyleneoxide)	
	4510	1-Chlorohexane	
	4665	2,2-Dichloropropane	
	4410	2-Butanone (Methyl ethyl ketone, MEK)	
	4500	2-Chloroethyl vinyl ether	
	4535	2-Chlorotoluene	
	4860	2-Hexanone (MBK)	
	4540	4-Chlorotoluene	
	4910	4-Isopropyltoluene (p-Cymene)	
	4995	4-Methyl-2-pentanone (MIBK)	
	4315	Acetone	
	4325	Acrolein (Propenal)	
	4340	Acrylonitrile	
	4355	Allyl chloride (3-Chloropropene)	
	4375	Benzene	
	5635	Benzyl chloride	

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Non-Potable Water

EPA 8260B	4385	Bromobenzene
	4390	Bromochloromethane
	4395	Bromodichloromethane
	4400	Bromoform
	4450	Carbon disulfide
	4455	Carbon tetrachloride
	4475	Chlorobenzene
	4575	Chlorodibromomethane
	4485	Chloroethane (Ethyl chloride)
	4505	Chloroform
	4525	Chloroprene (2-Chloro-1,3-butadiene)
	4645	cis-1,2-Dichloroethylene
	4680	cis-1,3-Dichloropropene
	4580	Dibromochloropropane
	4595	Dibromomethane (Methylene bromide)
	4625	Dichlorodifluoromethane (Freon-12)
	9375	Di-isopropylether (DIPE)
	4810	Ethyl methacrylate
	4765	Ethylbenzene
	4770	Ethyl-t-butylether (ETBE) (2-Ethoxy-2-methylpropane)
	9408	Gasoline range organics (GRO)
	4835	Hexachlorobutadiene
	4870	Iodomethane (Methyl iodide)
	4875	Isobutyl alcohol (2-Methyl-1-propanol)
	4900	Isopropylbenzene (Cumene)
	5240	m+p-xylene
	4925	Methacrylonitrile
	4950	Methyl bromide (Bromomethane)
	4960	Methyl chloride (Chloromethane)
	4990	Methyl methacrylate
	5000	Methyl tert-butyl ether (MTBE)
	4975	Methylene chloride (Dichloromethane)
	5005	Naphthalene
	4435	n-Butylbenzene
	4855	n-Hexane
	5090	n-Propylbenzene
	5250	o-Xylene
	5080	Propionitrile (Ethyl cyanide)
	4440	sec-Butylbenzene
	5100	Styrene
	4370	T-amylmethylether (TAME)
	4420	tert-Butyl alcohol
	4445	tert-Butylbenzene

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EPA 8260B	5115	Tetrachloroethylene (Perchloroethylene)	
	5140	Toluene	
	4700	trans-1,2-Dichloroethylene	
	4685	trans-1,3-Dichloropropylene	
	4605	trans-1,4-Dichloro-2-butene	
	5170	Trichloroethene (Trichloroethylene)	
	5175	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	
	5225	Vinyl acetate	
	5235	Vinyl chloride	
	5260	Xylene (total)	
EPA 8260C			10307003 Volatile Organics: GC/MS (capillary column)
	5105	1,1,1,2-Tetrachloroethane	
	5160	1,1,1-Trichloroethane	
	5110	1,1,2,2-Tetrachloroethane	
	5195	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	
	5165	1,1,2-Trichloroethane	
	4630	1,1-Dichloroethane	
	4640	1,1-Dichloroethylene	
	4670	1,1-Dichloropropene	
	5150	1,2,3-Trichlorobenzene	
	5180	1,2,3-Trichloropropane	
	5155	1,2,4-Trichlorobenzene	
	5210	1,2,4-Trimethylbenzene	
	4585	1,2-Dibromoethane (EDB, Ethylene dibromide)	
	4610	1,2-Dichlorobenzene	
	4635	1,2-Dichloroethane (Ethylene dichloride)	
	4655	1,2-Dichloropropane	
	5215	1,3,5-Trimethylbenzene	
	4615	1,3-Dichlorobenzene	
	4660	1,3-Dichloropropane	
	4620	1,4-Dichlorobenzene	
	4735	1,4-Dioxane (1,4- Diethyleneoxide)	
	4510	1-Chlorohexane	
	4665	2,2-Dichloropropane	
	4410	2-Butanone (Methyl ethyl ketone, MEK)	
	4500	2-Chloroethyl vinyl ether	
	4535	2-Chlorotoluene	
	4860	2-Hexanone (MBK)	
	4540	4-Chlorotoluene	
	4910	4-Isopropyltoluene (p-Cymene)	
	4995	4-Methyl-2-pentanone (MIBK)	

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EPA 8260C

4315	Acetone
4325	Acrolein (Propenal)
4340	Acrylonitrile
4355	Allyl chloride (3-Chloropropene)
4375	Benzene
5635	Benzyl chloride
4385	Bromobenzene
4390	Bromochloromethane
4395	Bromodichloromethane
4400	Bromoform
4450	Carbon disulfide
4455	Carbon tetrachloride
4475	Chlorobenzene
4575	Chlorodibromomethane
4485	Chloroethane (Ethyl chloride)
4505	Chloroform
4525	Chloroprene (2-Chloro-1,3-butadiene)
4645	cis-1,2-Dichloroethylene
4680	cis-1,3-Dichloropropene
4580	Dibromochloropropane
4595	Dibromomethane (Methylene bromide)
4625	Dichlorodifluoromethane (Freon-12)
9375	Di-isopropylether (DIPE)
4810	Ethyl methacrylate
4765	Ethylbenzene
4770	Ethyl-t-butylether (ETBE) (2-Ethoxy-2-methylpropane)
9408	Gasoline range organics (GRO)
4835	Hexachlorobutadiene
4870	Iodomethane (Methyl iodide)
4875	Isobutyl alcohol (2-Methyl-1-propanol)
4900	Isopropylbenzene (Cumene)
5240	m+p-xylene
4925	Methacrylonitrile
4950	Methyl bromide (Bromomethane)
4960	Methyl chloride (Chloromethane)
4990	Methyl methacrylate
5000	Methyl tert-butyl ether (MTBE)
4975	Methylene chloride (Dichloromethane)
5005	Naphthalene
4435	n-Butylbenzene
4855	n-Hexane
5090	n-Propylbenzene
5250	o-Xylene

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EPA 8260C	5080	Propionitrile (Ethyl cyanide)	
	4440	sec-Butylbenzene	
	5100	Styrene	
	4370	T-amylmethylether (TAME)	
	4420	tert-Butyl alcohol	
	4445	tert-Butylbenzene	
	5115	Tetrachloroethylene (Perchloroethylene)	
	5140	Toluene	
	4700	trans-1,2-Dichloroethylene	
	4685	trans-1,3-Dichloropropylene	
	4605	trans-1,4-Dichloro-2-butene	
	5170	Trichloroethene (Trichloroethylene)	
	5175	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	
	5225	Vinyl acetate	
	5235	Vinyl chloride	
	5260	Xylene (total)	
EPA 8270C			10185805 Semivolatile Organic compounds by GC/MS
	6703	1,1'-Biphenyl (BZ-0)	
	6715	1,2,4,5-Tetrachlorobenzene	
	5155	1,2,4-Trichlorobenzene	
	4610	1,2-Dichlorobenzene	
	6885	1,3,5-Trinitrobenzene (1,3,5-TNB)	
	4615	1,3-Dichlorobenzene	
	6160	1,3-Dinitrobenzene (1,3-DNB)	
	4620	1,4-Dichlorobenzene	
	6165	1,4-Dinitrobenzene	
	6420	1,4-Naphthoquinone	
	6630	1,4-Phenylenediamine	
	5790	1-Chloronaphthalene	
	6380	1-Methylnaphthalene	
	6425	1-Naphthylamine	
	6735	2,3,4,6-Tetrachlorophenol	
	6740	2,3,5,6-Tetrachlorophenol	
	6835	2,4,5-Trichlorophenol	
	6840	2,4,6-Trichlorophenol	
	6000	2,4-Dichlorophenol	
	6130	2,4-Dimethylphenol	
	6175	2,4-Dinitrophenol	
	6185	2,4-Dinitrotoluene (2,4-DNT)	
	6005	2,6-Dichlorophenol	
	6190	2,6-Dinitrotoluene (2,6-DNT)	
	5515	2-Acetylaminofluorene	

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Non-Potable Water	EPA 8270C	5795	2-Chloronaphthalene
		5800	2-Chlorophenol
		6360	2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)
		5145	2-Methylaniline (o-Toluidine)
		6385	2-Methylnaphthalene
		6400	2-Methylphenol (o-Cresol)
		6430	2-Naphthylamine
		6460	2-Nitroaniline
		6490	2-Nitrophenol
		5050	2-Picoline (2-Methylpyridine)
		5945	3,3'-Dichlorobenzidine
		6120	3,3'-Dimethylbenzidine
		6355	3-Methylcholanthrene
		6405	3-Methylphenol (m-Cresol)
		6465	3-Nitroaniline
		5540	4-Aminobiphenyl
		5660	4-Bromophenyl phenyl ether (BDE-3)
		5700	4-Chloro-3-methylphenol
		5745	4-Chloroaniline
		5825	4-Chlorophenyl phenylether
		6105	4-Dimethyl aminoazobenzene
		6410	4-Methylphenol (p-Cresol)
		6470	4-Nitroaniline
		6500	4-Nitrophenol
		6510	4-Nitroquinoline 1-oxide
		6570	5-Nitro-o-toluidine
		6115	7,12-Dimethylbenz(a) anthracene
		6125	a-a-Dimethylphenethylamine
		5500	Acenaphthene
		5505	Acenaphthylene
		5510	Acetophenone
		5545	Aniline
		5555	Anthracene
		5560	Aramite
		5562	Azobenzene
		5570	Benzaldehyde
		5595	Benzidine
		5575	Benzo(a)anthracene
		5580	Benzo(a)pyrene
		5590	Benzo(g,h,i)perylene
		5600	Benzo(k)fluoranthene
		5585	Benzo[b]fluoranthene
		5610	Benzoic acid

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EPA 8270C

5630	Benzyl alcohol
5760	bis(2-Chloroethoxy)methane
5765	bis(2-Chloroethyl) ether
5780	bis(2-Chloroisopropyl) ether
5670	Butyl benzyl phthalate
5680	Carbazole
7260	Chlorobenzilate
5855	Chrysene
6065	Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate, DEHP)
7405	Diallate
5900	Dibenz(a, j) acridine
5895	Dibenz(a,h) anthracene
5905	Dibenzofuran
6070	Diethyl phthalate
7475	Dimethoate
6135	Dimethyl phthalate
5925	Di-n-butyl phthalate
6200	Di-n-octyl phthalate
8620	Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)
6205	Diphenylamine
8625	Disulfoton
6260	Ethyl methanesulfonate
7580	Famphur
6265	Fluoranthene
6270	Fluorene
6275	Hexachlorobenzene
4835	Hexachlorobutadiene
6285	Hexachlorocyclopentadiene
4840	Hexachloroethane
6295	Hexachloropropene
6315	Indeno(1,2,3-cd) pyrene
7725	Isodrin
6320	Isophorone
6325	Isosafrole
7740	Kepone
6345	Methapyrilene
6375	Methyl methanesulfonate
7825	Methyl parathion (Parathion, methyl)
5005	Naphthalene
5015	Nitrobenzene
6525	n-Nitrosodiethylamine
6530	n-Nitrosodimethylamine

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EPA 8270C	5025	n-Nitroso-di-n-butylamine	
	6545	n-Nitrosodi-n-propylamine	
	6535	n-Nitrosodiphenylamine	
	6550	n-Nitrosomethylethalamine	
	6555	n-Nitrosomorpholine	
	6560	n-Nitrosopiperidine	
	6565	n-Nitrosopyrrolidine	
	8290	o,o,o-Triethyl phosphorothioate	
	7955	Parathion, ethyl	
	6590	Pentachlorobenzene	
	5035	Pentachloroethane	
	6600	Pentachloronitrobenzene	
	6605	Pentachlorophenol	
	6610	Phenacetin	
	6615	Phenanthrene	
	6625	Phenol	
	7985	Phorate	
	6650	Pronamide (Kerb)	
	6665	Pyrene	
	5095	Pyridine	
	6685	Safrole	
	8155	Sulfotepp	
	8235	Thionazin (Zinophos)	
EPA 8270C SIM			10242407 Semivolatile Organic compounds by GC/MS Selective Ion Monitoring
	4735	1,4-Dioxane (1,4- Diethyleneoxide)	
	6380	1-Methylnaphthalene	
	6385	2-Methylnaphthalene	
	5500	Acenaphthene	
	5505	Acenaphthylene	
	5555	Anthracene	
	5575	Benzo(a)anthracene	
	5580	Benzo(a)pyrene	
	5590	Benzo(g,h,i)perylene	
	5600	Benzo(k)fluoranthene	
	5585	Benzo[b]fluoranthene	
	5855	Chrysene	
	5895	Dibenz(a,h) anthracene	
	6265	Fluoranthene	
	6270	Fluorene	
	6315	Indeno(1,2,3-cd) pyrene	
	5005	Naphthalene	
	6615	Phenanthrene	
	6665	Pyrene	

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EPA 8270D — 10186002 — Semivolatile Organic compounds by GC/MS

6703	1,1'-Biphenyl (BZ-0)
6715	1,2,4,5-Tetrachlorobenzene
5155	1,2,4-Trichlorobenzene
4610	1,2-Dichlorobenzene
6885	1,3,5-Trinitrobenzene (1,3,5-TNB)
4615	1,3-Dichlorobenzene
6160	1,3-Dinitrobenzene (1,3-DNB)
4620	1,4-Dichlorobenzene
6165	1,4-Dinitrobenzene
6420	1,4-Naphthoquinone
6630	1,4-Phenylenediamine
5790	1-Chloronaphthalene
6380	1-Methylnaphthalene
6425	1-Naphthylamine
6735	2,3,4,6-Tetrachlorophenol
6740	2,3,5,6-Tetrachlorophenol
6835	2,4,5-Trichlorophenol
6840	2,4,6-Trichlorophenol
6000	2,4-Dichlorophenol
6130	2,4-Dimethylphenol
6175	2,4-Dinitrophenol
6185	2,4-Dinitrotoluene (2,4-DNT)
6005	2,6-Dichlorophenol
6190	2,6-Dinitrotoluene (2,6-DNT)
5515	2-Acetylaminofluorene
5795	2-Chloronaphthalene
5800	2-Chlorophenol
6360	2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)
5145	2-Methylaniline (o-Toluidine)
6385	2-Methylnaphthalene
6400	2-Methylphenol (o-Cresol)
6430	2-Naphthylamine
6460	2-Nitroaniline
6490	2-Nitrophenol
5050	2-Picoline (2-Methylpyridine)
5945	3,3'-Dichlorobenzidine
6120	3,3'-Dimethylbenzidine
6355	3-Methylcholanthrene
6405	3-Methylphenol (m-Cresol)
6465	3-Nitroaniline
5540	4-Aminobiphenyl

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EPA 8270D

5660	4-Bromophenyl phenyl ether (BDE-3)
5700	4-Chloro-3-methylphenol
5745	4-Chloroaniline
5825	4-Chlorophenyl phenylether
6105	4-Dimethyl aminoazobenzene
6410	4-Methylphenol (p-Cresol)
6470	4-Nitroaniline
6500	4-Nitrophenol
6510	4-Nitroquinoline 1-oxide
6570	5-Nitro-o-toluidine
6115	7,12-Dimethylbenz(a) anthracene
6125	a-a-Dimethylphenethylamine
5500	Acenaphthene
5505	Acenaphthylene
5510	Acetophenone
5545	Aniline
5555	Anthracene
5560	Aramite
5562	Azobenzene
5570	Benzaldehyde
5595	Benzidine
5575	Benzo(a)anthracene
5580	Benzo(a)pyrene
5590	Benzo(g,h,i)perylene
5600	Benzo(k)fluoranthene
5585	Benzo[b]fluoranthene
5610	Benzoic acid
5630	Benzyl alcohol
5760	bis(2-Chloroethoxy)methane
5765	bis(2-Chloroethyl) ether
5780	bis(2-Chloroisopropyl) ether
5670	Butyl benzyl phthalate
5680	Carbazole
7260	Chlorobenzilate
5855	Chrysene
6065	Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate, DEHP)
7405	Diallate
5900	Dibenz(a, j) acridine
5895	Dibenz(a,h) anthracene
5905	Dibenzofuran
6070	Diethyl phthalate
7475	Dimethoate
6135	Dimethyl phthalate

Non-Potable Water

EPA 8270D

5925	Di-n-butyl phthalate
6200	Di-n-octyl phthalate
8620	Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)
6205	Diphenylamine
8625	Disulfoton
6260	Ethyl methanesulfonate
7580	Famphur
6265	Fluoranthene
6270	Fluorene
6275	Hexachlorobenzene
4835	Hexachlorobutadiene
6285	Hexachlorocyclopentadiene
4840	Hexachloroethane
6295	Hexachloropropene
6315	Indeno(1,2,3-cd) pyrene
7725	Isodrin
6320	Isophorone
6325	Isosafrole
7740	Kepone
6345	Methapyrilene
6375	Methyl methanesulfonate
7825	Methyl parathion (Parathion, methyl)
5005	Naphthalene
5015	Nitrobenzene
6525	n-Nitrosodiethylamine
6530	n-Nitrosodimethylamine
5025	n-Nitroso-di-n-butylamine
6545	n-Nitrosodi-n-propylamine
6535	n-Nitrosodiphenylamine
6550	n-Nitrosomethylethalamine
6555	n-Nitrosomorpholine
6560	n-Nitrosopiperidine
6565	n-Nitrosopyrrolidine
8290	o,o,o-Triethyl phosphorothioate
7955	Parathion, ethyl
6590	Pentachlorobenzene
5035	Pentachloroethane
6600	Pentachloronitrobenzene
6605	Pentachlorophenol
6610	Phenacetin
6615	Phenanthrene
6625	Phenol
7985	Phorate

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EPA 8270D	6650	Pronamide (Kerb)		
	6665	Pyrene		
	5095	Pyridine		
	6685	Safrole		
	8155	Sulfotepp		
	8235	Thionazin (Zinophos)		
EPA 8270D SIM			10242509	Semivolatile Organic compounds by GC/MS Selective Ion Monitoring
	4735	1,4-Dioxane (1,4- Diethyleneoxide)		
	6380	1-Methylnaphthalene		
	6385	2-Methylnaphthalene		
	5500	Acenaphthene		
	5505	Acenaphthylene		
	5555	Anthracene		
	5575	Benzo(a)anthracene		
	5580	Benzo(a)pyrene		
	5590	Benzo(g,h,i)perylene		
	5600	Benzo(k)fluoranthene		
	5585	Benzo[b]fluoranthene		
	5855	Chrysene		
	5895	Dibenz(a,h) anthracene		
	6265	Fluoranthene		
	6270	Fluorene		
	6315	Indeno(1,2,3-cd) pyrene		
	5005	Naphthalene		
	6615	Phenanthrene		
	6665	Pyrene		
EPA 8280A			10186808	Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofurans by GC/HRMS
	9516	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)		
	9519	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)		
	9420	1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)		
	9426	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)		
	9423	1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)		
	9471	1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-Hxcdf)		
	9453	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd)		
	9474	1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf)		

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EPA 8280A	9456	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,6,7,8-Hxcdd)		
	9477	1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf)		
	9459	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd)		
	9543	1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf)		
	9540	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd)		
	9480	2,3,4,6,7,8-Hexachlorodibenzofuran		
	9549	2,3,4,7,8-Pentachlorodibenzofuran		
	9618	2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD)		
	9612	2,3,7,8-Tetrachlorodibenzofuran		
	9438	Hpcdd, total		
	9444	Hpcdf, total		
	9468	Hxcdd, total		
	9483	Hxcdf, total		
	9555	Pecdd, total		
	9552	Pecdf, total		
	9609	TCDD, total		
	9615	TCDF, total		
EPA 8280B			10187005	Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofurans by GC/HRMS
	9516	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)		
	9519	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)		
	9420	1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)		
	9426	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)		
	9423	1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)		
	9471	1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-Hxcdf)		
	9453	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd)		
	9474	1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf)		
	9456	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,6,7,8-Hxcdd)		
	9477	1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf)		
	9459	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd)		
	9543	1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf)		

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EPA 8280B	9540	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd)		
	9480	2,3,4,6,7,8-Hexachlorodibenzofuran		
	9549	2,3,4,7,8-Pentachlorodibenzofuran		
	9618	2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD)		
	9612	2,3,7,8-Tetrachlorodibenzofuran		
	9438	Hpcdd, total		
	9444	Hpcdf, total		
	9468	Hxcdd, total		
	9483	Hxcdf, total		
	9555	Pecdd, total		
	9552	Pecdf, total		
	9609	TCDD, total		
	9615	TCDF, total		
EPA 8290			10187209	Polychlorinated Dibenzodioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) by GC/HRMS
	9516	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)		
	9519	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)		
	9420	1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)		
	9426	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)		
	9423	1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)		
	9471	1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-Hxcdf)		
	9453	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd)		
	9474	1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf)		
	9456	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,6,7,8-Hxcdd)		
	9477	1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf)		
	9459	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd)		
	9543	1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf)		
	9540	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd)		
	9480	2,3,4,6,7,8-Hexachlorodibenzofuran		
	9549	2,3,4,7,8-Pentachlorodibenzofuran		
	9618	2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD)		
	9612	2,3,7,8-Tetrachlorodibenzofuran		

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EPA 8290	9438	Hpcdd, total		
	9444	Hpcdf, total		
	9468	Hxcdd, total		
	9483	Hxcdf, total		
	9555	Pecdd, total		
	9552	Pecdf, total		
	9609	TCDD, total		
	9615	TCDF, total		
EPA 8290A			10187403	Polychlorinated Dibenzodioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) by GC/HRMS
	9516	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)		
	9519	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)		
	9420	1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)		
	9426	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)		
	9423	1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)		
	9471	1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-Hxcdf)		
	9453	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd)		
	9474	1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf)		
	9456	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,6,7,8-Hxcdd)		
	9477	1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf)		
	9459	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd)		
	9543	1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf)		
	9540	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd)		
	9480	2,3,4,6,7,8-Hexachlorodibenzofuran		
	9549	2,3,4,7,8-Pentachlorodibenzofuran		
	9618	2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD)		
	9612	2,3,7,8-Tetrachlorodibenzofuran		
	9438	Hpcdd, total		
	9444	Hpcdf, total		
	9468	Hxcdd, total		
	9483	Hxcdf, total		
	9555	Pecdd, total		
	9552	Pecdf, total		

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EPA 8290A	9609	TCDD, total		
	9615	TCDF, total		
EPA 8330A			10190008	Nitroaromatics and Nitramines by High Performance Liquid Chromatography (HPLC)
	6885	1,3,5-Trinitrobenzene (1,3,5-TNB)		
	6160	1,3-Dinitrobenzene (1,3-DNB)		
	9651	2,4,6-Trinitrotoluene (2,4,6-TNT)		
	6185	2,4-Dinitrotoluene (2,4-DNT)		
	6190	2,6-Dinitrotoluene (2,6-DNT)		
	9303	2-Amino-4,6-dinitrotoluene (2-am-dnt)		
	9507	2-Nitrotoluene		
	9510	3-Nitrotoluene		
	9306	4-Amino-2,6-dinitrotoluene (4-am-dnt)		
	9513	4-Nitrotoluene		
	9418	Hexahydro-1-nitroso-3,5-dinitro-1,3,5-triazine (MNX)		
	6415	Methyl-2,4,6-trinitrophenylnitramine (tetryl)		
	5015	Nitrobenzene		
	6485	Nitroglycerin		
	9522	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)		
	9558	Pentaerythritoltetranitrate (PETN)		
	9432	RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine)		
EPA 8330B			10308006	Nitroaromatics, Nitramines and Nitrate Esters by High Performance Liquid Chromatography (HPLC)
	6885	1,3,5-Trinitrobenzene (1,3,5-TNB)		
	6160	1,3-Dinitrobenzene (1,3-DNB)		
	9651	2,4,6-Trinitrotoluene (2,4,6-TNT)		
	6185	2,4-Dinitrotoluene (2,4-DNT)		
	6190	2,6-Dinitrotoluene (2,6-DNT)		
	9303	2-Amino-4,6-dinitrotoluene (2-am-dnt)		
	9507	2-Nitrotoluene		
	6150	3,5-Dinitroaniline		
	9510	3-Nitrotoluene		
	9306	4-Amino-2,6-dinitrotoluene (4-am-dnt)		
	9513	4-Nitrotoluene		
	9416	Hexahydro-1,3-dinitroso-5-nitro-1,3,5-triazine (DNX)		
	9418	Hexahydro-1-nitroso-3,5-dinitro-1,3,5-triazine (MNX)		
	6415	Methyl-2,4,6-trinitrophenylnitramine (tetryl)		

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EPA 8330B	5015	Nitrobenzene		
	6485	Nitroglycerin		
	9522	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)		
	9558	Pentaerythritoltetranitrate (PETN)		
	1899	Picric Acid (2,4,6-Trinitrophenol)		
	9432	RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine)		
EPA 9040B			10197203	pH Electrometric Measurement
	1900	pH		
EPA 9040C			10244403	pH Electrometric Measurement
	1900	pH		
EPA 9056			10199005	Determination of Inorganic Anions by Ion Chromatography
	1540	Bromide		
	1575	Chloride		
	1730	Fluoride		
	1805	Nitrate		
	1835	Nitrite		
	1870	Orthophosphate as P		
	2000	Sulfate		
EPA 9056A			10199607	Determination of Inorganic Anions by Ion Chromatography
	1540	Bromide		
	1575	Chloride		
	1730	Fluoride		
	1805	Nitrate		
	1835	Nitrite		
	1870	Orthophosphate as P		
	2000	Sulfate		
SM 2320 B 21st ED			20045403	Alkalinity by Titration Method
	1505	Alkalinity as CaCO3		
SM 2340 B-97 SM 2340 B-97			20046600	Hardness by calculation
	1550	Calcium hardness as CaCO3		
SM 2540 B-97 SM 2540 B-97			20049405	Total Solids Dried at 103 - 105C
	1950	Residue-total		
SM 2540 C-97 SM 2540 C-97			20050402	Total Dissolved Solids Dried at 180C
	1955	Residue-filterable (TDS)		
SM 2540 D-97 SM 2540 D-97			20051201	Total Suspended Solids Dried at 103 - 105C
	1960	Residue-nonfilterable (TSS)		

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SM 4500-H+ B-2000 online			20105219	pH Value by Electrometric Method .
	1900	pH		
WS-LC-0010 3.4			60055154	TestAmerica West Sacramento - Nitroguanidine (EPA 8330)
	6462	2-Nitroguanidine		
WS-LC-0025 1.2			60055427	TestAmerica West Sacramento - Perfluorinated Compounds (PFCs) in Water, Soil, Sediments, and Tissue by LC/MS/MS
	6904	Perfluoroundecanoic acid (PFUDA)		
WS-MS-0010			60055483	Alkylphenol Compounds by GC/MS-SIM Internal Standard Technique
	6514	4-Octylphenol		
	9301	Bisphenol A		
	9529	Nonyl phenol		
	9589	Nonyl phenol diethoxylate		
	9592	Nonyl phenol monoethoxylate		
WS-MS-0011 2014			60055529	TestAmerica West Sacramento - 1,4-Dioxane by GC/MS SIM
	4735	1,4-Dioxane (1,4- Diethyleneoxide)		
WS-MS-0012 2014			60055530	TestAmerica West Sacramento - Nitrosamines by GC/MS/MS with LVI
	6525	n-Nitrosodiethylamine		
	6530	n-Nitrosodimethylamine		
	5025	n-Nitroso-di-n-butylamine		
	6545	n-Nitrosodi-n-propylamine		
	6535	n-Nitrosodiphenylamine		
	6550	n-Nitrosomethylethalamine		
	6555	n-Nitrosomorpholine		
	6520	n-Nitroso-n-methylurea		
	6560	n-Nitrosopiperidine		
	6565	n-Nitrosopyrrolidine		
WS-WC-0050 3.8			60055472	TestAmerica West Sacramento - Nitrocellulose in Aqueous and Soil/Sediment Samples by Colorimetric Autoanalyzer
	6484	Nitrocellulose		

Solids

AK101 GRO-MS			90015159	Determination of Gasoline Range Organics by GC/MS - Alaska Department of Environmental Conservation
	9408	Gasoline range organics (GRO)		
AK102 DRO			90015206	Determination of Diesel Range Organics - Alaska Department of Environmental Conservation
	9369	Diesel range organics (DRO)		

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AK102 DRO-SV			90015228	Determination of Diesel Range Organics Small Volume - Alaska DEC
	9369	Diesel range organics (DRO)		
AK103 RRO			90015400	Determination of Residual Range Organics - Alaska Department of Environmental Conservation
	9499	Motor Oil		
EPA 1311			10118806	Toxicity Characteristic Leaching Procedure
	8031	Extraction/Preparation		
EPA 1312			10119003	Synthetic Precipitation Leaching Procedure
	8031	Extraction/Preparation		
EPA 1613B			10120602	Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope Dilution GC/HRMS
	9516	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)		
	9519	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)		
	9420	1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)		
	9426	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)		
	9423	1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)		
	9471	1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-Hxcdf)		
	9453	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd)		
	9474	1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf)		
	9456	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,6,7,8-Hxcdd)		
	9477	1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf)		
	9459	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd)		
	9543	1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf)		
	9540	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd)		
	9480	2,3,4,6,7,8-Hexachlorodibenzofuran		
	9549	2,3,4,7,8-Pentachlorodibenzofuran		
	9618	2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD)		
	9612	2,3,7,8-Tetrachlorodibenzofuran		
	9438	Hpcdd, total		
	9444	Hpcdf, total		
	9468	Hxcdd, total		

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EPA 1613B	9483	Hxcdf, total	
	9555	Pecdd, total	
	9552	Pecdf, total	
	9609	TCDD, total	
	9615	TCDF, total	
EPA 1668A EPA 1668A			10262029 Chlorinated Biphenyl Cogeners in Water, Soil, Sediment, and Tissue by GC-HRMS
	9095	2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ-206)	
	9090	2,2',3,3',4,4',5,5'-Octachlorobiphenyl (BZ-194)	
	9101	2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl (BZ-207)	
	9103	2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ-195)	
	9102	2,2',3,3',4,4',5,6'-Octachlorobiphenyl (BZ-196)	
	9065	2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ-170)	
	9104	2,2',3,3',4,4',6,6'-Octachlorobiphenyl (BZ-197)	
	9106	2,2',3,3',4,4',6-Heptachlorobiphenyl (BZ-171)	
	9020	2,2',3,3',4,4'-Hexachlorobiphenyl (BZ-128)	
	9107	2,2',3,3',4,5,5',6,6'-Nonachlorobiphenyl (BZ-208)	
	9109	2,2',3,3',4,5,5',6-Octachlorobiphenyl (BZ-198)	
	9108	2,2',3,3',4,5,5',6'-Octachlorobiphenyl (BZ-199)	
	9110	2,2',3,3',4,5,5'-Heptachlorobiphenyl (BZ-172)	
	9111	2,2',3,3',4,5,6,6'-Octachlorobiphenyl (BZ-200)	
	9112	2,2',3,3',4,5',6,6'-Octachlorobiphenyl (BZ-201)	
	9113	2,2',3,3',4,5,6-Heptachlorobiphenyl (BZ-173)	
	9116	2,2',3,3',4,5,6'-Heptachlorobiphenyl (BZ-174)	
	9115	2,2',3,3',4,5',6-Heptachlorobiphenyl (BZ-175)	
	9114	2,2',3,3',4,5',6'-Heptachlorobiphenyl (BZ-177)	
	9118	2,2',3,3',4,5-Hexachlorobiphenyl (BZ-129)	
	9117	2,2',3,3',4,5'-Hexachlorobiphenyl (BZ-130)	

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Solids	EPA 1668A	9119	2,2',3,3',4,6,6'-Heptachlorobiphenyl (BZ-176)
	EPA 1668A	9121	2,2',3,3',4,6-Hexachlorobiphenyl (BZ-131)
		9120	2,2',3,3',4,6'-Hexachlorobiphenyl (BZ-132)
		9122	2,2',3,3',4-Pentachlorobiphenyl (BZ-82)
		9123	2,2',3,3',5,5',6,6'-Octachlorobiphenyl (BZ-202)
		9124	2,2',3,3',5,5',6-Heptachlorobiphenyl (BZ-178)
		9125	2,2',3,3',5,5'-Hexachlorobiphenyl (BZ-133)
		9126	2,2',3,3',5,6,6'-Heptachlorobiphenyl (BZ-179)
		9128	2,2',3,3',5,6-Hexachlorobiphenyl (BZ-134)
		9127	2,2',3,3',5,6'-Hexachlorobiphenyl (BZ-135)
		9129	2,2',3,3',5-Pentachlorobiphenyl (BZ-83)
		9130	2,2',3,3',6,6'-Hexachlorobiphenyl (BZ-136)
		9131	2,2',3,3',6-Pentachlorobiphenyl (BZ-84)
		9132	2,2',3,3'-Tetrachlorobiphenyl (BZ-40)
		9133	2,2',3,4,4',5,5',6-Octachlorobiphenyl (BZ-203)
		9134	2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ-180)
		9135	2,2',3,4,4',5,6,6'-Octachlorobiphenyl (BZ-204)
		9137	2,2',3,4,4',5,6-Heptachlorobiphenyl (BZ-181)
		9136	2,2',3,4,4',5,6'-Heptachlorobiphenyl (BZ-182)
		9075	2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ-183)
		9138	2,2',3,4,4',5-Hexachlorobiphenyl (BZ-137)
		9025	2,2',3,4,4',5'-Hexachlorobiphenyl (BZ-138)
		9139	2,2',3,4,4',6,6'-Heptachlorobiphenyl (BZ-184)
		9141	2,2',3,4,4',6-Hexachlorobiphenyl (BZ-139)
		9140	2,2',3,4,4',6'-Hexachlorobiphenyl (BZ-140)
		9142	2,2',3,4,4'-Pentachlorobiphenyl (BZ-85)
		9143	2,2',3,4,5,5',6-Heptachlorobiphenyl (BZ-185)

Solids

EPA 1668A	9080	2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ-187)
EPA 1668A	9030	2,2',3,4,5,5'-Hexachlorobiphenyl (BZ-141)
	9144	2,2',3,4',5,5'-Hexachlorobiphenyl (BZ-146)
	9145	2,2',3,4,5,6,6'-Heptachlorobiphenyl (BZ-186)
	9146	2,2',3,4',5,6,6'-Heptachlorobiphenyl (BZ-188)
	9148	2,2',3,4,5,6-Hexachlorobiphenyl (BZ-142)
	9152	2,2',3,4,5,6'-Hexachlorobiphenyl (BZ-143)
	9150	2,2',3,4,5',6-Hexachlorobiphenyl (BZ-144)
	9149	2,2',3,4',5,6-Hexachlorobiphenyl (BZ-147)
	9147	2,2',3,4',5,6'-Hexachlorobiphenyl (BZ-148)
	9151	2,2',3,4',5',6-Hexachlorobiphenyl (BZ-149)
	9153	2,2',3,4,5-Pentachlorobiphenyl (BZ-86)
	8975	2,2',3,4,5'-Pentachlorobiphenyl (BZ-87)
	9155	2,2',3,4',5-Pentachlorobiphenyl (BZ-90)
	9154	2,2',3,4',5'-Pentachlorobiphenyl (BZ-97)
	9156	2,2',3,4,6,6'-Hexachlorobiphenyl (BZ-145)
	9157	2,2',3,4',6,6'-Hexachlorobiphenyl (BZ-150)
	9158	2,2',3,4,6-Pentachlorobiphenyl (BZ-88)
	9161	2,2',3,4,6'-Pentachlorobiphenyl (BZ-89)
	9160	2,2',3,4',6-Pentachlorobiphenyl (BZ-91)
	9159	2,2',3,4',6'-Pentachlorobiphenyl (BZ-98)
	9163	2,2',3,4-Tetrachlorobiphenyl (BZ-41)
	9162	2,2',3,4'-Tetrachlorobiphenyl (BZ-42)
	9035	2,2',3,5,5',6-Hexachlorobiphenyl (BZ-151)
	9164	2,2',3,5,5'-Pentachlorobiphenyl (BZ-92)
	9165	2,2',3,5,6,6'-Hexachlorobiphenyl (BZ-152)
	9168	2,2',3,5,6-Pentachlorobiphenyl (BZ-93)
	9167	2,2',3,5,6'-Pentachlorobiphenyl (BZ-94)
	9166	2,2',3,5',6-Pentachlorobiphenyl (BZ-95)
	9169	2,2',3,5-Tetrachlorobiphenyl (BZ-43)
	8945	2,2',3,5'-Tetrachlorobiphenyl (BZ-44)
	9170	2,2',3,6,6'-Pentachlorobiphenyl (BZ-96)

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EPA 1668A	9172	2,2',3,6-Tetrachlorobiphenyl (BZ-45)
EPA 1668A	9171	2,2',3,6'-Tetrachlorobiphenyl (BZ-46)
	9173	2,2',3-Trichlorobiphenyl (BZ-16)
	9040	2,2',4,4',5,5'-Hexachlorobiphenyl (BZ-153)
	9174	2,2',4,4',5,6'-Hexachlorobiphenyl (BZ-154)
	9175	2,2',4,4',5-Pentachlorobiphenyl (BZ-99)
	9176	2,2',4,4',6,6'-Hexachlorobiphenyl (BZ-155)
	9177	2,2',4,4',6-Pentachlorobiphenyl (BZ-100)
	9178	2,2',4,4'-Tetrachlorobiphenyl (BZ-47)
	8980	2,2',4,5,5'-Pentachlorobiphenyl (BZ-101)
	9180	2,2',4,5,6'-Pentachlorobiphenyl (BZ-102)
	9179	2,2',4,5',6-Pentachlorobiphenyl (BZ-103)
	9181	2,2',4,5-Tetrachlorobiphenyl (BZ-48)
	8950	2,2',4,5'-Tetrachlorobiphenyl (BZ-49)
	9182	2,2',4,6,6'-Pentachlorobiphenyl (BZ-104)
	9184	2,2',4,6-Tetrachlorobiphenyl (BZ-50)
	9183	2,2',4,6'-Tetrachlorobiphenyl (BZ-51)
	9185	2,2',4-Trichlorobiphenyl (BZ-17)
	8955	2,2',5,5'-Tetrachlorobiphenyl (BZ-52)
	9186	2,2',5,6'-Tetrachlorobiphenyl (BZ-53)
	8930	2,2',5-Trichlorobiphenyl (BZ-18)
	9187	2,2',6,6'-Tetrachlorobiphenyl (BZ-54)
	9188	2,2',6-Trichlorobiphenyl (BZ-19)
	9189	2,2'-Dichlorobiphenyl (BZ-4)
	9190	2,3,3',4,4',5,5',6-Octachlorobiphenyl (BZ-205)
	9085	2,3,3',4,4',5,5'-Heptachlorobiphenyl (BZ-189)
	9191	2,3,3',4,4',5,6-Heptachlorobiphenyl (BZ-190)
	9192	2,3,3',4,4',5',6-Heptachlorobiphenyl (BZ-191)
	9050	2,3,3',4,4',5-Hexachlorobiphenyl (BZ-156)
	9045	2,3,3',4,4',5'-Hexachlorobiphenyl (BZ-157)
	9193	2,3,3',4,4',6-Hexachlorobiphenyl (BZ-158)
	8985	2,3,3',4,4'-Pentachlorobiphenyl (BZ-105)

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Solids	EPA 1668A	9194	2,3,3',4,5,5',6-Heptachlorobiphenyl (BZ-192)
	EPA 1668A	9195	2,3,3',4',5,5',6-Heptachlorobiphenyl (BZ-193)
		9196	2,3,3',4,5,5'-Hexachlorobiphenyl (BZ-159)
		9197	2,3,3',4',5,5'-Hexachlorobiphenyl (BZ-162)
		9198	2,3,3',4,5,6-Hexachlorobiphenyl (BZ-160)
		9199	2,3,3',4',5,6-Hexachlorobiphenyl (BZ-163)
		9201	2,3,3',4',5',6-Hexachlorobiphenyl (BZ-164)
		9200	2,3,3',4,5',6-Hexachlorobiphenyl (BZ-161)
		9204	2,3,3',4,5-Pentachlorobiphenyl (BZ-106)
		9205	2,3,3',4',5-Pentachlorobiphenyl (BZ-107)
		9203	2,3,3',4,5'-Pentachlorobiphenyl (BZ-108)
		9202	2,3,3',4',5'-Pentachlorobiphenyl (BZ-122)
		9206	2,3,3',4,6-Pentachlorobiphenyl (BZ-109)
		8990	2,3,3',4',6-Pentachlorobiphenyl (BZ-110)
		9208	2,3,3',4-Tetrachlorobiphenyl (BZ-55)
		9207	2,3,3',4'-Tetrachlorobiphenyl (BZ-56)
		9209	2,3,3',5,5',6-Hexachlorobiphenyl (BZ-165)
		9210	2,3,3',5,5'-Pentachlorobiphenyl (BZ-111)
		9211	2,3,3',5,6-Pentachlorobiphenyl (BZ-112)
		9212	2,3,3',5',6-Pentachlorobiphenyl (BZ-113)
		9214	2,3,3',5-Tetrachlorobiphenyl (BZ-57)
		9213	2,3,3',5'-Tetrachlorobiphenyl (BZ-58)
		9215	2,3,3',6-Tetrachlorobiphenyl (BZ-59)
		9216	2,3,3'-Trichlorobiphenyl (BZ-20)
		9055	2,3',4,4',5,5'-Hexachlorobiphenyl (BZ-167)
		9217	2,3,4,4',5,6-Hexachlorobiphenyl (BZ-166)
		9218	2,3',4,4',5',6-Hexachlorobiphenyl (BZ-168)
		9005	2,3,4,4',5-Pentachlorobiphenyl (BZ-114)

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Solids	EPA 1668A	8995	2,3',4,4',5-Pentachlorobiphenyl (BZ-118)
	EPA 1668A	9011	2,3',4,4',5'-Pentachlorobiphenyl (BZ-123)
		9219	2,3,4,4',6-Pentachlorobiphenyl (BZ-115)
		9220	2,3',4,4',6-Pentachlorobiphenyl (BZ-119)
		9221	2,3,4,4'-Tetrachlorobiphenyl (BZ-60)
		8960	2,3',4,4'-Tetrachlorobiphenyl (BZ-66)
		9223	2,3',4,5,5'-Pentachlorobiphenyl (BZ-120)
		9222	2,3',4',5,5'-Pentachlorobiphenyl (BZ-124)
		9225	2,3,4,5,6-Pentachlorobiphenyl (BZ-116)
		9227	2,3,4',5,6-Pentachlorobiphenyl (BZ-117)
		9226	2,3',4,5',6-Pentachlorobiphenyl (BZ-121)
		9224	2,3',4',5',6-Pentachlorobiphenyl (BZ-125)
		9228	2,3,4,5-Tetrachlorobiphenyl (BZ-61)
		9233	2,3,4',5-Tetrachlorobiphenyl (BZ-63)
		9231	2,3',4,5'-Tetrachlorobiphenyl (BZ-68)
		9230	2,3',4',5-Tetrachlorobiphenyl (BZ-70)
		9229	2,3',4',5'-Tetrachlorobiphenyl (BZ-76)
		9232	2,3',4,5-Tetrachlorobiphenyl (BZ-67)
		9234	2,3,4,6-Tetrachlorobiphenyl (BZ-62)
		9236	2,3,4',6-Tetrachlorobiphenyl (BZ-64)
		9235	2,3',4,6-Tetrachlorobiphenyl (BZ-69)
		9237	2,3',4',6-Tetrachlorobiphenyl (BZ-71)
		9238	2,3,4-Trichlorobiphenyl (BZ-21)
		9241	2,3,4'-Trichlorobiphenyl (BZ-22)
		9240	2,3',4-Trichlorobiphenyl (BZ-25)
		9239	2,3',4'-Trichlorobiphenyl (BZ-33)
		9242	2,3',5,5'-Tetrachlorobiphenyl (BZ-72)
		9243	2,3,5,6-Tetrachlorobiphenyl (BZ-65)
		9244	2,3',5',6-Tetrachlorobiphenyl (BZ-73)
		9245	2,3,5-Trichlorobiphenyl (BZ-23)
		8935	2,3',5-Trichlorobiphenyl (BZ-26)
		9246	2,3',5'-Trichlorobiphenyl (BZ-34)
		9247	2,3,6-Trichlorobiphenyl (BZ-24)
		9248	2,3',6-Trichlorobiphenyl (BZ-27)
		8920	2,3-Dichlorobiphenyl (BZ-5)
		9249	2,3'-Dichlorobiphenyl (BZ-6)

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EPA 1668A	9250	2,4,4',5-Tetrachlorobiphenyl (BZ-74)
EPA 1668A	9251	2,4,4',6-Tetrachlorobiphenyl (BZ-75)
	9252	2,4,4'-Trichlorobiphenyl (BZ-28)
	9253	2,4,5-Trichlorobiphenyl (BZ-29)
	8940	2,4',5-Trichlorobiphenyl (BZ-31)
	9254	2,4,6-Trichlorobiphenyl (BZ-30)
	9255	2,4',6-Trichlorobiphenyl (BZ-32)
	9257	2,4-Dichlorobiphenyl (BZ-7)
	9256	2,4'-Dichlorobiphenyl (BZ-8)
	9258	2,5-Dichlorobiphenyl (BZ-9)
	9259	2,6-Dichlorobiphenyl (BZ-10)
	8915	2-Chlorobiphenyl (BZ-1)
	9060	3,3',4,4',5,5'-Hexachlorobiphenyl (BZ-169)
	9015	3,3',4,4',5-Pentachlorobiphenyl (BZ-126)
	8965	3,3',4,4'-Tetrachlorobiphenyl (BZ-77)
	9260	3,3',4,5,5'-Pentachlorobiphenyl (BZ-127)
	9262	3,3',4,5-Tetrachlorobiphenyl (BZ-78)
	9261	3,3',4,5'-Tetrachlorobiphenyl (BZ-79)
	9263	3,3',4-Trichlorobiphenyl (BZ-35)
	9264	3,3',5,5'-Tetrachlorobiphenyl (BZ-80)
	9265	3,3',5-Trichlorobiphenyl (BZ-36)
	8925	3,3'-Dichlorobiphenyl (BZ-11)
	8970	3,4,4',5-Tetrachlorobiphenyl (BZ-81)
	9266	3,4,4'-Trichlorobiphenyl (BZ-37)
	9267	3,4,5-Trichlorobiphenyl (BZ-38)
	9268	3,4',5-Trichlorobiphenyl (BZ-39)
	9270	3,4-Dichlorobiphenyl (BZ-12)
	9269	3,4'-Dichlorobiphenyl (BZ-13)
	9271	3,5-Dichlorobiphenyl (BZ-14)
	9272	3-Chlorobiphenyl (BZ-2)
	9273	4,4'-Dichlorobiphenyl (BZ-15)
	9274	4-Chlorobiphenyl (BZ-3)
	9105	Decachlorobiphenyl (BZ-209)
	8876	Total Dichlorobiphenyls
	8877	Total Heptachlorobiphenyls
	8888	Total Hexachlorobiphenyls
	8889	Total Monochlorobiphenyls
	8891	Total Nonachlorobiphenyls
	8892	Total Octachlorobiphenyls
	8896	Total Pentachlorobiphenyls
	8893	Total Tetrachlorobiphenyls

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EPA 1668A EPA 1668A	8894	Total Trichlorobiphenyls		
EPA 1668C EPA 1668C			10262109	Chlorinated Biphenyl Cogeners in Water, Soil, Sediment, and Tissue by GC-HRMS
	9095	2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ-206)		
	9090	2,2',3,3',4,4',5,5'-Octachlorobiphenyl (BZ-194)		
	9101	2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl (BZ-207)		
	9103	2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ-195)		
	9102	2,2',3,3',4,4',5,6'-Octachlorobiphenyl (BZ-196)		
	9065	2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ-170)		
	9104	2,2',3,3',4,4',6,6'-Octachlorobiphenyl (BZ-197)		
	9106	2,2',3,3',4,4',6-Heptachlorobiphenyl (BZ-171)		
	9020	2,2',3,3',4,4'-Hexachlorobiphenyl (BZ-128)		
	9107	2,2',3,3',4,5,5',6,6'-Nonachlorobiphenyl (BZ-208)		
	9109	2,2',3,3',4,5,5',6-Octachlorobiphenyl (BZ-198)		
	9108	2,2',3,3',4,5,5',6'-Octachlorobiphenyl (BZ-199)		
	9110	2,2',3,3',4,5,5'-Heptachlorobiphenyl (BZ-172)		
	9111	2,2',3,3',4,5,6,6'-Octachlorobiphenyl (BZ-200)		
	9112	2,2',3,3',4,5',6,6'-Octachlorobiphenyl (BZ-201)		
	9113	2,2',3,3',4,5,6-Heptachlorobiphenyl (BZ-173)		
	9116	2,2',3,3',4,5,6'-Heptachlorobiphenyl (BZ-174)		
	9115	2,2',3,3',4,5',6-Heptachlorobiphenyl (BZ-175)		
	9114	2,2',3,3',4,5',6'-Heptachlorobiphenyl (BZ-177)		
	9118	2,2',3,3',4,5-Hexachlorobiphenyl (BZ-129)		
	9117	2,2',3,3',4,5'-Hexachlorobiphenyl (BZ-130)		
	9119	2,2',3,3',4,6,6'-Heptachlorobiphenyl (BZ-176)		
	9121	2,2',3,3',4,6-Hexachlorobiphenyl (BZ-131)		

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Solids	EPA 1668C	9120	2,2',3,3',4,6'-Hexachlorobiphenyl (BZ-132)
	EPA 1668C	9122	2,2',3,3',4-Pentachlorobiphenyl (BZ-82)
		9123	2,2',3,3',5,5',6,6'-Octachlorobiphenyl (BZ-202)
		9124	2,2',3,3',5,5',6-Heptachlorobiphenyl (BZ-178)
		9125	2,2',3,3',5,5'-Hexachlorobiphenyl (BZ-133)
		9126	2,2',3,3',5,6,6'-Heptachlorobiphenyl (BZ-179)
		9128	2,2',3,3',5,6-Hexachlorobiphenyl (BZ-134)
		9127	2,2',3,3',5,6'-Hexachlorobiphenyl (BZ-135)
		9129	2,2',3,3',5-Pentachlorobiphenyl (BZ-83)
		9130	2,2',3,3',6,6'-Hexachlorobiphenyl (BZ-136)
		9131	2,2',3,3',6-Pentachlorobiphenyl (BZ-84)
		9132	2,2',3,3'-Tetrachlorobiphenyl (BZ-40)
		9133	2,2',3,4,4',5,5',6-Octachlorobiphenyl (BZ-203)
		9134	2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ-180)
		9135	2,2',3,4,4',5,6,6'-Octachlorobiphenyl (BZ-204)
		9137	2,2',3,4,4',5,6-Heptachlorobiphenyl (BZ-181)
		9136	2,2',3,4,4',5,6'-Heptachlorobiphenyl (BZ-182)
		9075	2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ-183)
		9138	2,2',3,4,4',5-Hexachlorobiphenyl (BZ-137)
		9025	2,2',3,4,4',5'-Hexachlorobiphenyl (BZ-138)
		9139	2,2',3,4,4',6,6'-Heptachlorobiphenyl (BZ-184)
		9141	2,2',3,4,4',6-Hexachlorobiphenyl (BZ-139)
		9140	2,2',3,4,4',6'-Hexachlorobiphenyl (BZ-140)
		9142	2,2',3,4,4'-Pentachlorobiphenyl (BZ-85)
		9143	2,2',3,4,5,5',6-Heptachlorobiphenyl (BZ-185)
		9080	2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ-187)
		9030	2,2',3,4,5,5'-Hexachlorobiphenyl (BZ-141)

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Solids	EPA 1668C	9144	2,2',3,4',5,5'-Hexachlorobiphenyl (BZ-146)
	EPA 1668C	9145	2,2',3,4,5,6,6'-Heptachlorobiphenyl (BZ-186)
		9146	2,2',3,4',5,6,6'-Heptachlorobiphenyl (BZ-188)
		9148	2,2',3,4,5,6-Hexachlorobiphenyl (BZ-142)
		9152	2,2',3,4,5,6'-Hexachlorobiphenyl (BZ-143)
		9150	2,2',3,4,5',6-Hexachlorobiphenyl (BZ-144)
		9149	2,2',3,4',5,6-Hexachlorobiphenyl (BZ-147)
		9147	2,2',3,4',5,6'-Hexachlorobiphenyl (BZ-148)
		9151	2,2',3,4',5',6-Hexachlorobiphenyl (BZ-149)
		9153	2,2',3,4,5-Pentachlorobiphenyl (BZ-86)
		8975	2,2',3,4,5'-Pentachlorobiphenyl (BZ-87)
		9155	2,2',3,4',5-Pentachlorobiphenyl (BZ-90)
		9154	2,2',3,4',5'-Pentachlorobiphenyl (BZ-97)
		9156	2,2',3,4,6,6'-Hexachlorobiphenyl (BZ-145)
		9157	2,2',3,4',6,6'-Hexachlorobiphenyl (BZ-150)
		9158	2,2',3,4,6-Pentachlorobiphenyl (BZ-88)
		9161	2,2',3,4,6'-Pentachlorobiphenyl (BZ-89)
		9160	2,2',3,4',6-Pentachlorobiphenyl (BZ-91)
		9159	2,2',3,4',6'-Pentachlorobiphenyl (BZ-98)
		9163	2,2',3,4-Tetrachlorobiphenyl (BZ-41)
		9162	2,2',3,4'-Tetrachlorobiphenyl (BZ-42)
		9035	2,2',3,5,5',6-Hexachlorobiphenyl (BZ-151)
		9164	2,2',3,5,5'-Pentachlorobiphenyl (BZ-92)
		9165	2,2',3,5,6,6'-Hexachlorobiphenyl (BZ-152)
		9168	2,2',3,5,6-Pentachlorobiphenyl (BZ-93)
		9167	2,2',3,5,6'-Pentachlorobiphenyl (BZ-94)
		9166	2,2',3,5',6-Pentachlorobiphenyl (BZ-95)
		9169	2,2',3,5-Tetrachlorobiphenyl (BZ-43)
		8945	2,2',3,5'-Tetrachlorobiphenyl (BZ-44)
		9170	2,2',3,6,6'-Pentachlorobiphenyl (BZ-96)
		9172	2,2',3,6-Tetrachlorobiphenyl (BZ-45)
		9171	2,2',3,6'-Tetrachlorobiphenyl (BZ-46)
		9173	2,2',3-Trichlorobiphenyl (BZ-16)

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	EPA 1668C	9174	2,2',4,4',5,6'-Hexachlorobiphenyl (BZ-154)
		9175	2,2',4,4',5-Pentachlorobiphenyl (BZ-99)
		9176	2,2',4,4',6,6'-Hexachlorobiphenyl (BZ-155)
		9177	2,2',4,4',6-Pentachlorobiphenyl (BZ-100)
		9178	2,2',4,4'-Tetrachlorobiphenyl (BZ-47)
		8980	2,2',4,5,5'-Pentachlorobiphenyl (BZ-101)
		9180	2,2',4,5,6'-Pentachlorobiphenyl (BZ-102)
		9179	2,2',4,5',6-Pentachlorobiphenyl (BZ-103)
		9181	2,2',4,5-Tetrachlorobiphenyl (BZ-48)
		8950	2,2',4,5'-Tetrachlorobiphenyl (BZ-49)
		9182	2,2',4,6,6'-Pentachlorobiphenyl (BZ-104)
		9184	2,2',4,6-Tetrachlorobiphenyl (BZ-50)
		9183	2,2',4,6'-Tetrachlorobiphenyl (BZ-51)
		9185	2,2',4-Trichlorobiphenyl (BZ-17)
		8955	2,2',5,5'-Tetrachlorobiphenyl (BZ-52)
		9186	2,2',5,6'-Tetrachlorobiphenyl (BZ-53)
		8930	2,2',5-Trichlorobiphenyl (BZ-18)
		9187	2,2',6,6'-Tetrachlorobiphenyl (BZ-54)
		9188	2,2',6-Trichlorobiphenyl (BZ-19)
		9189	2,2'-Dichlorobiphenyl (BZ-4)
		9190	2,3,3',4,4',5,5',6-Octachlorobiphenyl (BZ-205)
		9085	2,3,3',4,4',5,5'-Heptachlorobiphenyl (BZ-189)
		9191	2,3,3',4,4',5,6-Heptachlorobiphenyl (BZ-190)
		9192	2,3,3',4,4',5',6-Heptachlorobiphenyl (BZ-191)
		9050	2,3,3',4,4',5-Hexachlorobiphenyl (BZ-156)
		9045	2,3,3',4,4',5'-Hexachlorobiphenyl (BZ-157)
		9193	2,3,3',4,4',6-Hexachlorobiphenyl (BZ-158)
		8985	2,3,3',4,4'-Pentachlorobiphenyl (BZ-105)
		9194	2,3,3',4,5,5',6-Heptachlorobiphenyl (BZ-192)
		9195	2,3,3',4',5,5',6-Heptachlorobiphenyl (BZ-193)

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Solids	EPA 1668C	9196	2,3,3',4,5,5'-Hexachlorobiphenyl (BZ-159)
	EPA 1668C	9197	2,3,3',4',5,5'-Hexachlorobiphenyl (BZ-162)
		9198	2,3,3',4,5,6-Hexachlorobiphenyl (BZ-160)
		9199	2,3,3',4',5,6-Hexachlorobiphenyl (BZ-163)
		9201	2,3,3',4',5',6-Hexachlorobiphenyl (BZ-164)
		9200	2,3,3',4,5',6-Hexachlorobiphenyl (BZ-161)
		9204	2,3,3',4,5-Pentachlorobiphenyl (BZ-106)
		9205	2,3,3',4',5-Pentachlorobiphenyl (BZ-107)
		9203	2,3,3',4,5'-Pentachlorobiphenyl (BZ-108)
		9202	2,3,3',4',5'-Pentachlorobiphenyl (BZ-122)
		9206	2,3,3',4,6-Pentachlorobiphenyl (BZ-109)
		8990	2,3,3',4',6-Pentachlorobiphenyl (BZ-110)
		9208	2,3,3',4-Tetrachlorobiphenyl (BZ-55)
		9207	2,3,3',4'-Tetrachlorobiphenyl (BZ-56)
		9209	2,3,3',5,5',6-Hexachlorobiphenyl (BZ-165)
		9210	2,3,3',5,5'-Pentachlorobiphenyl (BZ-111)
		9211	2,3,3',5,6-Pentachlorobiphenyl (BZ-112)
		9212	2,3,3',5',6-Pentachlorobiphenyl (BZ-113)
		9214	2,3,3',5-Tetrachlorobiphenyl (BZ-57)
		9213	2,3,3',5'-Tetrachlorobiphenyl (BZ-58)
		9215	2,3,3',6-Tetrachlorobiphenyl (BZ-59)
		9216	2,3,3'-Trichlorobiphenyl (BZ-20)
		9055	2,3',4,4',5,5'-Hexachlorobiphenyl (BZ-167)
		9217	2,3,4,4',5,6-Hexachlorobiphenyl (BZ-166)
		9218	2,3',4,4',5',6-Hexachlorobiphenyl (BZ-168)
		9005	2,3,4,4',5-Pentachlorobiphenyl (BZ-114)
		8995	2,3',4,4',5-Pentachlorobiphenyl (BZ-118)
		9011	2,3',4,4',5'-Pentachlorobiphenyl (BZ-123)

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EPA 1668C	9219	2,3,4,4',6-Pentachlorobiphenyl (BZ-115)
EPA 1668C	9220	2,3',4,4',6-Pentachlorobiphenyl (BZ-119)
	9221	2,3,4,4'-Tetrachlorobiphenyl (BZ-60)
	8960	2,3',4,4'-Tetrachlorobiphenyl (BZ-66)
	9223	2,3',4,5,5'-Pentachlorobiphenyl (BZ-120)
	9222	2,3',4',5,5'-Pentachlorobiphenyl (BZ-124)
	9225	2,3,4,5,6-Pentachlorobiphenyl (BZ-116)
	9227	2,3,4',5,6-Pentachlorobiphenyl (BZ-117)
	9226	2,3',4,5',6-Pentachlorobiphenyl (BZ-121)
	9224	2,3',4',5',6-Pentachlorobiphenyl (BZ-125)
	9228	2,3,4,5-Tetrachlorobiphenyl (BZ-61)
	9233	2,3,4',5-Tetrachlorobiphenyl (BZ-63)
	9231	2,3',4,5'-Tetrachlorobiphenyl (BZ-68)
	9230	2,3',4',5-Tetrachlorobiphenyl (BZ-70)
	9229	2,3',4',5'-Tetrachlorobiphenyl (BZ-76)
	9232	2,3',4,5-Tetrachlorobiphenyl (BZ-67)
	9234	2,3,4,6-Tetrachlorobiphenyl (BZ-62)
	9236	2,3,4',6-Tetrachlorobiphenyl (BZ-64)
	9235	2,3',4,6-Tetrachlorobiphenyl (BZ-69)
	9237	2,3',4',6-Tetrachlorobiphenyl (BZ-71)
	9238	2,3,4-Trichlorobiphenyl (BZ-21)
	9241	2,3,4'-Trichlorobiphenyl (BZ-22)
	9240	2,3',4-Trichlorobiphenyl (BZ-25)
	9239	2,3',4'-Trichlorobiphenyl (BZ-33)
	9242	2,3',5,5'-Tetrachlorobiphenyl (BZ-72)
	9243	2,3,5,6-Tetrachlorobiphenyl (BZ-65)
	9244	2,3',5',6-Tetrachlorobiphenyl (BZ-73)
	9245	2,3,5-Trichlorobiphenyl (BZ-23)
	8935	2,3',5-Trichlorobiphenyl (BZ-26)
	9246	2,3',5'-Trichlorobiphenyl (BZ-34)
	9247	2,3,6-Trichlorobiphenyl (BZ-24)
	9248	2,3',6-Trichlorobiphenyl (BZ-27)
	8920	2,3-Dichlorobiphenyl (BZ-5)
	9249	2,3'-Dichlorobiphenyl (BZ-6)
	9250	2,4,4',5-Tetrachlorobiphenyl (BZ-74)
	9251	2,4,4',6-Tetrachlorobiphenyl (BZ-75)
	9252	2,4,4'-Trichlorobiphenyl (BZ-28)
	9253	2,4,5-Trichlorobiphenyl (BZ-29)

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Solids	EPA 1668C	8940	2,4',5-Trichlorobiphenyl (BZ-31)		
	EPA 1668C	9254	2,4,6-Trichlorobiphenyl (BZ-30)		
		9255	2,4',6-Trichlorobiphenyl (BZ-32)		
		9257	2,4-Dichlorobiphenyl (BZ-7)		
		9256	2,4'-Dichlorobiphenyl (BZ-8)		
		9258	2,5-Dichlorobiphenyl (BZ-9)		
		9259	2,6-Dichlorobiphenyl (BZ-10)		
		8915	2-Chlorobiphenyl (BZ-1)		
		9060	3,3',4,4',5,5'-Hexachlorobiphenyl (BZ-169)		
		9015	3,3',4,4',5-Pentachlorobiphenyl (BZ-126)		
		8965	3,3',4,4'-Tetrachlorobiphenyl (BZ-77)		
		9260	3,3',4,5,5'-Pentachlorobiphenyl (BZ-127)		
		9262	3,3',4,5-Tetrachlorobiphenyl (BZ-78)		
		9261	3,3',4,5'-Tetrachlorobiphenyl (BZ-79)		
		9263	3,3',4-Trichlorobiphenyl (BZ-35)		
		9264	3,3',5,5'-Tetrachlorobiphenyl (BZ-80)		
		9265	3,3',5-Trichlorobiphenyl (BZ-36)		
		8925	3,3'-Dichlorobiphenyl (BZ-11)		
		8970	3,4,4',5-Tetrachlorobiphenyl (BZ-81)		
		9266	3,4,4'-Trichlorobiphenyl (BZ-37)		
		9267	3,4,5-Trichlorobiphenyl (BZ-38)		
		9268	3,4',5-Trichlorobiphenyl (BZ-39)		
		9270	3,4-Dichlorobiphenyl (BZ-12)		
		9269	3,4'-Dichlorobiphenyl (BZ-13)		
		9271	3,5-Dichlorobiphenyl (BZ-14)		
		9272	3-Chlorobiphenyl (BZ-2)		
		9273	4,4'-Dichlorobiphenyl (BZ-15)		
		9274	4-Chlorobiphenyl (BZ-3)		
		9105	Decachlorobiphenyl (BZ-209)		
		8876	Total Dichlorobiphenyls		
		8877	Total Heptachlorobiphenyls		
		8888	Total Hexachlorobiphenyls		
		8889	Total Monochlorobiphenyls		
		8891	Total Nonachlorobiphenyls		
		8892	Total Octachlorobiphenyls		
		8896	Total Pentachlorobiphenyls		
		8893	Total Tetrachlorobiphenyls		
		8894	Total Trichlorobiphenyls		
	EPA 3050B			10135601	Acid Digestion of Sediments, Sludges, and soils
		8031	Extraction/Preparation		

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EPA 314.0			10055400	Perchlorate in Drinking Water by Ion Chromatography
	1895	Perchlorate		
EPA 3535			10139205	Solid-Phase Extraction (SPE)
	8031	Extraction/Preparation		
EPA 3540C			10140202	Soxhlet Extraction
	8031	Extraction/Preparation		
EPA 3546			10141205	Microwave Extraction
	8031	Extraction/Preparation		
EPA 3550B			10141807	Ultrasonic Extraction
	8031	Extraction/Preparation		
EPA 3550C			10142004	Ultrasonic Extraction
	8031	Extraction/Preparation		
EPA 3580A			10143007	Waste Dilution
	8031	Extraction/Preparation		
EPA 3620B			10145809	Florisil Cleanup
	8031	Extraction/Preparation		
EPA 3630C			10146802	Silica gel cleanup
	8031	Extraction/Preparation		
EPA 3640A			10147203	Gel Preparation Cleanup
	8031	Extraction/Preparation		
EPA 3660B			10148400	Sulfur cleanup
	8031	Extraction/Preparation		
EPA 5035			10154004	Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples
	8031	Extraction/Preparation		
EPA 5035A			10284807	Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples
	8031	Extraction/Preparation		
EPA 537 - Modified 1.1			971	Perfluorinated Alkyl Acids in Drinking Water by SPE and LC/MS/MS
	4846	2-(N-Ethyl-perfluorooctane sufonamido) acetic acid (EtFOSAA)		
	4847	2-(N-Methyl-perfluorooctane sulfonamido) acetic acid (MeFOSAA)		
	6457	6:2 Fluorotelomersulfonate (6:2FTS)		
	6461	8:2 Fluorotelomersulfonate (8:2FTS)		
	6911	Perfluorobutane Sulfonate (PFBS)		
	6915	Perfluorobutyric acid (PFBA)		
	9562	Perfluorodecane Sulfonate (PFDS)		

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EPA 537 - Modified 1.1	6905	Perfluorodecanoic acid (PFDA)		
	6903	Perfluorododecanoic (PFDDA)		
	9470	Perfluoroheptanesulfonic acid (PFHpS)		
	6908	Perfluoroheptanoic acid (PFHpA)		
	6901	Perfluorohexadecanoic acid (PFHxDA)		
	6910	Perfluorohexane Sulfonate (PFHS)		
	6913	Perfluorohexanoic acid (PFHXA)		
	6906	Perfluorononanoic acid (PFNA)		
	6916	Perfluorooctadecanoic acid (PFODA)		
	6917	Perfluorooctane Sulfonamide (PFOSA)		
	6912	Perfluorooctanoic acid		
	6909	Perfluorooctanoic Sulfonate (PFOS)		
	6914	Perfluoropentanoic acid (PFPEA)		
	6902	Perfluorotetradecanoic acid (PFTDA)		
	9563	Perfluorotridecanoic (PFTRIA)		
	6904	Perfluoroundecanoic acid (PFUDA)		
EPA 6010B			10155609	ICP - AES
	1000	Aluminum		
	1005	Antimony		
	1010	Arsenic		
	1015	Barium		
	1020	Beryllium		
	1025	Boron		
	1030	Cadmium		
	1035	Calcium		
	1040	Chromium		
	1050	Cobalt		
	1055	Copper		
	1070	Iron		
	1075	Lead		
	1085	Magnesium		
	1090	Manganese		
	1100	Molybdenum		
	1105	Nickel		
	1910	Phosphorus, total		
	1125	Potassium		
	1140	Selenium		
	1150	Silver		
	1155	Sodium		
	1160	Strontium		
	1165	Thallium		
	1175	Tin		
	1180	Titanium		

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EPA 6010B	1185	Vanadium		
	1190	Zinc		
EPA 6010C 3			10155905	Inductively Coupled Plasma - Atomic Emission Spectrometry
	1000	Aluminum		
	1005	Antimony		
	1010	Arsenic		
	1015	Barium		
	1020	Beryllium		
	1025	Boron		
	1030	Cadmium		
	1035	Calcium		
	1040	Chromium		
	1050	Cobalt		
	1055	Copper		
	1070	Iron		
	1075	Lead		
	1085	Magnesium		
	1090	Manganese		
	1100	Molybdenum		
	1105	Nickel		
	1910	Phosphorus, total		
	1125	Potassium		
	1140	Selenium		
	1150	Silver		
	1155	Sodium		
	1160	Strontium		
	1165	Thallium		
	1175	Tin		
	1180	Titanium		
	1185	Vanadium		
	1190	Zinc		
EPA 6020			10156000	Inductively Coupled Plasma-Mass Spectrometry
	1000	Aluminum		
	1005	Antimony		
	1010	Arsenic		
	1015	Barium		
	1020	Beryllium		
	1030	Cadmium		
	1035	Calcium		
	1040	Chromium		
	1050	Cobalt		
	1055	Copper		

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EPA 6020	1070	Iron	
	1075	Lead	
	1080	Lithium	
	1085	Magnesium	
	1090	Manganese	
	1100	Molybdenum	
	1105	Nickel	
	1910	Phosphorus, total	
	1125	Potassium	
	1140	Selenium	
	1150	Silver	
	1155	Sodium	
	1160	Strontium	
	1165	Thallium	
	1175	Tin	
	1180	Titanium	
	3035	Uranium	
	1185	Vanadium	
	1190	Zinc	
EPA 6020A 1		10156419	Inductively Coupled Plasma -Mass Spectrometry
	1000	Aluminum	
	1005	Antimony	
	1010	Arsenic	
	1015	Barium	
	1020	Beryllium	
	1030	Cadmium	
	1035	Calcium	
	1040	Chromium	
	1050	Cobalt	
	1055	Copper	
	1070	Iron	
	1075	Lead	
	1080	Lithium	
	1085	Magnesium	
	1090	Manganese	
	1100	Molybdenum	
	1105	Nickel	
	1910	Phosphorus, total	
	1125	Potassium	
	1140	Selenium	
	1150	Silver	
	1155	Sodium	
	1160	Strontium	

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EPA 6020A 1	1165	Thallium		
	1175	Tin		
	1180	Titanium		
	3035	Uranium		
	1185	Vanadium		
	1190	Zinc		
EPA 6850			10304606	Perchlorate in Water, Soils and Solid Wastes Using High Performance Liquid Chromatography/Electrospray Ionization/Mass Spectrometry
	1895	Perchlorate		
EPA 7471A			10166208	Mercury in Solid Waste by Cold Vapor Atomic Absorption
	1095	Mercury		
EPA 7471B			10166402	Mercury by Cold Vapor Atomic Absorption
	1095	Mercury		
EPA 8015B			10173601	Non-halogenated organics using GC/FID
	9369	Diesel range organics (DRO)		
	9499	Motor Oil		
EPA 8015C			10173805	Non-halogenated organics using GC/FID
	9369	Diesel range organics (DRO)		
	9499	Motor Oil		
EPA 8081A			10178606	Organochlorine Pesticides by GC/ECD
	7355	4,4'-DDD		
	7360	4,4'-DDE		
	7365	4,4'-DDT		
	7025	Aldrin		
	7110	alpha-BHC (alpha-Hexachlorocyclohexane)		
	7240	alpha-Chlordane		
	7115	beta-BHC (beta-Hexachlorocyclohexane)		
	7250	Chlordane (tech.)		
	7260	Chlorobenzilate		
	7105	delta-BHC		
	7405	Diallate		
	7470	Dieldrin		
	7510	Endosulfan I		
	7515	Endosulfan II		
	7520	Endosulfan sulfate		
	7540	Endrin		
	7530	Endrin aldehyde		
	7535	Endrin ketone		

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Solids

EPA 8081A	7120	gamma-BHC (Lindane, gamma-HexachlorocyclohexanE)		
	7245	gamma-Chlordane		
	7685	Heptachlor		
	7690	Heptachlor epoxide		
	7725	Isodrin		
	7810	Methoxychlor		
	8250	Toxaphene (Chlorinated camphene)		
EPA 8081B			10178800	Organochlorine Pesticides by GC/ECD
	7355	4,4'-DDD		
	7360	4,4'-DDE		
	7365	4,4'-DDT		
	7025	Aldrin		
	7110	alpha-BHC (alpha-Hexachlorocyclohexane)		
	7240	alpha-Chlordane		
	7115	beta-BHC (beta-Hexachlorocyclohexane)		
	7250	Chlordane (tech.)		
	7260	Chlorobenzilate		
	7105	delta-BHC		
	7405	Diallate		
	7470	Dieldrin		
	7510	Endosulfan I		
	7515	Endosulfan II		
	7520	Endosulfan sulfate		
	7540	Endrin		
	7530	Endrin aldehyde		
	7535	Endrin ketone		
	7120	gamma-BHC (Lindane, gamma-HexachlorocyclohexanE)		
	7245	gamma-Chlordane		
	7685	Heptachlor		
	7690	Heptachlor epoxide		
	7725	Isodrin		
	7810	Methoxychlor		
	8250	Toxaphene (Chlorinated camphene)		
EPA 8082			10179007	Polychlorinated Biphenyls (PCBs) by GC/ECD
	8880	Aroclor-1016 (PCB-1016)		
	8885	Aroclor-1221 (PCB-1221)		
	8890	Aroclor-1232 (PCB-1232)		
	8895	Aroclor-1242 (PCB-1242)		
	8900	Aroclor-1248 (PCB-1248)		
	8905	Aroclor-1254 (PCB-1254)		

Solids

EPA 8082	8910	Aroclor-1260 (PCB-1260)		
	8912	Aroclor-1262 (PCB-1262)		
	8913	Aroclor-1268 (PCB-1268)		
EPA 8082A			10179201	Polychlorinated Biphenyls (PCBs) by GC/ECD
	8880	Aroclor-1016 (PCB-1016)		
	8885	Aroclor-1221 (PCB-1221)		
	8890	Aroclor-1232 (PCB-1232)		
	8895	Aroclor-1242 (PCB-1242)		
	8900	Aroclor-1248 (PCB-1248)		
	8905	Aroclor-1254 (PCB-1254)		
	8910	Aroclor-1260 (PCB-1260)		
	8912	Aroclor-1262 (PCB-1262)		
	8913	Aroclor-1268 (PCB-1268)		
EPA 8260B			10184802	Volatile Organic Compounds by purge and trap GC/MS
	5105	1,1,1,2-Tetrachloroethane		
	5160	1,1,1-Trichloroethane		
	5110	1,1,2,2-Tetrachloroethane		
	5195	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)		
	5165	1,1,2-Trichloroethane		
	4630	1,1-Dichloroethane		
	4640	1,1-Dichloroethylene		
	4670	1,1-Dichloropropene		
	5150	1,2,3-Trichlorobenzene		
	5180	1,2,3-Trichloropropane		
	5155	1,2,4-Trichlorobenzene		
	5210	1,2,4-Trimethylbenzene		
	4585	1,2-Dibromoethane (EDB, Ethylene dibromide)		
	4610	1,2-Dichlorobenzene		
	4635	1,2-Dichloroethane (Ethylene dichloride)		
	4655	1,2-Dichloropropane		
	5215	1,3,5-Trimethylbenzene		
	4615	1,3-Dichlorobenzene		
	4660	1,3-Dichloropropane		
	4620	1,4-Dichlorobenzene		
	4735	1,4-Dioxane (1,4- Diethyleneoxide)		
	4510	1-Chlorohexane		
	4665	2,2-Dichloropropane		
	4410	2-Butanone (Methyl ethyl ketone, MEK)		
	4500	2-Chloroethyl vinyl ether		
	4535	2-Chlorotoluene		
	4860	2-Hexanone (MBK)		

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Solids	EPA 8260B	4540	4-Chlorotoluene
		4910	4-Isopropyltoluene (p-Cymene)
		4995	4-Methyl-2-pentanone (MIBK)
		4315	Acetone
		4325	Acrolein (Propenal)
		4340	Acrylonitrile
		4355	Allyl chloride (3-Chloropropene)
		4375	Benzene
		5635	Benzyl chloride
		4385	Bromobenzene
		4390	Bromochloromethane
		4395	Bromodichloromethane
		4400	Bromoform
		4450	Carbon disulfide
		4455	Carbon tetrachloride
		4475	Chlorobenzene
		4575	Chlorodibromomethane
		4485	Chloroethane (Ethyl chloride)
		4505	Chloroform
		4525	Chloroprene (2-Chloro-1,3-butadiene)
		4645	cis-1,2-Dichloroethylene
		4680	cis-1,3-Dichloropropene
		4580	Dibromochloropropane
		4595	Dibromomethane (Methylene bromide)
		4625	Dichlorodifluoromethane (Freon-12)
		9375	Di-isopropylether (DIPE)
		4810	Ethyl methacrylate
		4765	Ethylbenzene
		4770	Ethyl-t-butylether (ETBE) (2-Ethoxy-2-methylpropane)
		9408	Gasoline range organics (GRO)
		4835	Hexachlorobutadiene
		4870	Iodomethane (Methyl iodide)
		4875	Isobutyl alcohol (2-Methyl-1-propanol)
		4900	Isopropylbenzene (Cumene)
		5240	m+p-xylene
		4925	Methacrylonitrile
		4950	Methyl bromide (Bromomethane)
		4960	Methyl chloride (Chloromethane)
		4990	Methyl methacrylate
		5000	Methyl tert-butyl ether (MTBE)
		4975	Methylene chloride (Dichloromethane)
		5005	Naphthalene
		4435	n-Butylbenzene

Solids

EPA 8260B	4855	n-Hexane	
	5090	n-Propylbenzene	
	5250	o-Xylene	
	5080	Propionitrile (Ethyl cyanide)	
	4440	sec-Butylbenzene	
	5100	Styrene	
	4370	T-amylmethylether (TAME)	
	4420	tert-Butyl alcohol	
	4445	tert-Butylbenzene	
	5115	Tetrachloroethylene (Perchloroethylene)	
	5140	Toluene	
	4700	trans-1,2-Dichloroethylene	
	4685	trans-1,3-Dichloropropylene	
	4605	trans-1,4-Dichloro-2-butene	
	5170	Trichloroethene (Trichloroethylene)	
	5175	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	
	5225	Vinyl acetate	
	5235	Vinyl chloride	
	5260	Xylene (total)	
EPA 8260C			10307003 Volatile Organics: GC/MS (capillary column)
	5105	1,1,1,2-Tetrachloroethane	
	5160	1,1,1-Trichloroethane	
	5110	1,1,2,2-Tetrachloroethane	
	5195	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	
	5165	1,1,2-Trichloroethane	
	4630	1,1-Dichloroethane	
	4640	1,1-Dichloroethylene	
	4670	1,1-Dichloropropene	
	5150	1,2,3-Trichlorobenzene	
	5180	1,2,3-Trichloropropane	
	5155	1,2,4-Trichlorobenzene	
	5210	1,2,4-Trimethylbenzene	
	4585	1,2-Dibromoethane (EDB, Ethylene dibromide)	
	4610	1,2-Dichlorobenzene	
	4635	1,2-Dichloroethane (Ethylene dichloride)	
	4655	1,2-Dichloropropane	
	5215	1,3,5-Trimethylbenzene	
	4615	1,3-Dichlorobenzene	
	4660	1,3-Dichloropropane	
	4620	1,4-Dichlorobenzene	
	4735	1,4-Dioxane (1,4- Diethyleneoxide)	

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Solids EPA 8260C

4510	1-Chlorohexane
4665	2,2-Dichloropropane
4410	2-Butanone (Methyl ethyl ketone, MEK)
4500	2-Chloroethyl vinyl ether
4535	2-Chlorotoluene
4860	2-Hexanone (MBK)
4540	4-Chlorotoluene
4910	4-Isopropyltoluene (p-Cymene)
4995	4-Methyl-2-pentanone (MIBK)
4315	Acetone
4325	Acrolein (Propenal)
4340	Acrylonitrile
4355	Allyl chloride (3-Chloropropene)
4375	Benzene
5635	Benzyl chloride
4385	Bromobenzene
4390	Bromochloromethane
4395	Bromodichloromethane
4400	Bromoform
4450	Carbon disulfide
4455	Carbon tetrachloride
4475	Chlorobenzene
4575	Chlorodibromomethane
4485	Chloroethane (Ethyl chloride)
4505	Chloroform
4525	Chloroprene (2-Chloro-1,3-butadiene)
4645	cis-1,2-Dichloroethylene
4680	cis-1,3-Dichloropropene
4580	Dibromochloropropane
4595	Dibromomethane (Methylene bromide)
4625	Dichlorodifluoromethane (Freon-12)
9375	Di-isopropylether (DIPE)
4810	Ethyl methacrylate
4765	Ethylbenzene
4770	Ethyl-t-butylether (ETBE) (2-Ethoxy-2-methylpropane)
9408	Gasoline range organics (GRO)
4835	Hexachlorobutadiene
4870	Iodomethane (Methyl iodide)
4875	Isobutyl alcohol (2-Methyl-1-propanol)
4900	Isopropylbenzene (Cumene)
5240	m+p-xylene
4925	Methacrylonitrile
4950	Methyl bromide (Bromomethane)

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Solids

EPA 8260C	4960	Methyl chloride (Chloromethane)	
	4990	Methyl methacrylate	
	5000	Methyl tert-butyl ether (MTBE)	
	4975	Methylene chloride (Dichloromethane)	
	5005	Naphthalene	
	4435	n-Butylbenzene	
	4855	n-Hexane	
	5090	n-Propylbenzene	
	5250	o-Xylene	
	5080	Propionitrile (Ethyl cyanide)	
	4440	sec-Butylbenzene	
	5100	Styrene	
	4370	T-amylmethylether (TAME)	
	4420	tert-Butyl alcohol	
	4445	tert-Butylbenzene	
	5115	Tetrachloroethylene (Perchloroethylene)	
	5140	Toluene	
	4700	trans-1,2-Dichloroethylene	
	4685	trans-1,3-Dichloropropylene	
	4605	trans-1,4-Dichloro-2-butene	
	5170	Trichloroethene (Trichloroethylene)	
	5175	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	
	5225	Vinyl acetate	
	5235	Vinyl chloride	
	5260	Xylene (total)	
EPA 8270C		10185805	Semivolatile Organic compounds by GC/MS
	6703	1,1'-Biphenyl (BZ-0)	
	6715	1,2,4,5-Tetrachlorobenzene	
	5155	1,2,4-Trichlorobenzene	
	4610	1,2-Dichlorobenzene	
	6885	1,3,5-Trinitrobenzene (1,3,5-TNB)	
	4615	1,3-Dichlorobenzene	
	6160	1,3-Dinitrobenzene (1,3-DNB)	
	4620	1,4-Dichlorobenzene	
	6165	1,4-Dinitrobenzene	
	6420	1,4-Naphthoquinone	
	6630	1,4-Phenylenediamine	
	5790	1-Chloronaphthalene	
	6380	1-Methylnaphthalene	
	6425	1-Naphthylamine	
	6735	2,3,4,6-Tetrachlorophenol	
	6740	2,3,5,6-Tetrachlorophenol	

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Solids	EPA 8270C	6835	2,4,5-Trichlorophenol
		6840	2,4,6-Trichlorophenol
		6000	2,4-Dichlorophenol
		6130	2,4-Dimethylphenol
		6175	2,4-Dinitrophenol
		6185	2,4-Dinitrotoluene (2,4-DNT)
		6005	2,6-Dichlorophenol
		6190	2,6-Dinitrotoluene (2,6-DNT)
		5515	2-Acetylaminofluorene
		5795	2-Chloronaphthalene
		5800	2-Chlorophenol
		6360	2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2 -methylphenol)
		5145	2-Methylaniline (o-Toluidine)
		6385	2-Methylnaphthalene
		6400	2-Methylphenol (o-Cresol)
		6430	2-Naphthylamine
		6460	2-Nitroaniline
		6490	2-Nitrophenol
		5050	2-Picoline (2-Methylpyridine)
		5945	3,3'-Dichlorobenzidine
		6120	3,3'-Dimethylbenzidine
		6355	3-Methylcholanthrene
		6405	3-Methylphenol (m-Cresol)
		6465	3-Nitroaniline
		5540	4-Aminobiphenyl
		5660	4-Bromophenyl phenyl ether (BDE-3)
		5700	4-Chloro-3-methylphenol
		5745	4-Chloroaniline
		5825	4-Chlorophenyl phenylether
		6105	4-Dimethyl aminoazobenzene
		6410	4-Methylphenol (p-Cresol)
		6470	4-Nitroaniline
		6500	4-Nitrophenol
		6510	4-Nitroquinoline 1-oxide
		6570	5-Nitro-o-toluidine
		6115	7,12-Dimethylbenz(a) anthracene
		6125	a-a-Dimethylphenethylamine
		5500	Acenaphthene
		5505	Acenaphthylene
		5510	Acetophenone
		5545	Aniline
		5555	Anthracene
		5560	Aramite

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Solids EPA 8270C

5562	Azobenzene
5570	Benzaldehyde
5595	Benzidine
5575	Benzo(a)anthracene
5580	Benzo(a)pyrene
5590	Benzo(g,h,i)perylene
5600	Benzo(k)fluoranthene
5585	Benzo[b]fluoranthene
5610	Benzoic acid
5630	Benzyl alcohol
5760	bis(2-Chloroethoxy)methane
5765	bis(2-Chloroethyl) ether
5780	bis(2-Chloroisopropyl) ether
5670	Butyl benzyl phthalate
5680	Carbazole
7260	Chlorobenzilate
5855	Chrysene
6065	Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate, DEHP)
7405	Diallate
5900	Dibenz(a, j) acridine
5895	Dibenz(a,h) anthracene
5905	Dibenzofuran
6070	Diethyl phthalate
7475	Dimethoate
6135	Dimethyl phthalate
5925	Di-n-butyl phthalate
6200	Di-n-octyl phthalate
8620	Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)
6205	Diphenylamine
8625	Disulfoton
6260	Ethyl methanesulfonate
7580	Famphur
6265	Fluoranthene
6270	Fluorene
6275	Hexachlorobenzene
4835	Hexachlorobutadiene
6285	Hexachlorocyclopentadiene
4840	Hexachloroethane
6295	Hexachloropropene
6315	Indeno(1,2,3-cd) pyrene
7725	Isodrin
6320	Isophorone

Solids

EPA 8270C	6325	Isosafrole	
	7740	Kepone	
	6345	Methapyrilene	
	6375	Methyl methanesulfonate	
	7825	Methyl parathion (Parathion, methyl)	
	5005	Naphthalene	
	5015	Nitrobenzene	
	6525	n-Nitrosodiethylamine	
	6530	n-Nitrosodimethylamine	
	5025	n-Nitroso-di-n-butylamine	
	6545	n-Nitrosodi-n-propylamine	
	6535	n-Nitrosodiphenylamine	
	6550	n-Nitrosomethylethalamine	
	6555	n-Nitrosomorpholine	
	6560	n-Nitrosopiperidine	
	6565	n-Nitrosopyrrolidine	
	8290	o,o,o-Triethyl phosphorothioate	
	7955	Parathion, ethyl	
	6590	Pentachlorobenzene	
	5035	Pentachloroethane	
	6600	Pentachloronitrobenzene	
	6605	Pentachlorophenol	
	6610	Phenacetin	
	6615	Phenanthrene	
	6625	Phenol	
	7985	Phorate	
	6650	Pronamide (Kerb)	
	6665	Pyrene	
	5095	Pyridine	
	6685	Safrole	
	8155	Sulfotepp	
	8235	Thionazin (Zinophos)	
EPA 8270C SIM			10242407 Semivolatile Organic compounds by GC/MS Selective Ion Monitoring
	6380	1-Methylnaphthalene	
	6385	2-Methylnaphthalene	
	5500	Acenaphthene	
	5505	Acenaphthylene	
	5555	Anthracene	
	5575	Benzo(a)anthracene	
	5580	Benzo(a)pyrene	
	5590	Benzo(g,h,i)perylene	
	5600	Benzo(k)fluoranthene	
	5585	Benzo[b]fluoranthene	

Solids

EPA 8270C SIM	5855	Chrysene	
	5895	Dibenz(a,h) anthracene	
	6265	Fluoranthene	
	6270	Fluorene	
	6315	Indeno(1,2,3-cd) pyrene	
	5005	Naphthalene	
	6615	Phenanthrene	
	6665	Pyrene	
EPA 8270D			10186002 Semivolatile Organic compounds by GC/MS
	6703	1,1'-Biphenyl (BZ-0)	
	6715	1,2,4,5-Tetrachlorobenzene	
	5155	1,2,4-Trichlorobenzene	
	4610	1,2-Dichlorobenzene	
	6885	1,3,5-Trinitrobenzene (1,3,5-TNB)	
	4615	1,3-Dichlorobenzene	
	6160	1,3-Dinitrobenzene (1,3-DNB)	
	4620	1,4-Dichlorobenzene	
	6165	1,4-Dinitrobenzene	
	6420	1,4-Naphthoquinone	
	6630	1,4-Phenylenediamine	
	5790	1-Chloronaphthalene	
	6380	1-Methylnaphthalene	
	6425	1-Naphthylamine	
	6735	2,3,4,6-Tetrachlorophenol	
	6740	2,3,5,6-Tetrachlorophenol	
	6835	2,4,5-Trichlorophenol	
	6840	2,4,6-Trichlorophenol	
	6000	2,4-Dichlorophenol	
	6130	2,4-Dimethylphenol	
	6175	2,4-Dinitrophenol	
	6185	2,4-Dinitrotoluene (2,4-DNT)	
	6005	2,6-Dichlorophenol	
	6190	2,6-Dinitrotoluene (2,6-DNT)	
	5515	2-Acetylaminofluorene	
	5795	2-Chloronaphthalene	
	5800	2-Chlorophenol	
	6360	2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	
	5145	2-Methylaniline (o-Toluidine)	
	6385	2-Methylnaphthalene	
	6400	2-Methylphenol (o-Cresol)	
	6430	2-Naphthylamine	
	6460	2-Nitroaniline	

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Solids	EPA 8270D	6490	2-Nitrophenol
		5050	2-Picoline (2-Methylpyridine)
		5945	3,3'-Dichlorobenzidine
		6120	3,3'-Dimethylbenzidine
		6355	3-Methylcholanthrene
		6405	3-Methylphenol (m-Cresol)
		6465	3-Nitroaniline
		5540	4-Aminobiphenyl
		5660	4-Bromophenyl phenyl ether (BDE-3)
		5700	4-Chloro-3-methylphenol
		5745	4-Chloroaniline
		5825	4-Chlorophenyl phenylether
		6105	4-Dimethyl aminoazobenzene
		6410	4-Methylphenol (p-Cresol)
		6470	4-Nitroaniline
		6500	4-Nitrophenol
		6510	4-Nitroquinoline 1-oxide
		6570	5-Nitro-o-toluidine
		6115	7,12-Dimethylbenz(a) anthracene
		6125	a-a-Dimethylphenethylamine
		5500	Acenaphthene
		5505	Acenaphthylene
		5510	Acetophenone
		5545	Aniline
		5555	Anthracene
		5560	Aramite
		5562	Azobenzene
		5570	Benzaldehyde
		5595	Benzidine
		5575	Benzo(a)anthracene
		5580	Benzo(a)pyrene
		5590	Benzo(g,h,i)perylene
		5600	Benzo(k)fluoranthene
		5585	Benzo[b]fluoranthene
		5610	Benzoic acid
		5630	Benzyl alcohol
		5760	bis(2-Chloroethoxy)methane
		5765	bis(2-Chloroethyl) ether
		5780	bis(2-Chloroisopropyl) ether
		5670	Butyl benzyl phthalate
		5680	Carbazole
		7260	Chlorobenzilate
		5855	Chrysene

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Solids	EPA 8270D	6065	Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate, DEHP)
		7405	Diallate
		5900	Dibenz(a, j) acridine
		5895	Dibenz(a,h) anthracene
		5905	Dibenzofuran
		6070	Diethyl phthalate
		7475	Dimethoate
		6135	Dimethyl phthalate
		5925	Di-n-butyl phthalate
		6200	Di-n-octyl phthalate
		8620	Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)
		6205	Diphenylamine
		8625	Disulfoton
		6260	Ethyl methanesulfonate
		7580	Famphur
		6265	Fluoranthene
		6270	Fluorene
		6275	Hexachlorobenzene
		4835	Hexachlorobutadiene
		6285	Hexachlorocyclopentadiene
		4840	Hexachloroethane
		6295	Hexachloropropene
		6315	Indeno(1,2,3-cd) pyrene
		7725	Isodrin
		6320	Isophorone
		6325	Isosafrole
		7740	Kepone
		6345	Methapyrilene
		6375	Methyl methanesulfonate
		7825	Methyl parathion (Parathion, methyl)
		5005	Naphthalene
		5015	Nitrobenzene
		6525	n-Nitrosodiethylamine
		6530	n-Nitrosodimethylamine
		5025	n-Nitroso-di-n-butylamine
		6545	n-Nitrosodi-n-propylamine
		6535	n-Nitrosodiphenylamine
		6550	n-Nitrosomethylethalamine
		6555	n-Nitrosomorpholine
		6560	n-Nitrosopiperidine
		6565	n-Nitrosopyrrolidine
		8290	o,o,o-Triethyl phosphorothioate

Solids

EPA 8270D	7955	Parathion, ethyl		
	6590	Pentachlorobenzene		
	5035	Pentachloroethane		
	6600	Pentachloronitrobenzene		
	6605	Pentachlorophenol		
	6610	Phenacetin		
	6615	Phenanthrene		
	6625	Phenol		
	7985	Phorate		
	6650	Pronamide (Kerb)		
	6665	Pyrene		
	5095	Pyridine		
	6685	Safrole		
	8155	Sulfotepp		
	8235	Thionazin (Zinophos)		
EPA 8270D SIM			10242509	Semivolatile Organic compounds by GC/MS Selective Ion Monitoring
	6380	1-Methylnaphthalene		
	6385	2-Methylnaphthalene		
	5500	Acenaphthene		
	5505	Acenaphthylene		
	5555	Anthracene		
	5575	Benzo(a)anthracene		
	5580	Benzo(a)pyrene		
	5590	Benzo(g,h,i)perylene		
	5600	Benzo(k)fluoranthene		
	5585	Benzo[b]fluoranthene		
	5855	Chrysene		
	5895	Dibenz(a,h) anthracene		
	6265	Fluoranthene		
	6270	Fluorene		
	6315	Indeno(1,2,3-cd) pyrene		
	5005	Naphthalene		
	6615	Phenanthrene		
	6665	Pyrene		
EPA 8280A			10186808	Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofurans by GC/HRMS
	9516	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)		
	9519	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)		
	9420	1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)		
	9426	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)		

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Solids

EPA 8280A	9423	1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)	
	9471	1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-Hxcdf)	
	9453	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd)	
	9474	1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf)	
	9456	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,6,7,8-Hxcdd)	
	9477	1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf)	
	9459	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd)	
	9543	1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf)	
	9540	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd)	
	9480	2,3,4,6,7,8-Hexachlorodibenzofuran	
	9549	2,3,4,7,8-Pentachlorodibenzofuran	
	9618	2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD)	
	9612	2,3,7,8-Tetrachlorodibenzofuran	
	9438	Hpcdd, total	
	9444	Hpcdf, total	
	9468	Hxcdd, total	
	9483	Hxcdf, total	
	9555	Pecdd, total	
	9552	Pecdf, total	
	9609	TCDD, total	
	9615	TCDF, total	
EPA 8280B			10187005 Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofurans by GC/HRMS
	9516	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	
	9519	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	
	9420	1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)	
	9426	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)	
	9423	1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)	
	9471	1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-Hxcdf)	
	9453	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd)	
	9474	1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf)	

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Solids

EPA 8280B	9456	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,6,7,8-Hxcdd)		
	9477	1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf)		
	9459	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd)		
	9543	1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf)		
	9540	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd)		
	9480	2,3,4,6,7,8-Hexachlorodibenzofuran		
	9549	2,3,4,7,8-Pentachlorodibenzofuran		
	9618	2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD)		
	9612	2,3,7,8-Tetrachlorodibenzofuran		
	9438	Hpcdd, total		
	9444	Hpcdf, total		
	9468	Hxcdd, total		
	9483	Hxcdf, total		
	9555	Pecdd, total		
	9552	Pecdf, total		
	9609	TCDD, total		
	9615	TCDF, total		
EPA 8290			10187209	Polychlorinated Dibenzodioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) by GC/HRMS
	9516	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)		
	9519	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)		
	9420	1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)		
	9426	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)		
	9423	1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)		
	9471	1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-Hxcdf)		
	9453	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd)		
	9474	1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf)		
	9456	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,6,7,8-Hxcdd)		
	9477	1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf)		
	9459	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd)		
	9543	1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf)		

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EPA 8290	9540	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd)		
	9480	2,3,4,6,7,8-Hexachlorodibenzofuran		
	9549	2,3,4,7,8-Pentachlorodibenzofuran		
	9618	2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD)		
	9612	2,3,7,8-Tetrachlorodibenzofuran		
	9438	Hpcdd, total		
	9444	Hpcdf, total		
	9468	Hxcdd, total		
	9483	Hxcdf, total		
	9555	Pecdd, total		
	9552	Pecdf, total		
	9609	TCDD, total		
	9615	TCDF, total		
EPA 8290A			10187403	Polychlorinated Dibenzodioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) by GC/HRMS
	9516	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)		
	9519	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)		
	9420	1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)		
	9426	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)		
	9423	1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)		
	9471	1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-Hxcdf)		
	9453	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd)		
	9474	1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf)		
	9456	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,6,7,8-Hxcdd)		
	9477	1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf)		
	9459	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd)		
	9543	1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf)		
	9540	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd)		
	9480	2,3,4,6,7,8-Hexachlorodibenzofuran		
	9549	2,3,4,7,8-Pentachlorodibenzofuran		
	9618	2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD)		
	9612	2,3,7,8-Tetrachlorodibenzofuran		

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EPA 8290A	9438	Hpcdd, total		
	9444	Hpcdf, total		
	9468	Hxcdd, total		
	9483	Hxcdf, total		
	9555	Pecdd, total		
	9552	Pecdf, total		
	9609	TCDD, total		
	9615	TCDF, total		
EPA 8330A			10190008	Nitroaromatics and Nitramines by High Performance Liquid Chromatography (HPLC)
	6885	1,3,5-Trinitrobenzene (1,3,5-TNB)		
	6160	1,3-Dinitrobenzene (1,3-DNB)		
	9651	2,4,6-Trinitrotoluene (2,4,6-TNT)		
	6185	2,4-Dinitrotoluene (2,4-DNT)		
	6190	2,6-Dinitrotoluene (2,6-DNT)		
	9303	2-Amino-4,6-dinitrotoluene (2-am-dnt)		
	9507	2-Nitrotoluene		
	9510	3-Nitrotoluene		
	9306	4-Amino-2,6-dinitrotoluene (4-am-dnt)		
	9513	4-Nitrotoluene		
	9418	Hexahydro-1-nitroso-3,5-dinitro-1,3,5-triazine (MNX)		
	6415	Methyl-2,4,6-trinitrophenylnitramine (tetryl)		
	5015	Nitrobenzene		
	6485	Nitroglycerin		
	9522	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)		
	9558	Pentaerythritoltetranitrate (PETN)		
	9432	RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine)		
EPA 8330B			10308006	Nitroaromatics, Nitramines and Nitrate Esters by High Performance Liquid Chromatography (HPLC)
	6887	1,3,5-Trinitroso-1,3,5-hexahydrotriazine (TNX)		
	6885	1,3,5-Trinitrobenzene (1,3,5-TNB)		
	6160	1,3-Dinitrobenzene (1,3-DNB)		
	9651	2,4,6-Trinitrotoluene (2,4,6-TNT)		
	6185	2,4-Dinitrotoluene (2,4-DNT)		
	6190	2,6-Dinitrotoluene (2,6-DNT)		
	9303	2-Amino-4,6-dinitrotoluene (2-am-dnt)		
	9507	2-Nitrotoluene		
	6150	3,5-Dinitroaniline		
	9510	3-Nitrotoluene		

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EPA 8330B	9306	4-Amino-2,6-dinitrotoluene (4-am-dnt)		
	9513	4-Nitrotoluene		
	9416	Hexahydro-1,3-dinitroso-5-nitro-1,3,5-triazine (DNX)		
	9418	Hexahydro-1-nitroso-3,5-dinitro-1,3,5-triazine (MNX)		
	6415	Methyl-2,4,6-trinitrophenylnitramine (tetryl)		
	5015	Nitrobenzene		
	6485	Nitroglycerin		
	9522	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)		
	9558	Pentaerythritoltetranitrate (PETN)		
	1899	Picric Acid (2,4,6-Trinitrophenol)		
	9432	RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine)		
EPA 9045C			10198400	Soil and Waste pH
	1900	pH		
EPA 9045D			10244607	Soil and Waste pH
	1900	pH		
EPA 9056			10199005	Determination of Inorganic Anions by Ion Chromatography
	1540	Bromide		
	1575	Chloride		
	1730	Fluoride		
	1805	Nitrate		
	1835	Nitrite		
	2000	Sulfate		
EPA 9056A			10199607	Determination of Inorganic Anions by Ion Chromatography
	1540	Bromide		
	1575	Chloride		
	1730	Fluoride		
	1805	Nitrate		
	1835	Nitrite		
	2000	Sulfate		
WS-LC-0010 3.4			60055154	TestAmerica West Sacramento - Nitroguanidine (EPA 8330)
	6462	2-Nitroguanidine		
WS-LC-0025 1.2			60055427	TestAmerica West Sacramento - Perfluorinated Compounds (PFCs) in Water, Soil, Sediments, and Tissue by LC/MS/MS
	6904	Perfluoroundecanoic acid (PFUDA)		

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Solids

WS-MS-0012 2014			60055530	TestAmerica West Sacramento - Nitrosamines by GC/MS/MS with LVI
	6525	n-Nitrosodiethylamine		
	6530	n-Nitrosodimethylamine		
	5025	n-Nitroso-di-n-butylamine		
	6545	n-Nitrosodi-n-propylamine		
	6535	n-Nitrosodiphenylamine		
	6550	n-Nitrosomethylethalamine		
	6555	n-Nitrosomorpholine		
	6520	n-Nitroso-n-methylurea		
	6560	n-Nitrosopiperidine		
	6565	n-Nitrosopyrrolidine		
WS-WC-0050 3.8			60055472	TestAmerica West Sacramento - Nitrocellulose in Aqueous and Soil/Sediment Samples by Colorimetric Autoanalyzer
	6484	Nitrocellulose		

Quality Assurance Manual Cover Page

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Title Page:

Quality Assurance Manual

Approval Signatures

Laboratory Director – Crystal Pollock	5/19/2017 Date
Quality Manager – Lisa Stafford	May 18, 2017 Date
Technical Manager, Dioxins, LCMS, Inorganics Robert Hrabak	5/18/17 Date
Manager, Volatiles, Semivolatiles, Organic/Dioxin Prep Koroush Vaziri	5/18/17 Date

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REFERENCED CORPORATE SOPs AND POLICIES

SOP / Policy Reference	Title
CA-I-P-002	Electronic Reporting and Signature Policy
CA-I-S-006	Software Testing, Validation and Verification
CW-I-P-006	Computer Systems Account and Naming Policy
CW-I-P-007	Computer Systems Password Policy
CA-L-P-002	Contract Compliance Policy
CA-Q-M-002	Corporate Quality Management Plan
CA-Q-S-001	Solvent and Acid Lot Testing and Approval
CA-Q-S-002	Acceptable Manual Integration Practices
CA-Q-S-006	Detection Limits
CA-Q-S-009	Root Cause Analysis
CA-T-P-001	Qualified Products List
CW-E-M-001	Corporate Environmental Health & Safety Manual
CW-F-P-002	Company-Wide Authorization Matrix
CW-F-P-004	Procurement and Contracts Policy
CW-F-S-007	Capital Expenditure, Controlled Purchase Requests and Fixed Asset Capitalization
CW-L-P-004	Ethics Policy
CW-L-S-002	Internal Investigation s
CW-L-S-004	Subcontracting
CW-Q-S-001	Corporate Document Control and Archiving
CW-Q-S-002	Writing a Standard Operating Procedure (SOPs)
CW-Q-S-003	Internal Auditing
CW-Q-S-004	Management Systems Review
CW-Q-S-005	Data Recalls
CA-C-S-001	Work Sharing Process

REFERENCED LABORATORY SOPs

SOP Reference	Title
WS-PQA-013	Procedures to Address Customer Complaints
WS-QA-0050	Management of Change
WS-QA-0009	Document Archiving
WS-QA-0022	Employee Orientation and Training
WS-QA-0021	Preparation and Management of Standard Operating Procedures
WS-QA-0006	Method Detection Limits (MDL) and Instrument Detection Limits (IDL)
WS-PQA-0011	Manual Integration Documentation Procedures
WS-PQA-003	Quality Control Program
WS-QA-0018	Subsampling and Compositing of Samples
WS-QA-0003	Sample Receipt and Procedures
WS-QA-0035	Statistical Process Control / Control Chart
WS-EHS-0001	Waste Disposal

SECTION 3. INTRODUCTION, SCOPE AND APPLICABILITY

3.1 Introduction and Compliance References

TestAmerica Sacramento's Quality Assurance Manual (QAM) is a document prepared to define the overall policies, organization objectives and functional responsibilities for achieving TestAmerica's data quality goals. The laboratory maintains a local perspective in its scope of services and client relations and maintains a national perspective in terms of quality.

The QAM has been prepared to assure compliance with The NELAC Institute (TNI) Standard, dated 2009, Volume 1 Modules 2 and 4, and ISO/IEC Guide 17025:2005(E). In addition, the policies and procedures outlined in this manual are compliant with TestAmerica's Corporate Quality Management Plan (CQMP) and the various accreditation and certification programs listed in Appendix 3. The CQMP provides a summary of TestAmerica's quality and data integrity system. It contains requirements and general guidelines under which all TestAmerica facilities shall conduct their operations.

The QAM has been prepared to be consistent with the requirements of the following documents:

- EPA 600/4-88/039, *Methods for the Determination of Organic Compounds in Drinking Water,* EPA, Revised July 1991.
- EPA 600/R-95/131, *Methods for the Determination of Organic Compounds in Drinking Water,* Supplement III, EPA, August 1995.
- EPA 600/4-79-019, *Handbook for Analytical Quality Control in Water and Wastewater Laboratories,* EPA, March 1979.
- *Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846), Third Edition, September 1986, Final Update I, July 1992, Final Update IIA, August 1993, Final Update II, September 1994; Final Update IIB, January 1995; Final Update III, December 1996; Final Update IV, January 2008.*
- *U.S. Department of Defense, Quality Systems Manual for Environmental Laboratories, Version 4.2, October 2010.*
- *U.S. Department of Denfense (DoD)/Department of Energy (DOE) Consolidated Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.0, July 2013.*
- *U.S. Department of Denfense (DoD)/Department of Energy (DOE) Consolidated Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1, 2017.*
- Federal Register, 40 CFR Parts 136, 141, 172, 173, 178, 179 and 261.
- *Manual for the Certification of Laboratories Analyzing Drinking Water (EPA 815-R-05-004, January 2005)*
- *Statement of Work for Inorganics & Organics Analysis, SOM, ISM, DLF and CBC, current versions, USEPA Contract Laboratory Program Multi-media, Multi-concentration.*
- APHA, *Standard Methods for the Examination of Water and Wastewater,* 18th Edition, 19th, 20th, 21st, and on-line Editions.
- *U.S. Department of Energy Order 414.1B, Quality Assurance, Approved April 29, 2004.*
- *U.S. Department of Energy Order 414.1C, Quality Assurance, June 17, 2005.*

- *U.S. Department of Energy Order 414.1D, Quality Assurance, April 25, 2011*
- Nuclear Regulatory Commission (NRC) Quality Assurance Requirements.
- Marine Protection, Research, and Sanctuaries Act (MPRSA).
- Toxic Substances Control Act (TSCA).

3.2 Terms and Definitions

A Quality Assurance Program is a company-wide system designed to ensure that data produced by the laboratory conforms to the standards set by state and/or federal regulations. The program functions at the management level through company goals and management policies, and at the analytical level through Standard Operating Procedures (SOPs) and quality control. The TestAmerica program is designed to minimize systematic error, encourage constructive, documented problem solving, and provide a framework for continuous improvement within the organization.

Refer to Appendix 2 for the Glossary/Acronyms.

3.3 Scope / Fields of Testing

The laboratory analyzes a broad range of environmental and industrial samples every month. Sample matrices vary among air, drinking water, effluent water, groundwater, hazardous waste, sludge, tissue and soils. The Quality Assurance Program contains specific procedures and methods to test samples of differing matrices for chemical, physical and biological parameters. The Program also contains guidelines on maintaining documentation of analytical processes, reviewing results, servicing clients and tracking samples through the laboratory. The technical and service requirements of all analytical requests are thoroughly evaluated before commitments are made to accept the work. Measurements are made using published reference methods or methods developed and validated by the laboratory.

The methods covered by this manual include the most frequently requested methodologies needed to provide analytical services in the United States and its territories. The specific list of test methods used by the laboratory can be found in Appendix 4. The approach of this manual is to define the minimum level of quality assurance and quality control necessary to meet these requirements. All methods performed by the laboratory shall meet these criteria as appropriate. In some instances, quality assurance project plans (QAPPs), project specific data quality objectives (DQOs) or local regulations may require criteria other than those contained in this manual. In these cases, the laboratory will abide by the requested criteria following review and acceptance of the requirements by the Laboratory Director and the Quality Assurance (QA) Manager. In some cases, QAPPs and DQOs may specify less stringent requirements. The Laboratory Director and the QA Manager must determine if it is in the lab's best interest to follow the less stringent requirements.

3.4 Management of the Manual

3.4.1 Review Process

The template on which this manual is based is reviewed annually by Corporate Quality Management Personnel to assure that it remains in compliance with Section 3.1. This manual itself is reviewed annually by senior laboratory management to assure that it reflects current practices and meets the requirements of the laboratory's clients and regulators as well as the CQMP. Occasionally, the manual may need changes in order to meet new or changing regulations and operations. The QA Manager will review the changes in the normal course of business and incorporate changes into revised sections of the document. All updates will be reviewed by the senior laboratory management staff. The laboratory updates and approves such changes according to our Document Control & Updating procedures (refer to SOP No. WS-QA-0021).

SECTION 4. MANAGEMENT REQUIREMENTS

4.1 Overview

TestAmerica Sacramento is a local operating unit of TestAmerica Laboratories, Inc. The organizational structure, responsibilities and authorities of the corporate staff of TestAmerica Laboratories, Inc. are presented in the CQMP. The laboratory has day-to-day independent operational authority overseen by corporate officers (e.g., Chief Executive Officer, Executive VP Operations, Corporate Quality, etc.). The laboratory operational and support staff work under the direction of the Laboratory Director. The organizational structure for both Corporate & TestAmerica Sacramento is presented in Figure 4-1.

4.2 Roles and Responsibilities

In order for the Quality Assurance Program to function properly, all members of the staff must clearly understand and meet their individual responsibilities as they relate to the quality program. The following descriptions briefly define each role in its relationship to the Quality Assurance Program.

4.2.1 Additional Requirements for Laboratories

The responsibility for quality resides with every employee of the laboratory. All employees have access to the QAM, are trained to this manual, and are responsible for upholding the standards therein. Each person carries out his/her daily tasks in a manner consistent with the goals and in accordance with the procedures in this manual and the laboratory's SOPs. Role descriptions for Corporate personnel are defined in the CQMP. This manual is specific to the operations of TestAmerica's Sacramento laboratory.

4.2.2 President and Chief Executive Officer (CEO)

The President and CEO is a member of the Board of Directors and is ultimately responsible for the quality and performance of all TestAmerica facilities. The President and CEO establishes the overall quality standard and data integrity program for the Analytical Business, providing the necessary leadership and resources to assure that the standard and integrity program are met.

4.2.3 Senior Vice President of Operations (SVPO)

The COO reports directly to the President and CEO of TestAmerica. The SVPO~~VPO~~ oversees the operations of all TestAmerica. The VP's of Operations report directly to the SVPO.

4.2.4 Vice President of Operations

Each VP of Operations reports directly to the Senior VP of Operations and is a part of the Executive Committee. Each VP of Operations is responsible for the overall administrative and operational management of their respective laboratories. The VP's responsibilities include allocation of personnel and resources, long-term planning, goal setting, and achieving the financial, business, and quality objectives of TestAmerica. The VP's ensure timely compliance with Corporate Management directives, policies, and management systems reviews. The VP's are also responsible for restricting any laboratory from performing analyses that cannot be consistently and successfully performed to meet the standards set forth in this manual.

4.2.5 Vice President of Quality and Environmental Health and Safety (VP-QA/EHS)

The Vice President (VP) of QA/EHS reports directly to the President and CEO. With the aid of the Executive Committee, Laboratory Directors, Quality Directors, Safety Manager, EH&S Coordinators and QA Managers, the VP-QA/EHS has the responsibility for the establishment, general overview and Corporate maintenance of the Quality Assurance and EH&S Programs within TestAmerica. Additional responsibilities include:

- Review of QA/QC and EHS aspects of Corporate SOPs & Policies, national projects and expansions or changes in services.
- Work with various organizations outside of TestAmerica to further the development of quality standards and represent TestAmerica at various trade meetings.
- Preparation of a monthly report that includes quality metrics across the analytical laboratories and a summary of any quality related initiatives and issues.
- Preparation of a monthly report that includes EH&S metrics across the analytical laboratories and a summary of any EH&S related initiatives and issues.
- Work with various organizations outside of TestAmerica to further the development of quality standards and represent TestAmerica at various trade meetings.
- With the assistance of the Corporate Senior Management Teams and the EHS Director~~s~~, development and implementation of the TestAmerica Environmental, Health and Safety Program.

4.2.6 Vice President of Client Service

The VP of Client Services leads the Client Service Organization (CSO) and is responsible for client satisfaction, driving operational excellence and improving client responsiveness. The VP provides direction to the Client Service Directors, Programs Managers and Project Managers.

4.2.7 Quality Assessment Director

The Quality Assessment Director reports to the VP-QA/EHS. The Quality Assessment Director has QA oversight of laboratories; responsible for the internal audit system, schedule and procedure; monitors laboratory internal audit findings; identifies common laboratory weaknesses; and monitors corrective action closures. Together with the Quality Compliance Director, the Quality Systems Director, and the VP-QA/EHS, the Quality Assessment Director has the responsibility for the establishment, general overview and maintenance of the Analytical Quality Assurance Program within TestAmerica.

4.2.8 Quality Compliance Director

The Quality Compliance Director reports to the VP-QA/EHS. The Quality Compliance Director has QA oversight of laboratories; monitors and communicates DoD / DoE requirements; develops corporate tools for ensuring and improving compliance; develops corporate assessment tools; identifies common laboratory weaknesses; and monitors corrective action closures. Together with the Quality Assessment Director, Quality Systems Director and the VP-QA/EHS, the Quality Compliance Director has the responsibility for the establishment, general overview and maintenance of the Analytical Quality Assurance Program within TestAmerica.

4.2.9 Quality Systems Director

The Quality Systems Director reports to the VP-QA/EHS. The Quality Systems Director has QA oversight of laboratories; develops quality policies, procedures and management tools; monitors and communicates regulatory and certification requirements; identifies common laboratory weaknesses; and monitors corrective action closures. Together with the Quality Assessment Director, Quality Compliance Director and the VP-QA/EHS, the Quality Systems Director has the responsibility for the establishment, general overview and maintenance of the Analytical Quality Assurance Program within TestAmerica.

4.2.10 Quality Information Manager

The Quality Information Manager is responsible for managing all company official documents (e.g., Policies, Procedures, Work Instructions), the company's accreditation database, intranet websites, external laboratory subcontracting, regulatory limits for clients on the company's TotalAccess website; internal and external client support for various company groups (e.g., Client Services, EH&S, Legal, IT, Sales) for both quality and operational functions. The Quality Information Manager reports to the VP-QA/EHS; and works alongside the Quality Assessment, Quality Compliance and Quality System Directors and EHS Managers to support both the Analytical Quality Assurance and EHS Programs within TestAmerica.

4.2.11 Technical Services Director

The Technical Services Director is responsible for establishing, implementing and communicating TestAmerica's Analytical Business's Technical Policies, SOPs, and Manuals. Other responsibilities include conducting technical assessments as required, acting as a technical resource in national contracts review, coordinating new technologies, establishing best practices, advising staff on technology advances, innovations, and applications.

4.2.12 Ethics and Compliance Officers (ECOs)

TestAmerica has designated two senior members of the Corporate staff to fulfill the role of Ethics and Compliance Officer (ECO) – Corporate Counsel & VP of Human Resources and the VP-QA/EHS. Each ECO acts as a back-up to the other ECO and both are involved when data investigations occur. Each ECO has a direct line of communication to the entire senior Corporate and lab management staff.

The ECOs ensure that the organization distributes the data integrity and ethical practices policies to all employees and ensures annual trainings and orientation of new hires to the ethics program and its policies. The ECO is responsible for establishing a mechanism to foster employee reporting of incidents of illegal, unethical, or improper practices in a safe and confidential environment.

The ECOs monitor and audit procedures to determine compliance with policies and to make recommendations for policy enhancements to the President and CEO, VPOs, Laboratory Director or other appropriate individuals within the laboratory. The ECO will assist the laboratory QA Manager in the coordination of internal auditing of ethical policy related activities and processes within the laboratory, in conjunction with the laboratories regular internal auditing function.

The ECOs will also participate in investigations of alleged violations of policies and work with the appropriate internal departments to investigate misconduct, remedy the situation, and prevent recurrence of any such activity.

4.2.13 Chief Information Officer (CIO)

The CIO is responsible for establishing, implementing and communicating TestAmerica's Information Technology (IT) Policies, SOPs and Manuals. Other responsibilities include coordinating new technologies, development of electronic communication tools such as TestAmerica's intranet and internet sites, ensuring data security and documentation of software, ensuring compliance with the NELAC standard, and assistance in establishing, updating, and maintaining Laboratory Information Management Systems (LIMS) at the various TestAmerica facilities.

4.2.14 Environmental Health and Safety Managers (Corporate)

The EHS Managers report directly to the VP-QA/EHS. The EHS Managers are responsible for the development and implementation of the TestAmerica Environmental, Health and Safety program. Responsibilities include:

- Consolidation and tracking all safety and health-related information and reports for the company, and managing compliance activities for TestAmerica locations.
- Coordination/preparation of the corporate Environmental, Health and Safety Manual Template that is used by each laboratory to prepare its own laboratory-specific Safety Manual/ CHP.
- Preparation of information and training materials for laboratory EHS Coordinators.
- Assistance in the internal and external coordination of employee exposure and medical monitoring programs to insure compliance with applicable safety and health regulations.
- Serving as Department of Transportation (D.O.T.) focal point and providing technical assistance to location management.
- Serving as Hazardous Waste Management main contact and providing technical assistance to location management.

4.2.15 Laboratory Director

TestAmerica Sacramento's Laboratory Director is responsible for the overall quality, safety, financial, technical, human resource and service performance of the laboratory and reports to their respective VP of Operations. The Laboratory Director provides the resources necessary to implement and maintain an effective and comprehensive Quality Assurance and Data Integrity Program.

Specific responsibilities include, but are not limited to:

- Providing one or more technical managers for the appropriate fields of testing. If the Technical Manager is absent for a period of time exceeding 15 calendar days, the Laboratory Director must designate another full time staff member meeting the qualifications of the Technical Manager to temporarily perform this function. If the absence

exceeds 65 consecutive calendar days, the primary accrediting authority must be notified in writing.

- Ensuring that all analysts and supervisors have the appropriate education and training to properly carry out the duties assigned to them and ensures that this training has been documented.
- Ensuring that personnel are free from any commercial, financial and other undue pressures which might adversely affect the quality of their work.
- Ensuring TestAmerica's human resource policies are adhered to and maintained.
- Ensuring that sufficient numbers of qualified personnel are employed to supervise and perform the work of the laboratory.
- Ensuring that appropriate corrective actions are taken to address analyses identified as requiring such actions by internal and external performance or procedural audits.
- Procedures that do not meet the standards set forth in the QAM or laboratory SOPs may be temporarily suspended by the Laboratory Director.
- Reviewing and approving all SOPs prior to their implementation and ensures all approved SOPs are implemented and adhered to.
- Pursuing and maintaining appropriate laboratory certification and contract approvals.
- Supporting ISO 17025 requirements.
- Supporting DoD/DOE ELAP requirements.
- Supporting The NELAC Institute (TNI) Standard requirements
- Ensuring client specific reporting and quality control requirements are met.
- Directing the management team, consisting of the QA Manager, the Operations Manager, the EH&S Coordinator and the Office Manager as direct reports.

4.2.16 Quality Assurance (QA) Manager or Designee

The QA Manager has responsibility and authority to ensure the continuous implementation of the quality system. The QA Manager reports directly to the Laboratory Director and their Corporate Quality Director. This person is able to evaluate data objectively and perform assessments without outside (e.g., managerial) influence. Corporate QA may be used as a resource in dealing with regulatory requirements, certifications and other quality assurance related items. This person has documented training and/or experience in QA/QC procedures and the laboratory's Quality System. The QA Manager directs the activities of the QA officers to accomplish specific responsibilities, which include, but are not limited to:

- Serving as the focal point for QA/QC in the laboratory.
- Having functions independent from laboratory operations for which he/she has quality assurance oversight.
- Maintaining and updating the QAM.

- Monitoring and evaluating laboratory certifications; scheduling proficiency testing samples.
- Monitoring and communicating regulatory changes that may affect the laboratory to management.
- Training and advising the laboratory staff on quality assurance/quality control procedures that are pertinent to their daily activities.
- Having a general knowledge of the analytical test methods for which data audit/review is performed (and/or having the means of getting this information when needed).
- Arranging for or conducting internal audits on quality systems and the technical operation.
- Maintaining records of all ethics-related training, including the type and proof of attendance.
- Maintaining, improving, and evaluating the corrective action database and the corrective and preventive action systems.
- Notifying laboratory management of deficiencies in the quality system and ensuring corrective action is taken. Procedures that do not meet the standards set forth in the QAM or laboratory SOPs shall be investigated following procedures outlined in Section 12 and if deemed necessary may be temporarily suspended during the investigation.
- Objectively monitoring standards of performance in quality control and quality assurance without outside (e.g., managerial) influence.
- Coordinating document control of SOPs, MDLs, control limits, and miscellaneous forms and information.
- Reviewing external audit reports and data validation requests.
- Following-up with audits to ensure client QAPP requirements are met.
- Establishing reporting schedule and preparation of various quality reports for the Laboratory Director, clients and/or Corporate QA.
- Developing suggestions and recommendations to improve quality systems.
- Researching current state and federal requirements and guidelines.
- Directing the QA team to enable communication and to distribute duties and responsibilities.
- Ensuring communication with laboratory staff and monitoring standards of performance to ensure that systems are in place to produce the level of quality as defined in this document.
- Evaluating of the thoroughness and effectiveness of training.
- Assuring compliance with ISO 17025.
- Assuring compliance with DoD/DOE ELAP.
- Assuring compliance with The NELAC Institute (TNI) Standard.

4.2.17 Technical Manager (Manager of Operations) or Designee

The Technical Manager(s) (noted as Manager of Operations on the organizational chart) report(s) directly to the Laboratory Director. He/she is accountable for all analyses and analysts under their experienced supervision and for compliance with the ISO 17025 Standard. The scope of responsibility ranges from the new-hire process and existing technology through the ongoing training and development programs for existing analysts and new instrumentation. Specific responsibilities include, but are not limited to:

- Exercising day-to-day supervision of laboratory operations for the appropriate field of accreditation and reporting of results. Coordinating, writing, and reviewing preparation of all test methods, i.e., SOPs, with regard to quality, integrity, regulatory and optimum and efficient production techniques, and subsequent analyst training and interpretation of the SOPs for implementation and unusual project samples. He/she insures that the SOPs are properly managed and adhered to at the bench. He/she develops standard costing of SOPs to include supplies, labor, overhead, and capacity (design versus demonstrated versus first run yield) utilization.

- Reviewing and approving, with input from the QA Manager, proposals from marketing, in accordance with an established procedure for the review of requests and contracts. This procedure addresses the adequate definition of methods to be used for analysis and any limitations, the laboratory's capability and resources, the client's expectations. Differences are resolved before the contract is signed and work begins. A system documenting any significant changes is maintained, as well as pertinent discussions with the client regarding their requirements or the results of the analyses during the performance of the contract. All work subcontracted by the laboratory must be approved by the client. Any deviations from the contract must be disclosed to the client. Once the work has begun, any amendments to the contract must be discussed with the client and so documented.

- Monitoring the validity of the analyses performed and data generated in the laboratory. This activity begins with reviewing and supporting all new business contracts, insuring data quality, analyzing internal and external non-conformances to identify root cause issues and implementing the resulting corrective and preventive actions, facilitating the data review process (training, development, and accountability at the bench), and providing technical and troubleshooting expertise on routine and unusual or complex problems.

- Providing training and development programs to applicable laboratory staff as new hires and, subsequently, on a scheduled basis. Training includes instruction on calculations, instrumentation management to include troubleshooting and preventive maintenance.

- Enhancing efficiency and improving quality through technical advances and improved LIMS utilization. Capital forecasting and instrument life cycle planning for second generation methods and instruments as well as asset inventory management.

- Coordinating sample management from "cradle to grave," insuring that no time is lost in locating samples.

- Scheduling all QA/QC-related requirements for compliance, e.g., MDLs, etc.

- Directing department personnel to communicate quality, technical, personnel, and instrumental issues for a consistent team approach.

- Complying with ISO 17025, The NELAC Institute (TNI) Standard, DoD/DOE ELAP and the various QC programs implemented at the Sacramento laboratory.

4.2.18 Client Services Manager

The CSM reports directly to the Client Service Director (Western Region) and indirectly to the Laboratory Director. The CSM serves as the interface between the laboratory's Project Management team, technical departments, and clients. The CSM shall:

- Oversee training and growth of the Project Management team.
- Act as technical liaison for the Project Management team.
- Provide human resource management support to the Project Management team.
- Assist PMs with responses to client inquiries or with resolutions to problems or complaints.
- Ensure that client specifications, when known, are met by communicating project and QA requirements to the laboratory.
- Notify Department Managers or supervisors of incoming projects and sample delivery schedules.
- Discuss with client any project-related problems, resolve service issues, and coordinate technical details with the laboratory staff.
- Monitor the status of projects in-house to ensure timely and accurate delivery of reports.
- Prepare price quotes or project bids.

4.2.19 Manager of Project Managers

The Manager of Project Management reports to the Regional Client Services Director and serves as the interface between the laboratory's technical departments and the laboratory's clients. The staff consists of the Project Management team. With the overall goal of total client satisfaction, the duties of this position are outlined below:

- Managing technical training and growth of the Project Management team
- Serving as technical liaison for the Project Management team
- Providing human resource management of the Project Management team
- Ensuring that clients receive the proper sampling supplies
- Overseeing response to client inquiries concerning sample status
- Assisting clients regarding the resolution of problems concerning COC
- Ensuring that client specifications, when known, are met by communicating project and quality assurance requirements to the laboratory
- Notifying the supervisors of incoming projects and sample delivery schedules
- Being accountable to clients for communicating sample progress in daily status meeting with agreed-upon due dates

- Discussing with clients any project-related problems, resolving service issues, and coordinating technical details with the laboratory staff
- Providing information to staff with respect to specific quotes, sample log-in review, and final report completeness
- Monitoring the status of all data package projects in-house to ensure timely and accurate delivery of reports
- Informing clients of data package-related problems and resolve service issues
- Coordinating requests for sample containers and other services (data packages)

4.2.20 Project Manager

Project Managers are a liaison between the laboratory's clients and the analytical staff. They report directly to the Manager of Program Management. The Project Managers have signature authority for final reports, and review project data packages for completeness and compliance with client needs and quality requirements.
The Project Manager's responsibilities include:

- Ensuring client specifications are met by communicating project and quality assurance requirements to the laboratory
- Notifying laboratory personnel of incoming projects and sample delivery schedules
- Monitoring the status of all projects in-house to ensure timely delivery of reports
- Informing clients of project-related problems, resolving service issues and coordinating technical issues with the laboratory staff
- Coordinating client requests for sample containers and other services
- Scheduling sample pick-ups from client offices or project sites and notifying the laboratory staff of incoming samples
- Coordinating subcontract work
- Assisting clients in procuring the proper sampling supplies
- Responding to client inquiries concerning sample status
- Assisting clients with resolution of problems concerning Chains-of-Custody
- Invoicing completed data packages
- Generating credit or debit invoices to ensure proper payment

4.2.21 Project Administrator

The Project Administrator reports to the Manager of Project Management and designated Project Manager. The Project Administrator assists the Project Manager in servicing the client's needs and communicating those needs to the laboratory. The Project Administrator's responsibilities include:

- Collating data reports, expanded deliverables, and electronic data deliverables (EDDs) for delivery to clients.
- Writing case narratives accompanying data packages to communicate anomalies to clients
- Coordinating client requests for sample containers and other services
- Assisting clients in procuring the proper sampling supplies
- Assisting Project Managers in changing compound lists, TAT, and other LIMS set up tasks.
- Monitoring report due dates for timely delivery
- Invoicing completed data packages
- Generating credit or debit invoices to ensure proper payment

4.2.22 Department Manager, Team Leader, or Supervisor

Department Managers report directly to the Operations Manager. They supervise the daily activities of analysis within a given laboratory area, and either oversee the review and approval, or perform the review and approval of all analytical data within that area.

Specific responsibilities include, but are not limited to:

- Exercising day-to-day supervision of laboratory operations for the appropriate field of accreditation and reporting of results.
- Ensuring that analysts in their department adhere to applicable SOPs and the QA Manual.
- Coordinating the writing and reviewing of documentation for all test methods, i.e., SOPs, with regard to quality, integrity, regulatory requirements and optimum and efficient production techniques, and subsequent analyst training and interpretation of the SOPs for implementation and unusual project samples.
- Monitoring the validity of the analyses performed and data generated in the laboratory. This activity includes insuring data quality, analyzing internal and external non-conformances to identify root cause issues and implementing the resulting corrective and preventive actions, facilitating the data review process (training, development, and accountability at the bench), and providing technical and troubleshooting expertise on routine and unusual or complex problems.
- Providing training and development programs to applicable laboratory staff as new hires and, subsequently, on a scheduled basis. Training includes instruction on calculations, instrumentation management to include troubleshooting and preventive maintenance.
- Enhancing efficiency and improving quality through technical advances, improved LIMS utilization, capital forecasting and instrument life cycle planning for second generation methods and instruments as well as asset inventory management.
- Scheduling all QA/QC-related requirements for compliance, e.g., MDLs, etc.
- Coordinating audit responses with the QA Manager.

- Complying with ISO 17025, The NELAC Institute (TNI) Standard, DoD/DOE QSM and the various QC programs implemented at the Sacramento laboratory.
- Participating in the selection, training (familiarization with SOP, QC, Safety and computer systems), developing performance objectives and standards of performance, appraising (measurement of objectives), scheduling, counseling, disciplining, and motivating analysts and documenting these activities in accordance with systems developed by the QA and Human Resources Departments.
- Evaluating staffing sufficiency and overtime needs.
- Encouraging the development of analysts to become cross-trained in various methods and/or operate multiple instruments efficiently while performing maintenance and documentation, self-supervise, and function as a department team.
- Providing guidance to analysts in resolving problems encountered daily during sample prep/analysis in conjunction with the Operations Manager, and/or QA Manager. Each is responsible for 100% of the data review and documentation, non-conformance and corrective actions, the timely and accurate completion of performance evaluation samples and MDLs, for his/her department.
- Ensuring all logbooks are maintained, current, reviewed, and properly labeled or archived.
- Reporting all non-conformance conditions to the QA Manager, Operations Manager, and/or Laboratory Director.
- Ensuring that preventive maintenance is performed on instrumentation as detailed in the QA Manual or SOPs. He/She has responsibility for developing and implementing a system for preventive maintenance, troubleshooting, and repairing or arranging for repair of instruments.
- Maintaining adequate and valid inventory of reagents, standards, spare parts, and other relevant resources required to perform daily analysis.
- Achieving optimum turnaround time on analyses and compliance with holding times.
- Conducting efficiency and cost control evaluations on an ongoing basis to determine optimization of labor, supplies, overtime, first-run yield, capacity (designed vs. demonstrated), second- and third-generation production techniques/instruments, and long term needs for budgetary planning.

4.2.23 Analyst

Analysts report to their respective Department Managers. They perform sample analyses and generate analytical data in accordance with documented procedures.

The responsibilities of the analysts are listed below:

- Collecting and preparing materials and supplies for the laboratory
- Retrieving samples from Sample Control for analysis

- Performing sample preparation by adhering to analytical and quality control protocols prescribed by current SOPs, this QA Manual, and project-specific plans honestly, accurately, timely, safely, and in the most cost-effective manner.
- Documenting standard and sample preparation, sample matrix effects, and any observed non-conformance on worklists, benchsheets, lab notebooks and/or the Non-Conformance Database.
- Reporting all non-conformance situations, sample preparation problems, matrix problems and QC failures, which might affect the reliability of the data, to their supervisor, the Technical Manager, and/or the QA Manager or member of QA staff.
- Performing 100% review of the data generated prior to entering and submitting for secondary level review.
- Suggesting method improvements to their supervisor, the Technical Manager, and the QA Manager. These improvements, if approved, will be incorporated. Providing ideas for the optimum performance of their assigned area, for example, through the proper cleaning and maintenance of the assigned instruments and equipment, are encouraged.
- Working cohesively as a team member in their department to achieve the goals of accurate results, optimum turnaround time, cost effectiveness, cleanliness, complete documentation, and personal knowledge of environmental analysis.

4.2.24 Sample Custodian

The Sample Custodian ensures the implementation of proper sample receipt procedures, including maintaining chain-of-custody. The Sample Custodian logs samples into the LIMS and ensures that all samples are stored appropriately. Duties for the Sample Custodian include the following:

- Receiving and unloading samples or consignments in accordance with DOT regulations
- Verifying samples against the Chain of Custody (COC)
- Logging samples into the LIMS to assign a lot number for tracking purposes, and notifying Project Managers of any irregularities with the sample shipment.
- Labeling samples with lot number assigned and deliver the samples to the appropriate labs for analysis daily
- Monitoring freezer and cooler temperatures daily to confirm that the readings are within SOP guidelines
- Shipping all subcontracted samples to designated lab in accordance with DOT regulations as needed.

4.2.25 Quality Assurance Staff

The Quality Assurance staff members report to the QA manager. They have responsibility and authority to ensure the continuous implementation of the quality system based on ISO 17025, through involvement in the following activities:

- Assisting the QA Manager in performing the annual internal laboratory audits, compiling the evaluation, and coordinating the development of an action plan to address any deficiency identified.
- Facilitating external audits, coordinating with the QA Manager and Laboratory Staff to address any deficiencies noted at the time of the audit and subsequently presented in the final audit report.
- Assisting the QA Manager in the preparation of new SOPs and in the maintenance of existing SOPs, coordinating annual reviews and updates.
- Managing the performance testing (PT) studies, coordinating follow-up studies for failed analytes, and working with QA Manager and Laboratory Staff to complete needed corrective action reports.
- Serving as a project manager for proficiency testing samples and other QC samples.
- Reviewing and maintaining personnel training records.
- Assisting the QA Manager and Project Management Group in the review of program plans for consistency with organizational and contractual requirements. Summarize and convey to appropriate personnel anomalies or inconsistencies observed in the review process.
- Managing certifications and accreditations.
- Monitoring for compliance with the following QA Metrics: Temperature Monitoring of refrigeration units; thermometer verifications and calibrations; balance verifications and callibrations; and Eppendorf/pipette calibrations.
- Periodically checking the proper use and review of logbooks.
- Assisting in the technical review of data packages which require QA review.
- Assisting the QA Manager in maintaining the laboratory's reference data to keep it current and accurate.
- Preparing certification applications for states as directed by QA Manager.
- Reviewing and maintaining personnel training records.
- Performing document control maintenance.
- Assisting departments in generating MDL spreadsheets and calculations, reviewing MDL studies submitted to QA.
- Assisting in control limit generation.
- Ensuring maintenance of records archives.

- Maintaining historical indices for all technical records including SOPs, QC records, laboratory data, etc.
- Assisting the QA Manager in meeting the responsibilities of the QA Department as described in laboratory policies and SOPs.

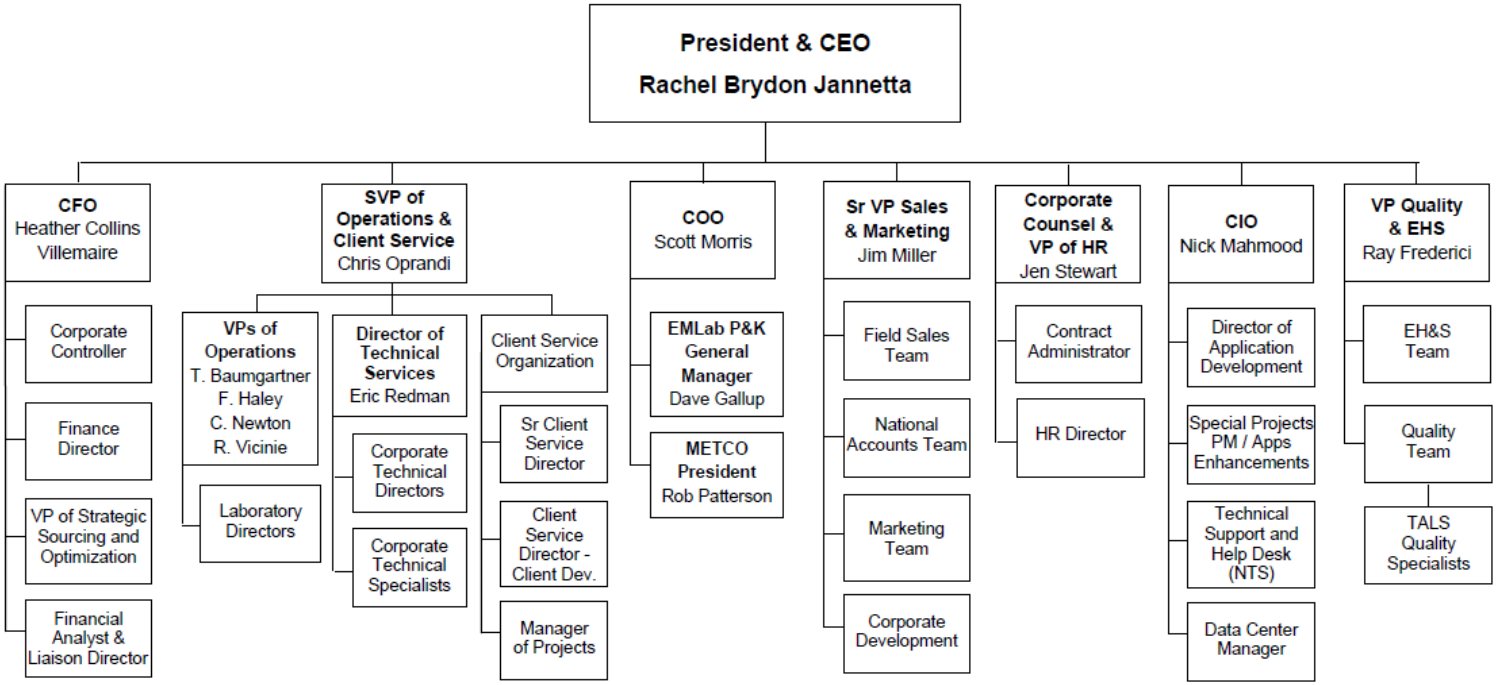
4.3 Deputies

The following table defines who assumes the responsibilities of key personnel in their absence:

Key Personnel	Deputy
Crystal Pollock - Laboratory Director	Robert Hrabak - Technical Director, Manager of Dioxins, LCMS & Inorganics
Lisa Stafford - Quality Assurance Manager	Russell Evans - Quality Assurance Staff Crystal Pollock - Laboratory Director
Robert Hrabak - Technical Director, Manager of Dioxins, LCMS & Inorganics	Crystal Pollock - Laboratory Director
Koroush Vaziri – Manager of Volatiles, Semivolatiles, & Organic/Dioxin Prep	Robert Hrabak - Technical Director, Manager of Dioxins, LCMS & Inorganics Crystal Pollock - Laboratory Director
Jill Kellmann - Manager of Project Management	David Herbert - Client Relations Manager (Corporate)
Joe Schairer - EHS Coordinator	Richard Kester - Hazardous Materials Specialist

Figure 4-1. Corporate and Laboratory Organization Charts

All organizational charts are current as of the date noted. Contact the laboratory for the most recent organizational chart.



February 27 2017

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Sacramento Laboratory Organization

VP Operations West
Fred Haley
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Laboratory Director
Crystal Pollock
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Corp EH&S/Sac EH&S
Joe Schairer

Corporate QAD
Pam Schemmer

Client Services Dir.
David Herbert

Technical Director
Manager of Dioxin, LC/MS
Metals & General Chemistry
Robert Hrabak
24

Manager of Air, VOA,
Organic / Dioxin Prep. and
Semivolatiles
Koroush Vaziri
57

Manager of
Quality Assurance
Lisa Stafford
3

Alyssa Hannigan
Russell Evans

Manager of
Project Managers
Jill Kellman
10

Aurora Contreras
Cesar Cortes
David Alltucker
Karen Dahl
Laura Turpen
LeeAnn Heathcoat
Linda Laver
Micah Smith
Stephanie Edwards

LC/MS Instruments - 6
Thep Phomsopha (Supv)
Cary Westendorf
John Barnett
Shane Rainey
Shyhara Chandrasena
Thessamon Changnoi* 1/2

Dioxin Data Review - 2
Mary Wolf
Sylvia Krenn

Dioxin Instruments - 5
Adrian Messecar
Kyle Stephens
Saleh Arghestani
Jenjira Dadun
Nuttawut Krongsing*

Metals / Gen Chem - 10
Lan Wang (Supv)
Jason Baynes (Lead)
Cheng Vue
Christopher Hand
Constantin Rusti
Greg Harry
Jenny Do
Maisee Yang
Natasha Merritt
Tiffany Wallace P/T

LCMS Preparation - 6
Veronika Marchenko (Lead)
Cassie Branscum
Horacio Arauz
Jonathan Reed
Kate Kolstad
Nooshin Sharif

Organic Preparation - 8
Amani Royce (Lead)
Christine Martin
Craig Lee
Medina Akbar
Natalia Kuzmenko
Renee Drusylla
Sina Rafieefar
Steve Valmores

Dioxin Prep - 7
Brittney Bingaman
David Do
Ethan Winchester
George Burkett
Miroslava Loera
Patrick Woodbury
Tatyana Lopuga

Semivolatile Instruments - 11
Victoria Nihart (Supv)
Sumaiya Haque (Lead)
Achtara Phantassen*
Apinya Chaijit*
Brian Husong
Farhama Dashti
Karen Russell
Kit Seong Lo
Marc Onishi
Olivia Lardie
Rungtip Sangjumnai* 1/2
Sarah Zeimer
Yun Huang

Sample Admin - 6
Kim Nelson (Supv)
Cheryl Hytrek
Connor Edman
Richard Kester
Shannon Merrill
Troy Turpen

Air Group -9
Steve Scott (Lead)
Ajay Sharda
Alireza Zehgami
Ana Ortiz
Hoseung Lee
Jeff Tecson
Kou Cheng Yang
Shae Van Ommen
Stanley Saechao

Volatiles GC/MS - 6
Melanie Luis (Supv)
Achtara Phantassen*
David Thorsrud
Esfir Popova
Rungtip Sangjumnai* 1/2
Sutaya Sawatthaweekul*
Thessamon Changnoi* 1/2
Virginia Grandfield

Warehouse / Supplies 1
Augustine Delacruz

Local CSO / Corporate Staff

David Herbert	Michelle Prasad
Eric Redman	Pam Schemmer
Karen Wilson	Scott Greene
Karla Buechler	Stephan Puga
Linda Leong	Taryn McKnight
Joe Schairer	

Remote associates are identified by the (Locations) after their name

QA Manager has a direct reporting relationship to both operations leadership and corporate functional leadership

* Remote Reviewers

SECTION 5. QUALITY SYSTEM

5.1 Quality Policy Statement

It is TestAmerica's Policy to:

- Provide data of known quality to its clients by adhering to approved methodologies, regulatory requirements and the QA/QC protocols.
- Effectively manage all aspects of the laboratory and business operations by the highest ethical standards.
- Continually improve systems and provide support to quality improvement efforts in laboratory, administrative and managerial activities. TestAmerica recognizes that the implementation of a quality assurance program requires management's commitment and support as well as the involvement of the entire staff.
- Provide clients with the highest level of professionalism and the best service practices in the industry.
- Comply with the ISO/IEC 17025:2005(E) International Standard, the 2009 TNI Standard and to continually improve the effectiveness of the management system.

Every staff member at the laboratory plays an integral part in quality assurance and is held responsible and accountable for the quality of their work. It is, therefore, required that all laboratory personnel are trained and agree to comply with applicable procedures and requirements established by this document.

5.2 Ethics and Data Integrity

TestAmerica is committed to ensuring the integrity of its data and meeting the quality needs of its clients. The elements of TestAmerica's Ethics and Data Integrity Program include:

- An Ethics Policy (Corporate Policy No. CW-L-P-004) and Employee Ethics Statements.
- Ethics and Compliance Officers (ECOs).
- A Training Program.
- Self-governance through disciplinary action for violations.
- A Confidential mechanism for anonymously reporting alleged misconduct and a means for conducting internal investigations of all alleged misconduct (Corporate SOP No. CW-L-S-002).
- Procedures and guidance for recalling data if necessary (Corporate SOP No. CW-L-S-002).
- Effective external and internal monitoring system that includes procedures for internal audits (Section 15).
- Produce results, which are accurate and include QA/QC information that meets client pre-defined Data Quality Objectives (DQOs).
- Present services in a confidential, honest and forthright manner.

- Provide employees with guidelines and an understanding of the Ethical and Quality Standards of our Industry.
- Operate our facilities in a manner that protects the environment and the health and safety of employees and the public.
- Obey all pertinent federal, state and local laws and regulations and encourage other members of our industry to do the same.
- Educate clients as to the extent and kinds of services available.
- Assert competency only for work for which adequate personnel and equipment are available and for which adequate preparation has been made.
- Promote the status of environmental laboratories, their employees, and the value of services rendered by them.

5.3 Quality System Documentation

The laboratory's Quality System is communicated through a variety of documents.

- Quality Assurance Manual – Each laboratory has a lab-specific quality assurance manual.
- Corporate SOPs and Policies – Corporate SOPs and Policies are developed for use by all relevant laboratories. They are incorporated into the laboratory's normal SOP distribution, training and tracking system. Corporate SOPs may be general or technical.
- Work Instructions – A subset of procedural steps, tasks or forms associated with an operation of a management system (e.g., checklists, preformatted bench sheets, forms).
- Laboratory SOPs – General and Technical
- Laboratory QA/QC Policy Memorandums

5.3.1 Order of Precedence

In the event of a conflict or discrepancy between policies, the order of precedence is as follows:

- Corporate Quality Management Plan (CQMP)
- Corporate SOPs and Policies
- Laboratory QA/QC Policy Memorandum
- Laboratory Quality Assurance Manual (QAM)
- Laboratory SOPs and Policies
- Other (Work Instructions (WI), memos, flow charts, etc.)

Note: The laboratory has the responsibility and authority to operate in compliance with regulatory requirements of the jurisdiction in which the work is performed. Where the CQMP conflicts with those regulatory requirements, the regulatory requirements of the jurisdiction shall hold primacy. The laboratory's QAM shall take precedence over the CQMP in those cases.

5.4 QA/QC Objectives for the Measurement of Data

Quality Assurance (QA) and Quality Control (QC) are activities undertaken to achieve the goal of producing data that accurately characterizes the sites or materials that have been sampled. Quality Assurance is generally understood to be more comprehensive than Quality Control. Quality Assurance can be defined as the integrated system of activities that ensures that a product or service meets defined standards.

Quality Control is generally understood to be limited to the analyses of samples and to be synonymous with the term *"analytical quality control"*. QC refers to the routine application of statistically based procedures to evaluate and control the accuracy of results from analytical measurements. The QC program includes procedures for estimating and controlling precision and bias and for determining reporting limits.

Request for Proposals (RFPs) and Quality Assurance Project Plans (QAPP) provide a mechanism for the client and the laboratory to discuss the data quality objectives in order to ensure that analytical services closely correspond to client needs. The client is responsible for developing the QAPP. In order to ensure the ability of the laboratory to meet the Data Quality Objectives (DQOs) specified in the QAPP, clients are advised to allow time for the laboratory to review the QAPP before being finalized. Additionally, the laboratory will provide support to the client for developing the sections of the QAPP that concern laboratory activities.

Historically, laboratories have described their QC objectives in terms of precision, accuracy, representativeness, comparability, completeness, selectivity and sensitivity (PARCCSS).

5.4.1 Precision

The laboratory objective for precision is to meet the performance for precision demonstrated for the methods on similar samples and to meet data quality objectives of the EPA and/or other regulatory programs. Precision is defined as the degree of reproducibility of measurements under a given set of analytical conditions (exclusive of field sampling variability). Precision is documented on the basis of replicate analysis, usually duplicate or matrix spike (MS) duplicate samples.

5.4.2 Accuracy

The laboratory objective for accuracy is to meet the performance for accuracy demonstrated for the methods on similar samples and to meet data quality objectives of the EPA and/or other regulatory programs. Accuracy is defined as the degree of bias in a measurement system. Accuracy may be documented through the use of laboratory control samples (LCS) and/or MS. A statement of accuracy is expressed as an interval of acceptance recovery about the mean recovery.

5.4.3 Representativeness

The laboratory objective for representativeness is to provide data which is representative of the sampled medium. Representativeness is defined as the degree to which data represent a characteristic of a population or set of samples and is a measurement of both analytical and field sampling precision. The representativeness of the analytical data is a function of the procedures used in procuring and processing the samples. The representativeness can be documented by the relative percent difference between separately procured, but otherwise identical samples or sample aliquots.

The representativeness of the data from the sampling sites depends on both the sampling procedures and the analytical procedures. The laboratory may provide guidance to the client regarding proper sampling and handling methods in order to assure the integrity of the samples.

5.4.4 Comparability

The comparability objective is to provide analytical data for which the accuracy, precision, representativeness and reporting limit statistics are similar to these quality indicators generated by other laboratories for similar samples, and data generated by the laboratory over time.

The comparability objective is documented by inter-laboratory studies carried out by regulatory agencies or carried out for specific projects or contracts, by comparison of periodically generated statements of accuracy, precision and reporting limits with those of other laboratories.

5.4.5 Completeness

The completeness objective for data is 90% (or as specified by a particular project), expressed as the ratio of the valid data to the total data over the course of the project. Data will be considered valid if they are adequate for their intended use. Data usability will be defined in a QAPP, project scope or regulatory requirement. Data validation is the process for reviewing data to determine its usability and completeness. If the completeness objective is not met, actions will be taken internally and with the data user to improve performance. This may take the form of an audit to evaluate the methodology and procedures as possible sources for the difficulty or may result in a recommendation to use a different method.

5.4.6 Selectivity

Selectivity is defined as: The capability of a test method or instrument to respond to a target substance or constituent in the presence of non-target substances. Target analytes are separated from non-target constituents and subsequently identified/detected through one or more of the following, depending on the analytical method: extractions (separation), digestions (separation), inter-element corrections (separation), use of matrix modifiers (separation), specific retention times (separation and identification), confirmations with different columns or detectors (separation and identification), specific wavelengths (identification), specific mass spectra (identification), specific electrodes (separation and identification), etc..

5.4.7 Sensitivity

Sensitivity refers to the amount of analyte necessary to produce a detector response that can be reliably detected (Method Detection Limit) or quantified (Reporting Limit).

5.5 Criteria for Quality Indicators

The laboratory maintains Reference Data in the LIMS that summarizes the precision and accuracy acceptability limits for performed analyses. This data includes an effective date, is updated each time new limits are generated and is managed by the laboratory's QA department. Unless otherwise noted, limits within these tables are laboratory generated. Some acceptability limits are derived from US EPA methods when they are required. Where US EPA method limits are not required, the laboratory has developed limits from evaluation of data from similar matrices. The criteria for development of control limits is contained in SOP WS-QA-0035, "Statistical Process Control / Control Chart" and Section 24.

5.6 Statistical Quality Control

Statistically-derived precision and accuracy limits are required by selected methods (such as SW-846) and programs. The laboratory routinely utilizes statistically-derived limits to evaluate method performance and determine when corrective action is appropriate. The analysts are instructed to use the current limits in the laboratory (dated and approved by the Technical Manager and QA Manager) and entered into the Laboratory Information Management System (LIMS). The Quality Assurance department maintains an archive of all limits used within the laboratory. If a method defines the QC limits, the method limits are used.

If a method requires the generation of historical limits, the lab develops such limits from recent data in the QC database of the LIMS following the guidelines described in SOP WS-QA-0035, "Statistical Process Control / Control Chart" and Section 24. All calculations and limits are documented and dated when approved and effective. On occasion, a client requests contract-specified limits for a specific project.

Current QC limits are entered and maintained in the LIMS analyte database. As sample results and the related QC are entered into LIMS, the sample QC values are compared with the limits in LIMS to determine if they are within the acceptable range. The analyst then evaluates if the sample needs to be rerun or re-extracted/rerun or if a comment should be added to the report explaining the reason for the QC outlier.

5.6.1 QC Charts

As the QC limits are calculated, QC charts are generated showing warning and control limits for the purpose of evaluating trends. The QA Manager evaluates these to determine if adjustments need to be made or for corrective actions to methods. All findings are documented and kept on file. Control charts are generated according to laboratory SOP No. SOP WS-QA-0035, "Statistical Process Control / Control Chart"

5.7 Quality System Metrics

In addition to the QC parameters discussed above, the entire Quality System is evaluated on a monthly basis through the use of specific metrics (refer to Section 16). These metrics are used to drive continuous improvement in the laboratory's Quality System.

SECTION 6. DOCUMENT CONTROL

6.1 Overview

The QA Department is responsible for the control of documents used in the laboratory to ensure that approved, up-to-date documents are in circulation and out-of-date (obsolete) documents are archived or destroyed. The following documents, at a minimum, must be controlled:

- Laboratory Quality Assurance Manual
- Laboratory Standard Operating Procedures (SOP)
- Laboratory Policies
- Work Instructions and Forms
- Corporate Policies and Procedures distributed outside the intranet

Corporate Quality posts Corporate Manuals, SOPs, Policies, Work Instructions, White Papers and Training Materials on the company intranet site. These Corporate documents are only considered controlled when they are read on the intranet site. Printed copies are considered uncontrolled unless the laboratory physically distributes them as controlled documents. A detailed description of the procedure for issuing, authorizing, controlling, distributing, and archiving Corporate documents is found in Corporate SOP No. CW-Q-S-001, Corporate Document Control and Archiving. The laboratory's internal document control procedure is defined in SOP No. WS-QA-0021, "Preparation and Management of Standard Operating Procedures".

The laboratory QA Department also maintains access to various references and document sources integral to the operation of the laboratory. This includes reference methods and regulations. Instrument manuals (hard or electronic copies) are also maintained by the laboratory.

The laboratory maintains control of records for raw analytical data and supporting records such as audit reports and responses, logbooks, standard logs, training files, MDL studies, Proficiency Testing (PT) studies, certifications and related correspondence, and corrective action reports. Raw analytical data consists of bound logbooks, instrument printouts, any other notes, magnetic media, electronic data and final reports.

6.2 Document Approval and Issue

The pertinent elements of a document control system for each document include a unique document title and number, pagination, the total number of pages of the item or an 'end of document' page, the effective date, revision number and the laboratory's name. The QA personnel are responsible for the maintenance of this system.

Controlled documents are authorized by the QA Department. In order to develop a new document, a manager submits an electronic draft to the QA Department for suggestions and approval before use. Upon approval QA personnel add the identifying version information to the document and retains that document as the official document on file. That document is then provided to all applicable operational units (may include electronic access). Controlled

documents are identified as such and records of their distribution are kept by the QA Department. Document control may be achieved by either electronic or hardcopy distribution.

The QA Department maintains a list of the official versions of controlled documents.

Quality System Policies and Procedures will be reviewed at a minimum of every two years (annually for documents applicable to drinking water and DoD/DOE programs), and revised as appropriate. Changes to documents occur when a procedural change warrants.

6.3 Procedures for Document Control Policy

For changes to the QA Manual, refer to SOP No. WS-QA-0021, "Preparation and Management of Standard Operating Procedures". Uncontrolled copies must not be used within the laboratory. Previous revisions and back-up data are stored by the QA department. Electronic copies are stored on the QA share on the local server for the applicable revision, and are accessible using the laboratory's Intranet.

For changes to SOPs, refer to SOP No. CW-Q-S-002, Writing a Standard Operating Procedure SOP and SOP No. WS-QA-0021, Preparation and Management of Standard Operating Procedures". The SOP identified above also defines the process of changes to SOPs.

Forms, worksheets, work instructions and information are organized by department in the QA office. There is a table of contents. Electronic versions are kept on a hard drive in the QA department; hard copies are kept in QA files. The procedure for the care of these documents is in SOP No. WS-QA-0021, "Preparation and Management of Standard Operating Procedures".

6.4 Obsolete Documents

All invalid or obsolete documents are removed, or otherwise prevented from unintended use. The laboratory has specific procedures as described above to accomplish this. In general, obsolete documents are collected from employees according to distribution lists and are marked obsolete on the cover or destroyed. At least one copy of the obsolete document is archived according to SOP No. WS-QA-0021, Preparation and Management of Standard Operating Procedures.

SECTION 7. SERVICE TO THE CLIENT

7.1 Overview

The laboratory has established procedures for the review of work requests and contracts, oral or written. The procedures include evaluation of the laboratory's capability and resources to meet the contract's requirements within the requested time period. All requirements, including the methods to be used, must be adequately defined, documented and understood. For many environmental sampling and analysis programs, testing design is site or program specific and does not necessarily "fit" into a standard laboratory service or product. It is the laboratory's intent to provide both standard and customized environmental laboratory services to our clients.

A thorough review of technical and QC requirements contained in contracts is performed to ensure project success. The appropriateness of requested methods, and the lab's capability to perform them must be established. Projects, proposals and contracts are reviewed for adequately defined requirements and the laboratory's capability to meet those requirements. Alternate test methods that are capable of meeting the clients' requirements may be proposed by the lab. A review of the lab's capability to analyze non-routine analytes is also part of this review process.

All projects, proposals and contracts are reviewed for the client's requirements in terms of compound lists, test methodology requested, sensitivity (detection and reporting levels), accuracy, and precision requirements (% Recovery and RPD). The reviewer ensures that the laboratory's test methods are suitable to achieve these requirements and that the laboratory holds the appropriate certifications and approvals to perform the work. The laboratory and any potential subcontract laboratories must be certified, as required, for all proposed tests.

The laboratory must determine if it has the necessary physical, personnel and information resources to meet the contract, and if the personnel have the expertise needed to perform the testing requested. Each proposal is checked for its impact on the capacity of the laboratory's equipment and personnel. As part of the review, the proposed turnaround time will be checked for feasibility.

Electronic or hard copy deliverable requirements are evaluated against the laboratory's capacity for production of the documentation.

If the laboratory cannot provide all services but intends to subcontract such services, whether to another TestAmerica facility or to an outside firm, this will be documented and discussed with the client prior to contract approval. (Refer to Section 8 for Subcontracting Procedures.)

The laboratory informs the client of the results of the review if it indicates any potential conflict, deficiency, lack of accreditation, or inability of the lab to complete the work satisfactorily. Any discrepancy between the client's requirements and the laboratory's capability to meet those requirements is resolved in writing before acceptance of the contract. It is necessary that the contract be acceptable to both the laboratory and the client. Amendments initiated by the client and/or TestAmerica, are documented in writing.

All contracts, QAPPs, Sampling and Analysis Plans (SAPs), contract amendments, and documented communications become part of the project record.

The same contract review process used for the initial review is repeated when there are amendments to the original contract by the client, and the participating personnel are informed of the changes.

7.2 Review Sequence and Key Personnel

Appropriate personnel will review the work request at each stage of evaluation.

For routine projects and other simple tasks, a review by the Project Manager (PM) is considered adequate. The PM confirms that the laboratory has any required certifications, that it can meet the clients' data quality and reporting requirements and that the lab has the capacity to meet the clients turn around needs. The PM will also get approval by the Laboratory Director to commit to delivery schedules that are shorter than the published standard turnaround times (TATs). The Laboratory Director updates these TATs on a routine basis, and it is the responsibility of CSMs and PMs to review them prior to making commitments for the laboratory.

It is recommended that, where there is a sales person assigned to the account, an attempt should be made to contact that sales person to inform them of the incoming samples.

For new, complex or large projects, the proposed contract is given to the Client Relationship Manager or Proposal Team, who will decide which lab will receive the work based on the scope of work and other requirements, including certification, testing methodology, and available capacity to perform the work. The contract review process is outlined in TestAmerica's Corporate SOP No. CA-L-P-002**,** Contract Compliance Policy.

This review encompasses all facets of the operation. The scope of work is distributed to the appropriate personnel, as needed based on scope of contract, to evaluate all of the requirements shown above (not necessarily in the order below):

- Contract Administrator
- VP of Operations
- Client Relations Manager
- Laboratory Project Manager
- Laboratory and/or Corporate Technical Managers / Directors
- Laboratory and/or Corporate Information Technology Managers/Directors
- Account Executives
- Laboratory and/or Corporate Quality
- Laboratory and/or Corporate Environmental Health and Safety Managers/Directors
- The Laboratory Director reviews the formal laboratory quote and makes final acceptance for their facility.

The Sales Director, Contracts Administrator, Account Executive, or Proposal Coordinator then submits the final proposal to the client.

In the event that one of the above personnel is not available to review the contract, his or her back-up will fulfill the review requirements.

The Contracts Department maintains copies of all signed contracts. TestAmerica Sacramento's Customer Service Organization maintains copies of all signed contracts on the computer network for reference locally.

7.3 Documentation

Appropriate records are maintained for every contract or work request. All stages of the contract review process are documented and include records of any significant changes. These records are archived by client and project in a restricted network folder accessible to laboratory department managers, project managers, and senior managers.

Records are maintained of pertinent discussions with a client relating to the client's requirements or the results of the work during the period of execution of the contract. Each Laboratory Project Manager keeps a phone log of conversations with the client. In addition, all conversations involving notification of important information, or actions directed by the client are documented with a follow up e-mail and archived in the contracts folder or the SDG documentation and case narrative. Instances include change in scope, alterations to the requests listed on a chain of custody, directions to proceed in the event of a non-conformance, and any other conversation that changes the direction of a COC or contract.

7.3.1 Project-Specific Quality Planning

Communication of contract specific technical and QC criteria is an essential activity in ensuring the success of site specific testing programs. To achieve this goal, a PM is assigned to each client. It is the PM's responsibility to ensure that project-specific technical and QC requirements are effectively evaluated and communicated to the laboratory personnel before and during the project. QA department involvement may be needed to assist in the evaluation of custom QC requirements. Quality Assurance Project Plans, if submitted by the client, will be evaluated per policy WS-PQA-0018.

PM's are the primary client contact and they ensure resources are available to meet project requirements. Although PM's do not have direct reports or staff in production, they coordinate opportunities and work with laboratory management and supervisory staff to ensure available resources are sufficient to perform work for the client's project. Project management is positioned between the client and laboratory resources.

Prior to work on a new project, the dissemination of project information and/or project opening meetings may occur to discuss schedules and unique aspects of the project. Items to be discussed may include the project technical profile, turnaround times, holding times, methods, analyte lists, reporting limits, deliverables, sample hazards, or other special requirements. The PM introduces new projects to the laboratory staff through project kick-off meetings or to the supervisory staff during production meetings. These meetings provide direction to the laboratory staff in order to maximize production and client satisfaction, while maintaining quality. In addition, project notes may be associated with each sample batch as a reminder upon sample receipt and analytical processing.

During the project, any change that may occur within an active project is agreed upon between the client/regulatory agency and the PM/laboratory. These changes (e.g., use of a non-standard method or modification of a method) and approvals must be documented prior to implementation. Documentation pertains to any document, e.g., letter, e-mail, variance, contract addendum, which has been signed by both parties.

Such changes are updated to the Quality Assurance Summary (QAS) and introduced to the managers at these meetings. The laboratory staff is then introduced to the modified requirements via the PM or the individual laboratory Technical Manager. After the modification is implemented into the laboratory process, documentation of the modification is made in the case narrative of the data report(s).

The laboratory strongly encourages client visits to the laboratory and for formal/informal information sharing session with employees in order to effectively communicate ongoing client needs as well as project specific details for customized testing programs.

7.4 Special Services

The laboratory cooperates with clients and their representatives to monitor the laboratory's performance in relation to work performed for the client. It is the laboratory's goal to meet all client requirements in addition to statutory and regulatory requirements. The laboratory has procedures to ensure confidentiality to clients (Section 15 and 25).

Note: ISO/IEC 17025 states that a laboratory "shall afford clients or their representatives cooperation to clarify the client's request". This topic is discussed in Section 7.

The laboratory's standard procedures for reporting data are described in Section 25. Special services are also available and provided upon request. These services include:

- Reasonable access for our clients or their representatives to the relevant areas of the laboratory for the witnessing of tests performed for the client.
- Assist client-specified third party data validators as specified in the client's contract.
- Allow the client access to supplemental information that pertains to the analysis of their samples. Note: An additional charge may apply for additional data/information that was not requested prior to the time of sample analysis or previously agreed upon.

7.5 Client Communication

Project managers are the primary communication link to the clients. They shall inform their clients of any delays in project completion as well as any non-conformances in either sample receipt or sample analysis. Project management will maintain ongoing client communication throughout the entire client project.

Any member of the laboratory's senior staff or any of the laboratory's identified technical experts is available to discuss any technical questions or concerns that the client may have.

7.6 Reporting

The laboratory works with our clients to produce any special communication reports required by the contract.

7.7 Client Surveys

The laboratory assesses both positive and negative client feedback. The results are used to improve overall laboratory quality and client service. TestAmerica's Sales and Marketing teams periodically develops lab and client specific surveys to assess client satisfaction.

SECTION 8. SUBCONTRACTING OF TESTS

8.1 Overview

For the purpose of this quality manual, the phrase subcontract laboratory refers to a laboratory external to the TestAmerica laboratories. The phrase "work sharing" refers to internal transfers of samples between the TestAmerica laboratories. The term outsourcing refers to the act of subcontracting tests.

When contracting with our clients, the laboratory makes commitments regarding the services to be performed and the data quality for the results to be generated. When the need arises to outsource testing for our clients because project scope, changes in laboratory capabilities, capacity or unforeseen circumstances, we must be assured that the subcontractors or work sharing laboratories understand the requirements and will meet the same commitments we have made to the client. Refer to TestAmerica's Corporate SOPs on Subcontracting Procedures (CW-L-S-004).

When outsourcing analytical services, the laboratory will assure, to the extent necessary, that the subcontract or work sharing laboratory maintains a program consistent with the requirements of this document, the requirements specified in TNI/ISO 17025 and/or the client's Quality Assurance Project Plan (QAPP). All QC guidelines specific to the client's analytical program are transmitted to the subcontractor and agreed upon before sending the samples to the subcontract facility. Additionally, work requiring accreditation will be placed with an appropriately accredited laboratory. The laboratory performing the subcontracted work will be identified in the final report, as will non-TNI accredited work where required.

Project Managers (PMs), Client Service Managers (CSM), or Account Executives (AE) for the Export Lab (TestAmerica laboratory that transfers samples to another laboratory) are responsible for obtaining client approval prior to subcontracting any samples. The laboratory will advise the client of a subcontract or work sharing arrangement in writing and when possible approval from the client shall be retained in the project folder. Standard TestAmerica Terms and Conditions include the flexibility to subcontract samples within the TestAmerica laboratories. Therefore, additional advance notification to clients for intra-laboratory subcontracting is not necessary unless specifically required by a client contract.

Note: In addition to the client, some regulating agencies (e.g., USDA) or contracts (e.g., DoD and DOE projects) may require notification prior to placing such work. Documentation of approval is stored electronically in the quote folder within SACSALES share on a local laboratory server.

8.2 Qualifying and Monitoring Subcontractors

Whenever a PM or Client Services Manager becomes aware of a client requirement or laboratory need where samples must be outsourced to another laboratory, the other laboratory(s) shall be selected based on the following:

- Subcontractors specified by the client - In these circumstances, the client assumes responsibility for the quality of the data generated from the use of a subcontractor.

- Subcontractors reviewed by TestAmerica – Firms which have been reviewed by the company and are known to meet standards for accreditations (e.g., State, TNI and DoD/DOE); technical specifications; legal and financial information.

A listing of vendors is available on the TestAmerica intranet site.

All TestAmerica laboratories are pre-qualified for work sharing provided they hold the appropriate accreditations, can adhere to the project/program requirements, and the client approved sending samples to that laboratory. The client must provide acknowledgement that the samples can be sent to that facility (an e-mail is sufficient documentation or if acknowledgement is verbal, the date, time, and name of person providing acknowledgement must be documented). The originating laboratory is responsible for communicating all technical, quality, and deliverable requirements as well as other contract needs. (Corporate SOP No. CA-C-S-001, Work Sharing Process).

8.2.1 When the potential sub-contract laboratory has not been previously approved, PMs or CSMs may nominate a laboratory as a subcontractor based on need. The decision to nominate a laboratory must be approved by the Client Relations Manager (CRM) or Laboratory Director. The CRM or Laboratory Director requests that the QA Manager begin the process of approving the subcontract laboratory as outlined in Corporate SOP No. CW-L-S-004, Subcontracting.

Once the appropriate accreditation and legal information is received by the laboratory, it is evaluated for acceptability (where applicable) and forwarded to the Corporate Quality Information Manager (QIM) for review. After the Corporate QIM reviews the documents for completeness, the information is forwarded to the Finance Department for formal signature and contracting with the laboratory. The approved vendor will be added to the approved subcontractor list on the intranet site and the finance group is concurrently notified for JD Edwards.

The client will assume responsibility for the quality of the data generated from the use of a subcontractor they have requested the lab to use. The qualified subcontractors on the intranet site are known to meet minimal standards. TestAmerica does not certify laboratories. The subcontractors on our approved list can only be recommended to the extent that we would use them.

8.3 Oversight and Reporting

8.3.1 The status and performance of qualified subcontractors will be monitored by the Corporate Quality department. Any problems identified will be brought to the attention of TestAmerica's Corporate Finance, Legal and Corporate Quality personnel.

- Complaints shall be investigated. Documentation of the complaint, investigation and corrective action will be maintained in the subcontractor's file on the intranet site. Complaints are posted using the Vendor Performance Report.
- Information shall be updated on the intranet when new information is received from the subcontracted laboratories.
- Subcontractors in good standing will be retained on the intranet listing. CSO personnel will notify all TestAmerica laboratories, Corporate Quality and Corporate Contracts if any

laboratory requires removal from the intranet site. This notification will be posted on the intranet site and e-mailed to all CSO Personnel, Laboratory Directors, QA Managers and Sales Personnel.

Prior to initially sending samples to the subcontracted laboratory, the PM confirms their certification status to determine if it's current and scope-inclusive. The information is stored electronically in the quote folder within the SACSALES share on a local laboratory server.

8.3.2 For continued use of a subcontractor, verification of certification is placed upon the subcontractor for the defined project. Samples are subcontracted under Chain of Custody with the program defined as 'Accreditation Required' and the following statement for verification upon sample receipt:

Note: Since laboratory accreditations are subject to change, TestAmerica Laboratories, Inc. places the ownership of method, analyte & accreditation compliance upon our subcontract laboratories. This sample shipment is forwarded under Chain of Custody. If the laboratory does not currently maintain accreditation in the State of Origin listed above for analytes/tests/matrix being analyzed, the samples must be shipped back to the TestAmerica laboratory or other instructions will be provided. Any changes to accreditation status should be brought to TestAmerica Laboratories, Inc. attention immediately. If all requested accreditations are current to date, return the signed Chain of Custody attesting to said compliance to TestAmerica Laboratories, Inc.

For TestAmerica laboratories, certifications can be viewed on the company's TotalAccess Database.

8.3.3 All subcontracted samples must be accompanied by a TestAmerica Chain of Custody (COC). A copy of the original COC sent by the client must be available in TALS for all samples workshared within TestAmerica. Client COCs are only forwarded to external subcontractors when samples are shipped directly from the project site to the subcontractor lab. Under routine circumstances, client COCs are not provided to external subcontractors.

Through communication with the subcontracted laboratory, the PM monitors the status of the subcontracted analyses, facilitates successful execution of the work, and ensures the timeliness and completeness of the analytical report.

Non-TNI accredited work must be identified in the subcontractor's report as appropriate. If TNI accreditation is not required, the report does not need to include this information.

Reports submitted from subcontractor laboratories are not altered and are included in their original form in the final project report. This clearly identifies the data as being produced by a subcontractor facility. If subcontract laboratory data is incorporated into the laboratories EDD (i.e., imported), the report must explicitly indicate which lab produced the data for which methods and samples.

Note: The results submitted by a TestAmerica work sharing laboratory may be transferred electronically and the results reported by the TestAmerica work sharing lab are identified on the final report. The report must explicitly indicate which lab produced the data for which methods and samples. The final report must include a copy of the completed COC for all work sharing reports.

8.4 Contingency Planning

The full qualification of a subcontractor may be waived to meet emergency needs; however, this decision & justification must be documented in the project files, and the 'Purchase Order Terms And Conditions For Subcontracted Laboratory Services' must be sent with the samples and Chain-of-Custody. In the event this provision is utilized, the laboratory (e.g., PM) will be required to verify and document the applicable accreditations of the subcontractor. All other quality and accreditation requirements will still be applicable, but the subcontractor need not have signed a subcontract with TestAmerica at this time.

The use of any emergency subcontractor will require the PM to complete a JDE New Vendor Add Form in order to process payment to the vendor and add them to TALS. This form requires the user to define the subcontractor's category/s of testing and the reason for testing.

SECTION 9. PURCHASING SERVICES AND SUPPLIES

9.1 Overview

Evaluation and selection of suppliers and vendors is performed, in part, on the basis of the quality of their products, their ability to meet the demand for their products on a continuous and short term basis, the overall quality of their services, their past history, and competitive pricing. This is achieved through evaluation of objective evidence of quality furnished by the supplier, which can include certificates of analysis, recommendations, and proof of historical compliance with similar programs for other clients. To ensure that quality critical consumables and equipment conform to specified requirements, which may affect quality, all purchases from specific vendors are approved by a member of the supervisory or management staff. Capital expenditures are made in accordance with TestAmerica's Controlled Purchase Requests and Fixed Asset Capitalization Procedure, SOP No. CW-F-S-007.

Contracts will be signed in accordance with TestAmerica's Company-Wide Authorization Matrix Policy, Policy No. CW-F-P-002. Request for Proposals (RFP's) will be issued where more information is required from the potential vendors than just price. Process details are available in TestAmerica's Corporate Procurement and Contracts Policy (Policy No. CW-F-P-004). RFP's allow TestAmerica to determine if a vendor is capable of meeting requirements such as supplying all of the TestAmerica facilities, meeting required quality standards and adhering to necessary ethical and environmental standards. The RFP process also allows potential vendors to outline any additional capabilities they may offer.

9.2 Glassware

Glassware used for volumetric measurements must be Class A or verified for accuracy according to laboratory procedure. Pyrex (or equivalent) glass should be used where possible. For safety purposes, thick-wall glassware should be used where available.

9.3 Reagents, Standards & Supplies

Purchasing guidelines for equipment, consumables, and reagents must meet the requirements of the specific method and testing procedures for which they are being purchased. Solvents and acids are pre-tested in accordance with TestAmerica's Corporate SOP on Solvent & Acid Lot Testing & Approval, SOP No. CA-Q-S-001. Approval information for the solvents and acids tested under SOP CA-Q-S-001 is stored on the TestAmerica Sharepoint, under Solvent Approvals. A master list of all tested materials, as well as the certificates of analysis for the materials, is stored in the same location.

9.3.1 Purchasing

Chemical reagents, solvents, glassware, and general supplies are ordered as needed to maintain sufficient quantities on hand. Materials used in the analytical process must be of a known quality. The wide variety of materials and reagents available makes it advisable to specify recommendations for the name, brand, and grade of materials to be used in any determination. This information is contained in the method SOP. Many items used routinely are pre-qualified and placed into the on-site consignment system.

For items not available from the consignment system or items that are not used routinely, an order is placed in the JDE ordering system. Only personnel trained in the ordering program JDE may place orders using the program. All relevant information, including quantity, must be entered. Only approved vendors may be used. A vendor must be approved by corporate to be on the approved vendor list in JDE. The Laboratory Director or designee approves all orders placed in JDE.

9.3.2 Receiving

It is the responsibility of the purchasing manager to receive the shipment. For items received for the on-site consignment system, the purchasing manager verifies that the material received meets the quality level specified. This is documented by stamping the packing slip with "Received" and the date. For materials that are outside of the on-site consignment systems, it is the responsibility of the analyst who ordered the materials to document the date materials were received. Once the ordered reagents or materials are received, the analyst compares the information on the label or packaging to the original order to ensure that the purchase meets the quality level specified. This is documented through the addition of the received date and initials to the information present on the daily order log.

The purchasing manager verifies the lot numbers of received solvents and acids against the pre-approval lists. If a received material is listed as unapproved, or is not listed, it is sequestered and returned to the vendor. Alternatively, the laboratory may test the material for the intended use, and if it is acceptable, document the approval on the approval list. Records of any testing performed locally are maintained on the shared "public" folder on the computer network.

Materials may not be released for use in the laboratory until they have been inspected, verified as suitable for use, and the inspection/verification has been documented.

Safety Data Sheets (SDSs) are available online through the Company's intranet website. Anyone may review these for relevant information on the safe handling and emergency precautions of on-site chemicals.

9.3.3 Specifications

Methods in use in the laboratory specify the grade of reagent that must be used in the procedure. If the quality of the reagent is not specified, analytical reagent grade will be used. It is the responsibility of the analyst to check the procedure carefully for the suitability of the grade of reagent.

Chemicals must not be used past the manufacturer's expiration date and must not be used past the expiration time noted in a method SOP. If expiration dates are not provided, the laboratory may contact the manufacturer to determine an expiration date.

The laboratory assumes a five year expiration date on inorganic dry chemicals unless noted otherwise by the manufacturer or by the reference source method. Chemicals should not be used past the manufacturer's or SOP's expiration date unless 'verified' (refer to bullet 3 below). See laboratory SOP No. WS-QA-0017, "Standards and Reagent Preparation and Quality Control Check Procedures", for standard verification procedures.)

- An expiration date **cannot** be extended if the dry chemical/solvent is discolored or appears otherwise physically degraded, the dry chemical/solvent must be discarded.
- Expiration dates can be extended if the dry chemical/solvent is found to be satisfactory based on acceptable performance of quality control samples (Continuing Calibration Verification (CCV), Blanks, Laboratory Control Sample (LCS), etc.).
- If the dry chemical/solvent is used for the preparation of standards, the expiration dates can be extended 6 months if the dry chemical/solvent is compared to an unexpired independent source in performing the method and the performance of the dry chemical/solvent is found to be satisfactory. The comparison must show that the dry chemical/solvent meets CCV limits. The comparison studies are maintained on the shared public folder on the computer network.

Wherever possible, standards must be traceable to national or international standards of measurement or to national or international reference materials. Records to that effect are available to the user.

Compressed gases in use are checked for pressure and secure positioning daily. To prevent a tank from going to dryness, or introducing potential impurities, the pressure would be closely watched as it decreases to approximately 15% of the original reading, at which point it should be replaced. For example, a standard sized laboratory gas cylinder containing 3,000 psig of gas should be replaced when it drops to approximately 500 psig. For the automated “tank farm” in use through most of the laboratory, the minimum total pressure at which the system switches to the next bank of tanks is 250 psig. The quality of the gases must meet method or manufacturer specification or be of a grade that does not cause any analytical interference.

Water used in the preparation of standards or reagents must have a specific conductivity of less than 1- µmho/cm (or specific resistivity of greater than 1.0 megohm-cm) at 25°C. The specific conductivity is checked and recorded daily. If the water’s specific conductivity is greater than the specified limit, the Facility Manager and appropriate Technical Managers must be notified immediately in order to notify all departments, decide on cessation (based on intended use) of activities, and make arrangements for correction.

The laboratory may purchase reagent grade (or other similar quality) water for use in the laboratory. This water must be certified “clean” by the supplier for all target analytes or otherwise verified by the laboratory prior to use. This verification is documented.

Standard lots are verified before first time use if the laboratory switches manufacturers or has historically had a problem with the type of standard. See laboratory SOP No. WS-QA-0017, “Standards and Reagent Preparation and Quality Control Check Procedures”, for standard QC procedures.

Purchased bottleware used for sampling must be certified clean and the certificates must be maintained. If uncertified sampling bottleware is purchased, all lots must be verified clean prior to use. This verification must be maintained.

Each laboratory section maintains records of manufacturer’s certification and traceability statements on the network. These records include date of receipt, lot number (when

applicable), and expiration date (when applicable). Furthermore, certificates of analysis for standards are scanned and attached to the preparation record in the LIMS. Incorporation of the item into the record indicates that the analyst has compared the new certificate with the previous one for the same purpose and that no difference is noted, unless approved and so documented by the Technical Manager or QA Manager.

9.3.4 Storage

Reagent and chemical storage is important from the aspects of both integrity and safety. Light-sensitive reagents may be stored in brown-glass containers. Storage conditions are per the Corporate Environmental Health & Safety Manual (Corp. Doc. No. CW-E-M-001) and method SOPs or manufacturer instructions.

9.4 Purchase of Equipment / Instruments / Software

When a new piece of equipment is needed, either for additional capacity or for replacing inoperable equipment, the analyst or supervisor makes a supply request to the Technical Manager and/or the Laboratory Director. If they agree with the request, the procedures outlined in TestAmerica's Corporate Policy No. CA-T-P-001, Qualified Products List, are followed. A decision is made as to which piece of equipment can best satisfy the requirements. The appropriate written requests are completed and purchasing places the order.

Upon receipt of a new or used piece of equipment, an identification name is assigned and added to the equipment list. IT must also be notified so that they can synchronize the instrument for back-ups. Its capability is assessed to determine if it is adequate or not for the specific application. For instruments, a calibration curve is generated, followed by MDLs, Demonstration of Capabilities (DOCs), and other relevant criteria (refer to Section 19). For software, its operation must be deemed reliable and evidence of instrument verification must be retained by the QA Department. Software certificates supplied by the vendors are filed with the LIMS Administrator. The manufacturer's operation manual is retained at the bench and inventoried in the master document list.

9.5 Services

Service to analytical instruments (except analytical balances) is performed on an as needed basis. Routine preventative maintenance is discussed in Section 20. The need for service is determined by analysts and/or Technical Managers. The service providers that perform the services are approved by the Technical Manager.

Analytical balances are serviced and calibrated annually in accordance with SOP WS-QA-0041, Calibration and Calibration Check of Balances. The calibration and maintenance services are performed on-site, and the balances are returned to use immediately following successful calibration. When the calibration certificates are received (usually within two weeks of the service), they are reviewed, and documentation of the review is filed with the certificates. If the calibration was unsuccessful, the balance is immediately removed from service and segregated pending either further maintenance or disposal.

Calibration services for support equipment such as thermometers, weight sets, autopipettors, etc, are obtained from vendors with current and valid ISO 17025 accreditation for calibration of

the specific piece of equipment. Prior to utilizing the vendor's services, the vendor's accreditation status is verified. Once the equipment has been calibrated, the calibration certificates are reviewed by the QA department, and documentation of the review is filed with the calibration certificates. The equipment is then returned to service within the laboratory.

9.6 Suppliers

TestAmerica selects vendors through a competitive proposal / bid process, strategic business alliances or negotiated vendor partnerships (contracts). This process is defined in the Procurement & Contracts Policy (Policy No. CW-F-P-004). The level of control used in the selection process is dependent on the anticipated spending amount and the potential impact on TestAmerica business. Vendors that provide test and measuring equipment, solvents, standards, certified containers, instrument related service contracts or subcontract laboratory services shall be subject to more rigorous controls than vendors that provide off-the-shelf items of defined quality that meet the end use requirements. The JD Edwards purchasing system includes all suppliers/vendors that have been approved for use.

Evaluation of suppliers is accomplished by ensuring the supplier ships the product or material ordered and that the material is of the appropriate quality. This is documented by signing off on packing slips or other supply receipt documents. The purchasing documents contain the data that adequately describe the services and supplies ordered.

Any issues of vendor performance are to be reported immediately by the laboratory staff to the Corporate Purchasing Group by completing a Vendor Performance Report.

The Corporate Purchasing Group will work through the appropriate channels to gather the information required to clearly identify the problem and will contact the vendor to report the problem and to make any necessary arrangements for exchange, return authorization, credit, etc.

As deemed appropriate, the Vendor Performance Reports will be summarized and reviewed to determine corrective action necessary, or service improvements required by vendors

The laboratory has access to a listing of all approved suppliers of critical consumables, supplies and services. This information is provided through the JD Edwards purchasing system.

9.6.1 New Vendor Procedure

TestAmerica employees who wish to request the addition of a new vendor must complete a J.D. Edwards Vendor Add Request Form.

New vendors are evaluated based upon criteria appropriate to the products or services provided as well as their ability to provide those products and services at a competitive cost. Vendors are also evaluated to determine if there are ethical reasons or potential conflicts of interest with TestAmerica employees that would make it prohibitive to do business with them as well as their financial stability. The QA Department and/or the Technical Services Director are consulted with vendor and product selection that have an impact on quality.

SECTION 10. COMPLAINTS

10.1 Overview

The laboratory considers an effective client complaint handling processes to be of significant business and strategic value. Listening to and documenting client concerns captures 'client knowledge' that enables our operations to continually improve processes and client satisfaction. An effective client complaint handling process also provides assurance to the data user that the laboratory will stand behind its data, service obligations and products.

A client complaint is any expression of dissatisfaction with any aspect of our business services (e.g., communications, responsiveness, data, reports, invoicing and other functions) expressed by any party, whether received verbally or in written form. Client inquiries, complaints or noted discrepancies are documented, communicated to management, and addressed promptly and thoroughly.

The laboratory has procedures for addressing both external and internal complaints with the goal of providing satisfactory resolution to complaints in a timely and professional manner.

The nature of the complaint is identified, documented and investigated, and an appropriate action is determined and taken. In cases where a client complaint indicates that an established policy or procedure was not followed, the QA Department must evaluate whether a special audit must be conducted to assist in resolving the issue. A written confirmation or letter to the client, outlining the issue and response taken is recommended as part of the overall action taken.

The process of complaint resolution and documentation utilizes the procedures outlined in Section 12 (Corrective Actions) and is documented following laboratory policy WS-PQA-013, Procedure to Address Customer Complaints.

10.2 External Complaints

An employee that receives a complaint initiates the complaint resolution process by first documenting the complaint according to laboratory policy WS-PQA-013, Procedure to Address Customer Complaints.

Complaints fall into two categories: correctable and non-correctable. An example of a correctable complaint would be one where a report re-issue would resolve the complaint. An example of a non-correctable complaint would be one where a client complains that their data was repeatedly late. Non-correctable complaints should be reviewed for preventive action measures to reduce the likelihood of future occurrence and mitigation of client impact.

The general steps in the complaint handling process are:

- Receiving and Documenting Complaints
- Complaint Investigation and Service Recovery
- Process Improvement

The laboratory shall inform the initiator of the complaint of the results of the investigation and the corrective action taken, if any.

10.3 Internal Complaints

Internal complaints include, but are not limited to: errors and non-conformances, training issues, internal audit findings, and deviations from methods. Corrective actions may be initiated by any staff member who observes a nonconformance and shall follow the procedures outlined in Section 12. In addition, Corporate Management, Sales and Marketing and IT may initiate a complaint by contacting the laboratory or through the corrective action system described in Section 12.

10.4 Management Review

The number and nature of client complaints is reported by the QA Manager to the laboratory and QA Director in the QA Monthly report. Monitoring and addressing the overall level and nature of client complaints and the effectiveness of the solutions is part of the Annual Management Review (Section 16).

SECTION 11. CONTROL OF NON-CONFORMING WORK

11.1 Overview

When data discrepancies are discovered or deviations and departures from laboratory SOPs, policies and/or client requests have occurred, corrective action is taken immediately. First, the laboratory evaluates the significance of the nonconforming work. Then, a corrective action plan is initiated based on the outcome of the evaluation. If it is determined that the nonconforming work is an isolated incident, the plan could be as simple as adding a qualifier to the final results and/or making a notation in the case narrative. If it is determined that the nonconforming work is a systematic or improper practices issue, the corrective action plan could include a more in depth investigation and a possible suspension of an analytical method. In all cases, the actions taken are documented using the laboratory's corrective action system (refer to Section 12).

Due to the frequently unique nature of environmental samples, sometimes departures from documented policies and procedures are needed. When an analyst encounters such a situation, the problem is presented to the supervisor for resolution. The supervisor may elect to discuss it with the Technical Manager or have a representative contact the client to decide on a logical course of action. Once an approach is agreed upon, the analyst documents it using the laboratories corrective action system described in Section 12. This information can then be supplied to the client in the form of a footnote or a case narrative with the report.

Project Management may encounter situations where a client may request that a special procedure be applied to a sample that is not standard lab practice. Based on a technical evaluation, the lab may accept or opt to reject the request based on technical or ethical merit. An example might be the need to report a compound that the lab does not normally report. The lab would not have validated the method for this compound following the procedures in Section 19. The client may request that the compound be reported based only on the calibration. Such a request would need to be approved by the Technical Manager and QA Manager, documented and included in the project folder. Deviations **must** also be noted on the final report with a statement that the compound is not reported in compliance with TNI (or the analytical method) requirements and the reason. Data being reported to a non-TNI state would need to note the change made to how the method is normally run.

11.2 Responsibilities and Authorities

Under certain circumstances, the Laboratory Director, a Technical Manager, or a member of the QA team may authorize departures from documented procedures or policies. The departures may be a result of procedural changes due to the nature of the sample; a one-time procedure for a client; QC failures with insufficient sample to reanalyze, etc. In most cases, the client will be informed of the departure prior to the reporting of the data. Any departures must be well documented using the laboratory's corrective action procedures. This information may also be documented in logbooks and/or data review checklists as appropriate. Any impacted data must be referenced in a case narrative and/or flagged with an appropriate data qualifier.

Any misrepresentation or possible misrepresentation of analytical data discovered by any laboratory staff member must be reported to facility Senior Management within 24-hours. The Senior Management staff is comprised of the Laboratory Director, the QA Manager, and the

Technical Managers. The reporting of issues involving alleged violations of the company's Data Integrity or Manual Integration procedures must be conveyed to an Ethics and Compliance Officer (ECO), Exec. Director of Quality & EHS and the laboratory's Quality Director within 24 hours of discovery.

Whether an inaccurate result was reported due to calculation or quantitation errors, data entry errors, improper practices, or failure to follow SOPs, the data must be evaluated to determine the possible effect.

The Laboratory Director, QA Manager, ECOs, Corporate Quality, Executive VP of Operations, VP of Operations, and the Quality Directors have the authority and responsibility to halt work, withhold final reports, or suspend an analysis for due cause as well as authorize the resumption of work.

11.3 Evaluation of Significance and Actions Taken

For each nonconforming issue reported, an evaluation of its significance and the level of management involvement needed is made. This includes reviewing its impact on the final data, whether or not it is an isolated or systematic issue, and how it relates to any special client requirements.
When the laboratory discovers that erroneous or biased data may have been reported to clients or regulatory agencies, the procedures described in the corporate SOP CW-Q-S-005, Data Recalls, must be followed.
During investigation and correction of situations involving alleged incidents of misconduct or violation of the company's ethics policy, the procedures described in the corporate SOP CW-L-S-002, Internal Investigations, must be followed.

Laboratory level decisions are documented and approved using the laboratory's standard nonconformance/corrective action reporting in lieu of the data recall determination form contained in TestAmerica's Corporate SOP No. CW-L-S-002.

11.4 Prevention of NonConforming Work

If it is determined that the nonconforming work could recur, further corrective actions must be made following the laboratory's corrective action system. Periodically, on a monthly basis, the QA Department evaluates non-conformances to determine if any nonconforming work has been repeated multiple times. If so, the laboratory's corrective action process may be followed.

11.5 Method Suspension / Restriction (Stop Work Procedures)

In some cases, it may be necessary to suspend/restrict the use of a method or target compound which constitutes significant risk and/or liability to the laboratory. Suspension/restriction procedures can be initiated by any of the persons noted in Section 11.2, Paragraph 5.

Prior to suspension/restriction, confidentiality will be respected, and the problem with the required corrective and preventive action will be stated in writing and presented to the Laboratory Director.

The Laboratory Director shall arrange for the appropriate personnel to meet with the QA Manager as needed. This meeting shall be held to confirm that there is a problem, that

suspension/restriction of the method is required and will be concluded with a discussion of the steps necessary to bring the method/target or test fully back on line. In some cases, that may not be necessary if all appropriate personnel have already agreed there is a problem and there is agreement on the steps needed to bring the method, target or test fully back on line.

The QA Manager will also initiate a corrective action report as described in Section 12 if one has not already been started. A copy of any meeting notes and agreed upon steps should be faxed or e-mailed by the laboratory to the appropriate VP of Operations and member of Corporate QA. This fax/e-mail acts as notification of the incident.

After suspension/restriction, the lab will hold all reports to clients pending review. No faxing, mailing or distributing through electronic means may occur. The report must not be posted for viewing on the internet. It is the responsibility of the Laboratory Director to hold all reporting and to notify all relevant laboratory personnel regarding the suspension/restriction (e.g., Project Management, Log-in, etc…). Clients will NOT generally be notified at this time. Analysis may proceed in some instances depending on the non-conformance issue.

Within 72 hours, the QA Manager will determine if compliance is now met and reports can be released, OR determine the plan of action to bring work into compliance, and release work. A team, with all principals involved (Laboratory Director, Technical Manager/Director, QA Manager) can devise a start-up plan to cover all steps from client notification through compliance and release of reports. Project Management and the Directors of Client Services and Sales and Marketing must be notified if clients must be notified or if the suspension/restriction affects the laboratory's ability to accept work. The QA Manager must approve start-up or elimination of any restrictions after all corrective action is complete. This approval is given by final signature on the completed corrective action report.

SECTION 12. CORRECTIVE ACTION

12.1 Overview

A major component of TestAmerica's Quality Assurance (QA) Program is the problem investigation and feedback mechanism designed to keep the laboratory staff informed on quality related issues and to provide insight to problem resolution. When nonconforming work or departures from policies and procedures in the quality system or technical operations are identified, the corrective action procedure provides a systematic approach to assess the issues, restore the laboratory's system integrity, and prevent reoccurrence. Corrective actions are documented using Non-Conformance Memos (NCM) and Corrective Action Reports (CAR) (refer to Figure 12-1).

12.2 General

Problems within the quality system or within analytical operations may be discovered in a variety of ways, such as QC sample failures, internal or external audits, proficiency testing (PT) performance, client complaints, staff observation, etc.

The purpose of a corrective action system is to:

- Identify non-conformance events and assign responsibility(s) for investigating.
- Resolve non-conformance events and assign responsibility for any required corrective action.
- Identify systematic problems before they become serious.
- Identify and track client complaints and provide resolution.

12.2.1 Non-Conformance Memo (NCM) - is used to document the following types of corrective actions:

- Deviations from an established procedure or SOP
- QC outside of limits (non-matrix related)
- Isolated reporting / calculation errors
- Client complaints
- Discrepancies in materials / goods received vs. manufacturer packing slips.

12.2.2 Corrective Action Report (CAR) - is used to document the following types of corrective actions:

- Questionable trends that are found in the review of NCMs.
- Issues found while reviewing NCMs that warrant further investigation.
- Internal and external audit findings.
- Failed or unacceptable PT results.
- Corrective actions that cross multiple departments in the laboratory.
- Systematic reporting / calculation errors
- Client complaints

- Data recall investigations
- Identified poor process or method performance trends
- Excessive revised reports
- Health and Safety violations

This will provide background documentation to enable root cause analysis and preventive action.

12.3 Closed Loop Corrective Action Process

Any employee in the company can initiate a corrective action. There are four main components to a closed-loop corrective action process once an issue has been identified: Cause Analysis, Selection and Implementation of Corrective Actions (both short and long term), Monitoring of the Corrective Actions, and Follow-up.

12.3.1 Cause Analysis

- Upon discovery of a non-conformance event, the event must be defined and documented. An NCM or CAR must be initiated, someone is assigned to investigate the issue and the event is investigated for cause. Laboratory SOP No. WS-QA-0023, Nonconformance and Corrective Action System, provides some general guidelines on determining responsibility for assessment.
- The cause analysis step is the key to the process as a long term corrective action cannot be determined until the cause is determined.
- If the cause is not readily obvious, the Technical Manager, Laboratory Director, or QA Manager (or QA designee) is consulted.

12.3.2 Selection and Implementation of Corrective Actions

- Where corrective action is needed, the laboratory shall identify potential corrective actions. The action(s) most likely to eliminate the problem and prevent recurrence are selected and implemented. Responsibility for implementation is assigned.
- Corrective actions shall be to a degree appropriate to the magnitude of the problem identified through the cause analysis.
- Whatever corrective action is determined to be appropriate, the laboratory shall document and implement the changes. The NCM or CAR is used for this documentation.

12.3.3 Root Cause Analysis

Root Cause Analysis is a class of problem solving (investigative) methods aimed at identifying the basic or causal factor(s) that underlie variation in performance or the occurrence of a significant failure. The root cause may be buried under seemingly innocuous events, many steps preceding the perceived failure. At first glance, the immediate response is typically directed at a symptom and not the cause. Typically, root cause analysis would be best with three or more incidents to triangulate a weakness. Corporate SOP Root Cause Analysis (No. CA-Q-S-009) describes the procedure.

Systematically analyze and document the Root Causes of the more significant problems that are reported. Identify, track, and implement the corrective actions required to reduce the likelihood of recurrence of significant incidents. Trend the root cause data from these incidents to identify root causes that, when corrected, can lead to dramatic improvements in performance by eliminating entire classes of problems.

Identify the one event associated with the problem and ask why this event occurred. Brainstorm the root causes of failures; for example, by asking why events occurred or conditions existed; and then why the cause occurred 5 consecutive times until you get to the root cause. For each of these sub events or causes, ask why it occurred. Repeat the process for the other events associated with the incident.

Root cause analysis does not mean the investigation is over. Look at technique, or other systems outside the normal indicators. Often creative thinking will find root causes that ordinarily would be missed, and continue to plague the laboratory or operation.

12.3.4 Monitoring of the Corrective Actions

- The Technical Manager and QA Manager are responsible to ensure that the corrective action taken was effective.
- Ineffective actions are documented and re-evaluated until acceptable resolution is achieved. Technical Managers are accountable to the Laboratory Director to ensure final acceptable resolution is achieved and documented appropriately.
- Each NCM and CAR is entered into a database for tracking purposes and these are periodically reviewed to ensure that the corrective actions have taken effect.
- TestAmerica laboratories began using the Incident/Corrective Action Tracker (iCAT) database developed by the company in 2015. (Previously, a local database [name of local system here] served this purpose.) An incident is an event triggering the need for one or more corrective actions as distinct from a corrective action, a potential deficiency stemming from an incident that requires investigation and possibly fixing. The database is independent of TALS, available to all local and corporate managers, and capable of notifying and tracking multiple corrective actions per event, dates, and personnel. iCAT allows associated document upload, categorization (such as, external/internal audit, client service concerns, data quality issues, proficiency testing, etc.), and trend analysis. Refer to Figure 12-1.
- The QA Manager reviews monthly NCMs and CARs for trends. Highlights are included in the QA monthly report (refer to Section 16). If a significant trend develops that adversely affects quality, an audit of the area is performed and corrective action implemented.
- Any out-of-control situations that are not addressed acceptably at the laboratory level may be reported to the Corporate Quality Director by the QA Manager, indicating the nature of the out-of-control situation and problems encountered in solving the situation.

12.3.5 Follow-up Audits

- Follow-up audits may be initiated by the QA Manager and shall be performed as soon as possible when the identification of a nonconformance casts doubt on the laboratory's compliance with its own policies and procedures, or on its compliance with state or federal requirements.

- These audits often follow the implementation of the corrective actions to verify effectiveness. An additional audit would only be necessary when a critical issue or risk to business is discovered.

(Also refer to Section 15.1.4, Special Audits.)

12.4 Technical Corrective Actions

In addition to providing acceptance criteria and specific protocols for technical corrective actions in the method SOPs, the laboratory has general procedures to be followed to determine when departures from the documented policies and procedures and quality control have occurred (refer to Section 11). The documentation of these procedures is through the use of an NCM or CAR.

Table 12-1 includes examples of general technical corrective actions. For specific criteria and corrective actions, refer to the analytical methods or specific method SOPs. The laboratory may also maintain Work Instructions on these items that are available upon request.

Table 12-1 provides some general guidelines for identifying the individual(s) responsible for assessing each QC type and initiating corrective action. The SOP also provides general guidance on how a data set should be treated if associated QC measurements are unacceptable. Specific procedures are included in Method SOPs, Work Instructions, QAM Sections 19 and 20. All corrective actions are reviewed monthly, at a minimum, by the QA Manager and highlights are included in the QA monthly report.

To the extent possible, samples shall be reported only if all quality control measures are acceptable. If the deficiency does not impair the usability of the results, data will be reported with an appropriate data qualifier and/or the deficiency will be noted in the case narrative. Where sample results may be impaired, the Project Manager is notified by an NCM and appropriate corrective action (e.g., reanalysis) is taken and documented.

12.5 Basic Corrections

When mistakes occur in records, each mistake shall be crossed-out, [not obliterated (e.g. no white-out)], and the correct value entered alongside. All such corrections shall be initialed (or signed) and dated by the person making the correction. In the case of records stored electronically, the original “uncorrected” file must be maintained intact and a second “corrected” file is created.

This same process applies to adding additional information to a record. All additions made later than the initial must also be initialed (or signed) and dated.

When corrections are due to reasons other than obvious transcription errors, the reason for the corrections (or additions) shall also be documented.

Figure 12-1.
Example - Corrective Action Report

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Sacramento
Corrective Action Report

Title: <Enter Title Here>

Reference: <tracking information>

Initiated by: **Date:**

Responsible Party: **Date:** <date report submitted>

Description of Problem:
[enter text to briefly explain how the problem was discovered, who discovered it and when, and what work, if any, is affected]

Investigation Planned or Completed:
[enter text to briefly what was examined to determine the extent of the problem, when the investigation was conducted, what was the proximate cause(s), and what were the root causes. The key is to demonstrate that the investigation is comprehensive]

Root Cause Analysis
[True root cause analysis should involve multiple layers of questioning]
Examples:
- *Why did this problem occur?*
- *What weaknesses are indicated by this problem?*
- *What Quality Systems mechanisms are in place that should have prevented this problem from occurring?*
- *Is this issue acute or chronic?*
- *Are changes needed to existing SOPs to correct this problem and prevent its recurrence?*
- *Are other departments affected by this issue?*

Corrective Action Plan
[Based on the Root Cause Analysis outlined above, what action items need to be completed to correct this deficiency, and prevent its recurrence?]
Examples:
- *Identify impacted lots*
- *Revise results/reports*
- *Initiate formal Data Recall*
- *Revise SOP*
- *Re-train staff*

QA Monitoring of Corrective Action Status
[If an anomalous or isolated event, and no further action required, this section may be omitted. Otherwise, note the need for a routine follow-up assessment and the associated details (responsible party, due date, documentation necessary), or the need to add to the internal audit checklist for reassessment at a later date.

Closed by: _____ _____
<Name, title> Date

Table 12-1. Example – General Corrective Action Procedures

QC Activity ***(Individual Responsible for Initiation/Assessment)***	**Acceptance Criteria**	**Recommended Corrective Action**
Initial Instrument Blank *(Analyst)*	- Instrument response <MDL.	- Prepare another blank. - If same response, determine cause of contamination: reagents, environment, instrument equipment failure, etc.
Initial Calibration Standards *(Analyst, Technical Manager(s))*	- Correlation coefficient > 0.99 or standard concentration value. - % Recovery within acceptance range. - See details in Method SOP.	- Reanalyze standards. - If still unacceptable, remake standards and recalibrate instrument.
Independent Calibration Verification (Second Source) *(Analyst, Technical Manager(s))*	- % Recovery within control limits.	- Remake and reanalyze standard. - If still unacceptable, then remake calibration standards or use new primary standards and recalibrate instrument.
Continuing Calibration Standards *(Analyst, Data Reviewer)*	% Recovery within control limits.	- Reanalyze standard. - If still unacceptable, then recalibrate and rerun affected samples.
Matrix Spike / Matrix Spike Duplicate (MS/MSD) *(Analyst, Data Reviewer)*	- % Recovery within limits documented in the LIMS or Project QAPP.	- If the acceptance criteria for duplicates or matrix spikes are not met because of matrix interferences, the acceptance of the analytical batch is determined by the validity of the LCS. - If the LCS is within acceptable limits the batch is acceptable. - The results of the duplicates, matrix spikes and the LCS are reported with the data set. - For matrix spike or duplicate results outside criteria the data for that sample shall be reported with qualifiers.

QC Activity ***(Individual Responsible for Initiation/Assessment)***	**Acceptance Criteria**	**Recommended Corrective Action**
Laboratory Control Sample (LCS) *(Analyst, Data Reviewer)*	- % Recovery within limits documented in the LIMS or Project QAPP.	- Batch must be re-prepared and re-analyzed. This includes any allowable marginal exceedance. When not using marginal exceedances, the following exceptions apply: 1) when the acceptance criteria for the positive control are exceeded high (i.e., high bias) and there are associated samples that are non-detects, then those non-detects may be reported with data qualifying codes; 2) when the acceptance criteria for the positive control are exceeded low (i.e., low bias), those sample results may be reported if they exceed a maximum regulatory limit/decision level with data qualifying codes. **Note:** If there is insufficient sample or the holding time cannot be met, contact client and report with flags.
Surrogates *(Analyst, Data Reviewer)*	- % Recovery within limits of method or within three standard deviations of the historical mean.	- Individual sample must be repeated. Place comment in LIMS. - Surrogate results outside criteria shall be reported with qualifiers.
Method Blank (MB) *(Analyst, Data Reviewer)*	< Reporting Limit [1]	- Reanalyze blank. - If still positive, determine source of contamination. If necessary, reprocess (i.e. digest or extract) entire sample batch. Report blank results. - Qualify the result(s) if the concentration of a targeted analyte in the MB is at or above the reporting limit AND is > 1/10 of the amount measured in the sample.
Proficiency Testing (PT) Samples *(QA Manager, Technical Manager(s))*	- Criteria supplied by PT Supplier.	- Any failures or warnings must be investigated for cause. Failures may result in the need to repeat a PT sample to show the problem is corrected.
Internal / External Audits *(QA Manager, Technical Manager(s), Laboratory Director)*	- Defined in Quality System documentation such as SOPs, QAM, etc..	- Non-conformances must be investigated through CAR system and necessary corrections must be made.

QC Activity *(Individual Responsible for Initiation/Assessment)*	**Acceptance Criteria**	**Recommended Corrective Action**
Reporting / Calculation Errors (Depends on issue – possible individuals include: Analysts, Data Reviewers, Project Managers, Technical Managers, QA Manager, Corporate QA, Corporate Management)	- SOP CW-L-S-002, Internal Investigation of Potential Data Discrepancies and Determination for Data Recall.	- Corrective action is determined by type of error. Follow the procedures in SOP CW-L-S-002.
Client Complaints *(Project Managers, Lab Director/Manager, Sales and Marketing)*	-	- Corrective action is determined by the type of complaint. For example, a complaint regarding an incorrect address on a report will result in the report being corrected and then follow-up must be performed on the reasons the address was incorrect (e.g., database needs to be updated).
QA Monthly Report (Refer to Section 16 for an example) (QA Manager, Lab Director/Manager, *Technical Manager(s)*)	- QAM, SOPs.	- Corrective action is determined by the type of issue. For example, CARs for the month are reviewed and possible trends are investigated.
Health and Safety Violation (Safety Officer, Lab Director/Manager, *Technical Manager(s)*)	- Environmental Health and Safety (EHS) Manual.	- Non-conformance is investigated and corrected through CAR system.

Note:
1. Except as noted below for certain compounds, the method blank should be below the detection limit. Concentrations up to five times the reporting limit will be allowed for the ubiquitous laboratory and reagent contaminants as defined in policy WS-PQA-003 **provided** they appear at similar levels in the reagent blank and samples. The ubiquitous contaminants include: methylene chloride, toluene, acetone, 2-butanone, phthalates and octachlorodibenzodioxin. This allowance presumes that the detection limit is significantly below any regulatory limit to which the data are to be compared and that blank subtraction will not occur. For benzene and ethylene dibromide (EDB) and other analytes for which regulatory limits are extremely close to the detection limit, the method blank must be below the method detection limit.

SECTION 13. PREVENTIVE ACTION / IMPROVEMENT

13.1 Overview

The laboratory's preventive action programs improve or eliminate potential causes of nonconforming product and/or nonconformance to the quality system. This preventive action process is a proactive and continuous process of improvement activities that can be initiated through feedback from clients, employees, business providers, and affiliates. The QA Department has the overall responsibility to ensure that the preventive action process is in place, and that relevant information on actions is submitted for management review.

Dedicating resources to an effective preventive action system emphasizes the laboratory's commitment to its Quality Program. It is beneficial to identify and address negative trends before they develop into complaints, problems and corrective actions. Additionally, the laboratory continually strives to improve customer service and client satisfaction through continuous improvements to laboratory systems.

Opportunities for improvement may be discovered through any of the following:

- review of the monthly QA Metrics Report,
- trending NCMs,
- review of control charts and QC results,
- trending proficiency testing (PT) results,
- performance of management system reviews,
- trending client complaints,
- review of processing operations, or
- staff observations.

The monthly Management Systems Metrics Report shows performance indicators in all areas of the laboratory and quality system. These areas include revised reports, corrective actions, audit findings, internal auditing and data authenticity audits, client complaints, PT samples, holding time violations, SOPs, ethics training, etc. The metrics report is reviewed monthly by the laboratory management, Corporate QA and TestAmerica's Executive Committee. These metrics are used ~~to~~ in evaluating the management and quality system performance on an ongoing basis and provide a tool for identifying areas for improvement.

Items identified as continuous improvement opportunities to the management system may be issued as goals from the annual management systems review, recommendations from internal audits, white papers, Lesson Learned, Technical Services audit report, Technical Best Practices, or as Corporate or management initiatives.
The laboratory's corrective action process is integral to implementation of preventive actions. A critical piece of the corrective action process is the implementation of actions to prevent further occurrence of a non-compliance event. Historical review of corrective action and non-conformances provides a valuable mechanism for identifying preventive action opportunities.

13.1.1 The following elements are part of a preventive action/process improvement system:

- Identification of an opportunity for preventive action or process improvement.
- Process for the preventive action or improvement.
- Define the measurements of the effectiveness of the process once undertaken.
- Execution of the preventive action or improvement.
- Evaluation of the plan using the defined measurements.
- Verification of the effectiveness of the preventive action or improvement.
- Close-Out by documenting any permanent changes to the Quality System as a result of the Preventive Action or Process Improvement. Documentation of Preventive Action/Process Improvement is incorporated into the monthly QA reports, corrective action process and management review.

13.1.2 Any Preventive Actions/Process Improvement undertaken or attempted shall be taken into account during the annual Management Systems Review (Section 16). A highly detailed report is not required; however, a summary of successes and failures within the preventive action program is sufficient to provide management with a measurement for evaluation.

13.2 Management of Change

The Management of Change process is designed to manage significant events and changes that occur within the laboratory. Through these procedures, the potential risks inherent with a new event or change are identified and evaluated. The risks are minimized or eliminated through pre-planning and the development of preventive measures. The types of changes covered under this system include: Facility Changes, Major Accreditation Changes, Addition or Deletion to Division's Capabilities or Instrumentation, Key Personnel Changes, Laboratory Information Management System (LIMS) changes. This process is discussed in further detail in WS-QA-0050, Management of Change Procedures.

SECTION 14. CONTROL OF RECORDS

The laboratory maintains a records management system appropriate to its needs and that complies with applicable standards or regulations as required. The system produces unequivocal, accurate records that document all laboratory activities. The laboratory retains all original observations, calculations and derived data, calibration records and a copy of the analytical report for a minimum of five years after it has been issued.

14.1 Overview

The laboratory has established procedures for identification, collection, indexing, access, filing, storage, maintenance and disposal of quality and technical records. A record index is listed in Table 14-1. More detailed information on retention of specific records is provided in CW-L-P-001, Records Retention Policy and CW-L-WI-001, TestAmerica Records Retention/Storage Schedule. Quality records are maintained by the QA department in a database or in specific folders on the local QA share on a corporate server, which is backed up as part of the regular backup. Records are of two types; either electronic or hard copy paper formats depending on whether the record is computer or hand generated (some records may be in both formats). Technical records are maintained by Department Managers.

Table 14-1. Record Index[1]

	Record Types [1]:	**Retention Time:**
Technical Records	- Raw Data - Logbooks[2] - Standards - Certificates - Analytical Records - MDLs/IDLs/DOCs - Lab Reports	5 Years from analytical report issue*
Official Documents	- Quality Assurance Manual (QAM) - Work Instructions - Policies - SOPs - Policy Memorandums - Manuals - Published Methods	Indefinitely
QA Records	- Certifications - Method and Software Validation / Verification Data	Indefinitely
QA Records	- Internal & External Audits/Responses - Corrective/Preventive Actions - Management Reviews - Data Investigation	5 Years from archival* **Data Investigation:** 5 years or the life of the affected raw data storage whichever is greater (beyond 5 years if ongoing project or pending investigation)

	Record Types [1]:	Retention Time:
Project Records	- Sample Receipt & COC Documentation - Contracts and Amendments - Correspondence - QAPP - SAP - Telephone Logbooks - Lab Reports	5 Years from analytical report issue*
Administrative Records	Finance and Business Operations	Refer to CW-L-WI-001
	EH&S Manual, Permits	Indefinitely
	Disposal Records (Add Permits?)	Indefinitely
	Employee Handbook	Indefinitely
	Personnel files, Employee Signature & Initials, Administrative Training Records (e.g., Ethics)	Refer to HR Manual. All HR documents have different retention times.
	Administrative Policies	Indefinitely
	Technical Training Records	7 years
	Legal Records	Indefinitely
	HR Records	Refer to CW-L-WI-001
	IT Records	Refer to CW-L-WI-001
	Corporate Governance Records	Refer to CW-L-WI-001
	Sales & Marketing	5 years
	Real Estate	Indefinitely

[1] Record Types encompass hardcopy and electronic records.
[2] Examples of Logbook types: Maintenance, Instrument Run, Preparation (standard and samples), Standard and Reagent Receipt, Archiving, Balance Calibration, Temperature (hardcopy or electronic records).
* Exceptions listed in Table 14-2.

14.1.1 All records are stored and retained in such a way that they are secure and readily retrievable at the laboratory facility. All records shall be protected against fire, theft, loss, environmental deterioration, and vermin. In the case of electronic records, electronic or magnetic sources, storage media are protected from deterioration caused by magnetic fields and/or electronic deterioration.

Access to the data is limited to laboratory and company employees and shall be documented with an access log**.** Logs are maintained in each storage box to note removal and return of records. Records are maintained for a minimum of five years unless otherwise specified by a client or regulatory requirement.

For raw data and project records, record retention shall be calculated from the date the project report is issued. For other records, such as Controlled Documents, QA, or Administrative Records, the retention time is calculated from the date the record is formally retired. Records related to the programs listed in Table 14-2 have lengthier retention requirements and are subject to the requirements in Section 14.1.3.

14.1.2 Programs with Longer Retention Requirements

Some regulatory programs have longer record retention requirements than the standard record retention time. These are detailed in Table 14-2 with their retention requirements. In these cases, the longer retention requirement is enacted. If special instructions exist such that client data cannot be destroyed prior to notification of the client, the container or box containing that data is marked as to who to contact for authorization prior to destroying the data.

Table 14-2. Example: Special Record Retention Requirements

Program	[1]Retention Requirement
Drinking Water – All States	10 years (lab reports and raw data) 10 years - Radiochemistry (project records)
Drinking Water Lead and Copper Rule	12 years (project records)
Commonwealth of MA – All environmental data 310 CMR 42.14	10 years
FIFRA – 40 CFR Part 160	Retain for life of research or marketing permit for pesticides regulated by EPA
Housing and Urban Development (HUD) Environmental Lead Testing	10 years
Alaska	10 years
Louisiana – All	10 years
Michigan Department of Environmental Quality – all environmental data	10 years
Navy Facilities Engineering Service Center (NFESC)	10 years
Ohio VAP	10 years and State contacted prior to disposal
TSCA - 40 CFR Part 792	10 years after publication of final test rule or negotiated test agreement
OSHA	30 years

[1]Note: Extended retention requirements must be noted with the archive documents or addressed in facility-specific records retention procedures.

14.1.3 The laboratory has procedures to protect and back-up records stored electronically and to prevent unauthorized access to or amendment of these records. All analytical data is maintained as hard copy or in a secure readable electronic format. For analytical reports that are maintained as copies in PDF format, refer to Section 19.14.1 and WS-PQA-017 for more information.

14.1.4 The record keeping system allows for historical reconstruction of all laboratory activities that produced the analytical data, as well as rapid recovery of historical data. The history of the sample from when the laboratory took possession of the samples must be readily understood through the documentation. This shall include inter-laboratory transfers of samples and/or extracts.

- The records include the identity of personnel involved in sampling, sample receipt, preparation, or testing. All analytical work contains the initials (at least) of the personnel involved. The laboratory's copy of the COC is stored with the invoice and the work order sheet generated by the LIMS. The chain of custody would indicate the name of the sampler. If any sampling notes are provided with a work order, they are kept with this package.

- All information relating to the laboratory facilities equipment, analytical test methods, and related laboratory activities, such as sample receipt, sample preparation, or data verification are documented.

- The record keeping system facilitates the retrieval of all working files and archived records for inspection and verification purposes (e.g., set format for naming electronic files, set format for what is included with a given analytical data set.) Refer to SOP WS-QA-0009, Document Archiving. Instrument data is stored by project, except for inorganics and calibration data. Inorganics and calibration data is stored sequentially by instrument as appropriate. Run logs are maintained for each instrument or method; a copy of each day's run log or instrument sequence is stored with the data to aid in re-constructing an analytical sequence. Where an analysis is performed without an instrument, bound logbooks or bench sheets are used to record and file data. Standard and reagent information is recorded in logbooks or entered into the LIMS for each method as required.

- Changes to hardcopy records shall follow the procedures outlined in Section 12 and 19. Changes to electronic records in LIMS or instrument data are recorded in audit trails.

- The reason for a signature or initials on a document is clearly indicated in the records such as "sampled by," "prepared by," "reviewed by", or "analyzed by".

- All generated data except those that are generated by automated data collection systems, are recorded directly, promptly and legibly in permanent dark ink.

- Hard copy data may be scanned into PDF format for record storage as long as the scanning process can be verified in order to ensure that no data is lost and the data files and storage media must be tested to verify the laboratory's ability to retrieve the information prior to the destruction of the hard copy that was scanned. The procedure for this verification can be found in SOP WS-QA-0009.

- Also refer to Section 19.14.1 'Computer and Electronic Data Related Requirements'**.**

14.2 <u>Technical and Analytical Records</u>

14.2.1 The laboratory retains records of original observations, derived data and sufficient information to establish an audit trail, calibration records, staff records and a copy of each analytical report issued, for a minimum of five years unless otherwise specified by a client or regulatory requirement. The records for each analysis shall contain sufficient information to enable the analysis to be repeated under conditions as close as possible to the original. The records shall include the identity of laboratory personnel responsible for the sampling, performance of each analysis and reviewing results.

14.2.2 Observations, data and calculations are recorded real-time and are identifiable to the specific task.

14.2.3 Changes to hardcopy records shall follow the procedures outlined in Section 12 and 19. Changes to electronic records in LIMS or instrument data are recorded in audit trails.

The essential information to be associated with analysis, such as strip charts, tabular printouts, computer data files, analytical notebooks, and run logs, include:

- laboratory sample ID code**;**
- Date of analysis; Time of Analysis is also required if the holding time is seventy-two (72) hours or less, or when time critical steps are included in the analysis (e.g., drying times, incubations, etc.); instrumental analyses have the date and time of analysis recorded as part of their general operations. Where a time critical step exists in an analysis, location for such a time is included as part of the documentation in a specific logbook, on a benchsheet or in the LIMS.
- Instrumentation identification and instrument operating conditions/parameters. Operating conditions/parameters are typically recorded in instrument maintenance logs where available.
- analysis type**;**
- all manual calculations and manual integrations**;**
- analyst's or operator's initials/signature**;**
- sample preparation including cleanup, separation protocols, ID codes, volumes, weights, instrument printouts, meter readings, calculations, reagents**;**
- test results**;**
- standard and reagent origin, receipt, preparation, and use**;**
- calibration criteria, frequency and acceptance criteria**;**
- data and statistical calculations, review, confirmation, interpretation, assessment and reporting conventions**;**
- quality control protocols and assessment**;**
- electronic data security, software documentation and verification, software and hardware audits, backups, and records of any changes to automated data entries; and
- Method performance criteria including expected quality control requirements. These are indicated both in the LIMS and on specific analytical report formats**.**

14.2.4 All logbooks used during receipt, preparation, storage, analysis, and reporting of samples or monitoring of support equipment shall undergo a documented supervisory or peer review on a monthly basis.

14.3 Laboratory Support Activities

In addition to documenting all the above-mentioned activities, the following are retained QA records and project records (previous discussions in this section relate where and how these data are stored):

- all original raw data, whether hard copy or electronic, for calibrations, samples and quality control measures, including analysts' work sheets and data output records (chromatograms, strip charts, and other instrument response readout records)**;**

- a written description or reference to the specific test method used which includes a description of the specific computational steps used to translate parametric observations into a reportable analytical value**;**
- copies of final reports**;**
- archived SOPs**;**
- correspondence relating to laboratory activities for a specific project**;**
- all corrective action reports, audits and audit responses**;**
- proficiency test results and raw data; and
- results of data review, verification, and crosschecking procedures

14.3.1 Sample Handling Records

Records of all procedures to which a sample is subjected while in the possession of the laboratory are maintained. These include but are not limited to records pertaining to:

- sample preservation including appropriateness of sample container and compliance with holding time requirement;
- sample identification, receipt, acceptance or rejection and login;
- sample storage and tracking including shipping receipts, sample transmittal / COC forms; and
- procedures for the receipt and retention of samples, including all provisions necessary to protect the integrity of samples.

14.4 Administrative Records

The laboratory also maintains the administrative records in either electronic or hard copy form. Refer to Table 14-1.

14.5 Records Management, Storage and Disposal

All records (including those pertaining to test equipment), certificates and reports are safely stored, held secure and in confidence to the client. Certification related records are available upon request.

All information necessary for the historical reconstruction of data is maintained by the laboratory. Records that are stored only on electronic media must be supported by the hardware and software necessary for their retrieval.

Records that are stored or generated by computers or personal computers have hard copy, write-protected backup copies, or an electronic audit trail controlling access**.**

The laboratory has a record management system (a.k.a., document control) for control of laboratory notebooks, instrument logbooks, standards logbooks, and records for data reduction, validation, storage and reporting. Laboratory notebooks are issued on a per analysis basis, and

are numbered sequentially. All data are recorded sequentially within a series of sequential notebooks. Bench sheets are filed sequentially. Standards are maintained in a logbook or in the LIMS. Records are considered archived when noted as such in the records management system (a.k.a., document control.)

14.5.1 Transfer of Ownership

In the event that the laboratory transfers ownership or goes out of business, the laboratory shall ensure that the records are maintained or transferred according to client's instructions. Upon ownership transfer, record retention requirements shall be addressed in the ownership transfer agreement and the responsibility for maintaining archives is clearly established. In addition, in cases of bankruptcy, appropriate regulatory and state legal requirements concerning laboratory records must be followed. In the event of the closure of the laboratory, all records will revert to the control of the corporate headquarters. Should the entire company cease to exist, as much notice as possible will be given to clients and the accrediting bodies who have worked with the laboratory during the previous 5 years of such action.

14.5.2 Records Disposal

Records are removed from the archive and destroyed after 5 years unless otherwise specified by a client or regulatory requirement. On a project specific or program basis, clients may need to be notified prior to record destruction. Records are destroyed in a manner that ensures their confidentiality such as shredding, mutilation or incineration. (Refer to Tables 14-1 and 14-2).

Electronic copies of records must be destroyed by erasure or physically damaging off-line storage media so no records can be read.

If a third party records management company is hired to dispose of records, a "Certificate of Destruction" is required.

SECTION 15. AUDITS

15.1 Internal Audits

Internal audits are performed to verify that laboratory operations comply with the requirements of the lab's quality system and with the external quality programs under which the laboratory operates. Audits are planned and organized by the QA staff. Personnel conducting the audits should be independent of the area being evaluated. Auditors will have sufficient authority, access to work areas, and organizational freedom necessary to observe all activities affecting quality and to report the assessments to laboratory management and, when requested, to corporate management.

Audits are conducted and documented as described in the TestAmerica Corporate SOP on performing Internal Auditing, SOP No. CW-Q-S-003. The types and frequency of routine internal audits are described in Table 15-1. Special or ad hoc assessments may be conducted as needed under the direction of the QA staff.

Table 15-1. Types of Internal Audits and Frequency

Description	Performed by	Frequency
Quality Systems Audits	QA Department, QA approved designee, or Corporate QA	All areas of the laboratory annually
QA Technical Audits	Joint responsibility: a) QA Manager or designee b) Technical Manager or Designee (Refer to CW-Q-S-003)	Technical Audits Frequency: 50% of methods annually
SOP Method Compliance	Joint responsibility: a) QA Manager or designee c) Technical Manager or Designee (Refer to CW-Q-S-003)	SOP Compliance Review Frequency • Minimum of every two years. • Annually for all methods and administrative SOPs relating to DoD/DOE programs.
Special	QA Department or Designee	Surveillance or spot checks performed as needed, e.g., to confirm corrective actions from other audits.
Performance Testing	Analysts with QA oversight	Two successful per year for each TNI field of testing or as dictated by regulatory requirements

15.1.1 Annual Quality Systems Audit

An annual quality systems audit is required to ensure compliance to analytical methods and SOPs, TestAmerica's Data Integrity and Ethics Policies, TNI quality systems, client and state requirements, and the effectiveness of the internal controls of the analytical process, including but not limited to data review, quality controls, preventive action and corrective action. The completeness of earlier corrective actions is assessed for effectiveness & sustainability. The

audit is divided into sections for each operating or support area of the lab, and each section is comprehensive for a given area. The area audits may be performed on a rotating schedule throughout the year to ensure adequate coverage of all areas. This schedule may change as situations in the laboratory warrant.

15.1.2 QA Technical Audits

QA technical audits are based on client projects, associated sample delivery groups, and the methods performed. Reported results are compared to raw data to verify the authenticity of results. The validity of calibrations and QC results are compared to data qualifiers, footnotes, and case narratives. Documentation is assessed by examining run logs and records of manual integrations. Manual calculations are checked. Where possible, electronic audit miner programs (e.g., MintMiner and Chrom AuditMiner) are used to identify unusual manipulations of the data deserving closer scrutiny. QA technical audits will include all methods within a two-year period.

15.1.3 SOP Method Compliance

Compliance of all SOPs with the source methods and compliance of the operational groups with the SOPs will be assessed by the Technical Manager or qualified designee at least every two years. (Annually for methods and administrative SOPs related to DoD/DOE programs.) It is also recommended that the work of each newly hired analyst is assessed within 3 months of working independently, (e.g., completion of method IDOC). In addition, as analysts add methods to their capabilities, (new IDOC) reviews of the analyst work products will be performed within 3 months of completing the documented training.

15.1.4 Special Audits

Special audits are conducted on an as needed basis, generally as a follow up to specific issues such as client complaints, corrective actions, PT results, data audits, system audits, validation comments, regulatory audits or suspected ethical improprieties. Special audits are focused on a specific issue, and report format, distribution, and timeframes are designed to address the nature of the issue.

15.1.5 Performance Testing

The laboratory participates semi-annually in performance audits conducted through the analysis of PT samples provided by a third party. The laboratory generally participates in the following types of PT studies: Soil, Water Supply, Water Pollution, Air, and round-robin studies for sediments and biological materials. When available for parameters tested by the laboratory, the laboratory will also participate in the DOE administered MAPEP program.

It is TestAmerica's policy that PT samples be treated as typical samples in the production process. Furthermore, where PT samples present special or unique problems, in the regular production process they may need to be treated differently, as would any special or unique request submitted by any client. The QA Manager must be consulted and in agreement with any decisions made to treat a PT sample differently due to some special circumstance.

Written responses to unacceptable PT results are required. In some cases it may be necessary for blind QC samples to be submitted to the laboratory to show a return to control.

15.2 External Audits

External audits are performed when certifying agencies or clients conduct on-site inspections or submit performance testing samples for analysis. It is TestAmerica's policy to cooperate fully with regulatory authorities and clients. The laboratory makes every effort to provide the auditors with access to personnel, documentation, and assistance. Laboratory supervisors are responsible for providing corrective actions to the QA Manager who coordinates the response for any deficiencies discovered during an external audit. Audit responses are due in the time allotted by the client or agency performing the audit. When requested, a copy of the audit report and the labs corrective action plan will be forwarded to Corporate Quality.

The laboratory cooperates with clients and their representatives to monitor the laboratory's performance in relation to work performed for the client. The client may only view data and systems related directly to the client's work. All efforts are made to keep other client information confidential.

15.2.1 Confidential Business Information (CBI) Considerations

During on-site audits, auditors may come into possession of information claimed as business confidential. A business confidentiality claim is defined as "a claim or allegation that business information is entitled to confidential treatment for reasons of business confidentiality or a request for a determination that such information is entitled to such treatment." When information is claimed as business confidential, the laboratory must place on (or attach to) the information at the time it is submitted to the auditor, a cover sheet, stamped or typed legend or other suitable form of notice, employing language such as "trade secret", "proprietary" or "company confidential". Confidential portions of documents otherwise non-confidential must be clearly identified. CBI may be purged of references to client identity by the responsible laboratory official at the time of removal from the laboratory. However, sample identifiers may not be obscured from the information. Additional information regarding CBI can be found within the 2009 TNI standards.

15.3 Audit Findings

Audit findings are documented using the corrective action process and database. The laboratory's corrective action responses for both types of audits may include action plans that could not be completed within a predefined timeframe. In these instances, a completion date must be set and agreed to by operations management and the QA Manager.

Developing and implementing corrective actions to findings is the responsibility of the Technical Manager where the finding originated. Findings that are not corrected by specified due dates are reported monthly to management in the QA monthly report. When requested, a copy of the audit report and the labs corrective action plan will be forwarded to Corporate Quality.

If any audit finding casts doubt on the effectiveness of the operations or on the correctness or validity of the laboratory's test results, the laboratory shall take timely corrective action, and shall notify clients in writing if the investigations show that the laboratory results have been

affected. Once corrective action is implemented, a follow-up audit is scheduled to ensure that the problem has been corrected.

Clients must be notified promptly in writing, of any event such as the identification of defective measuring or test equipment that casts doubt on the validity of results given in any test report or amendment to a test report. The investigation must begin within 24-hours of discovery of the problem and all efforts are made to notify the client within two weeks after the completion of the investigation.

SECTION 16. MANAGEMENT REVIEWS

16.1 Quality Assurance Report

A comprehensive QA Report shall be prepared each month by the laboratory's QA Department and forwarded to the Laboratory Director, Technical Managers, their Quality Director as well as the VP of Operations. All aspects of the QA system are reviewed to evaluate the suitability of policies and procedures. During the course of the year, the Laboratory Director, VP of Operations, or Corporate QA may request that additional information be added to the report.

On a monthly basis, Corporate QA compiles information from all the monthly laboratory reports. The Corporate Quality Directors prepare a report that includes a compilation of all metrics and notable information and concerns regarding the QA programs within the laboratories. The report also includes a listing of new regulations that may potentially impact the laboratories. This report is presented to the Senior Management Team and General Managers.

16.2 Annual Management Review

The senior lab management team (Laboratory Director, Technical Managers, and QA Manager) conducts a review annually of its quality systems and LIMS to ensure its continuing suitability and effectiveness in meeting client and regulatory requirements and to introduce any necessary changes or improvements. It will also provide a platform for defining goals, objectives and action items that feed into the laboratory planning system. Corporate Operations and Corporate QA personnel can be included in this meeting at the discretion of the Laboratory Director. The LIMS review consists of examining any audits, complaints or concerns that have been raised through the year that are related to the LIMS. The laboratory will summarize any critical findings that cannot be solved by the lab and report them to Corporate IT.

This management systems review (Corporate SOP No. CW-Q-S-004 & Work Instruction No. CW-Q-WI-003) uses information generated during the preceding year to assess the "big picture" by ensuring that routine actions taken and reviewed on a monthly basis are not components of larger systematic concerns. The monthly review should keep the quality systems current and effective, therefore, the annual review is a formal senior management process to review specific existing documentation. Significant issues from the following documentation are compiled or summarized by the QA Manager prior to the review meeting:

- Matters arising from the previous annual review.
- Prior Monthly QA Reports issues.
- Laboratory QA Metrics.
- Review of report reissue requests.
- Review of client feedback and complaints.
- Issues arising from any prior management or staff meetings.
- Minutes from prior senior lab management meetings. Issues that may be raised from these meetings include:
    - Adequacy of staff, equipment and facility resources.
    - Adequacy of policies and procedures.
    - Future plans for resources and testing capability and capacity.

- The annual internal double blind PT program sample performance (if performed),
- Compliance to the Ethics Policy and Data Integrity Plan. Including any evidence/incidents of inappropriate actions or vulnerabilities related to data Integrity.

A report is generated by the QA Manager and management. The report is distributed to the appropriate General Manager and the Quality Director. The report includes, but is not limited to:

- The date of the review and the names and titles of participants.
- A reference to the existing data quality related documents and topics that were reviewed.
- Quality system or operational changes or improvements that will be made as a result of the review [e.g., an implementation schedule including assigned responsibilities for the changes (Action Table)].

Changes to the quality systems requiring update to the laboratory QA Manual shall be included in the next revision of the QA Manual.

16.3 Potential Integrity Related Managerial Reviews

Potential integrity issues (data or business related) must be handled and reviewed in a confidential manner until such time as a follow-up evaluation, full investigation, or other appropriate actions have been completed and issues clarified. TestAmerica's Corporate Data Investigation/Recall SOP shall be followed (SOP No. CW-L-S-002). All investigations that result in finding of inappropriate activity are documented and include any disciplinary actions involved, corrective actions taken, and all appropriate notifications of clients.

TestAmerica's CEO, Executive VP of Operations, VP of Client & Technical Services, VPs of Operations and Quality Directors receive a monthly report from the Exec Director of Quality & EHS summarizing any current data integrity or data recall investigations. The VPs of Operations are also made aware of progress on these issues for their specific labs.

SECTION 17. PERSONNEL

17.1 Overview

The laboratory's management believes that its highly qualified and professional staff is the single most important aspect in assuring a high level of data quality and service. The staff consists of professionals and support personnel as outlined in the organization chart in Figure 4-1.

All personnel must demonstrate competence in the areas where they have responsibility. Any staff that is undergoing training shall have appropriate supervision until they have demonstrated their ability to perform their job function on their own. Staff shall be qualified for their tasks based on appropriate education, training, experience and/or demonstrated skills as required.

The laboratory employs sufficient personnel with the necessary education, training, technical knowledge and experience for their assigned responsibilities.

All personnel are responsible for complying with all QA/QC requirements that pertain to the laboratory and their area of responsibility. Each staff member must have a combination of experience and education to adequately demonstrate a specific knowledge of their particular area of responsibility. Technical staff must also have a general knowledge of lab operations, test methods, QA/QC procedures and records management.

Laboratory management is responsible for formulating goals for lab staff with respect to education, training and skills and ensuring that the laboratory has a policy and procedures for identifying training needs and providing training of personnel. The training shall be relevant to the present and anticipated responsibilities of the lab staff.

The laboratory only uses personnel that are employed by or under contract to, the laboratory. Contracted personnel, when used, must meet competency standards of the laboratory and work in accordance to the laboratory's quality system.

17.2 Education and Experience Requirements for Technical Personnel

The laboratory makes every effort to hire analytical staffs that possess a college degree (AA, BA, BS) in an applied science with some chemistry in the curriculum. Exceptions can be made based upon the individual's experience and ability to learn. Selection of qualified candidates for laboratory employment begins with documentation of minimum education, training, and experience prerequisites needed to perform the prescribed task. Minimum education and training requirements for TestAmerica employees are outlined in job descriptions and are generally summarized for analytical staff in the table below.

The laboratory maintains job descriptions for all personnel who manage, perform or verify work affecting the quality of the environmental testing the laboratory performs. Job Descriptions are located on the TestAmerica intranet site's Human Resources web-page (Also see Section 4 for position descriptions/responsibilities).

Experience and specialized training are occasionally accepted in lieu of a college degree (basic lab skills such as using a balance, colony counting, aseptic or quantitation techniques, etc., are also considered).

As a general rule for analytical staff:

Specialty	Education	Experience
Extractions, Digestions, some electrode methods (pH, Conductivity, etc.), or Titrimetric and Gravimetric Analyses	H.S. Diploma	On the job training (OJT)
GFAA, CVAA, FLAA, Single component or short list Chromatography (e.g., Fuels, BTEX-GC, IC)	A college degree in an applied science or 2 years of college and at least 1 year of college chemistry	Or 2 years prior analytical experience is required
ICP, ICPMS, Long List or complex chromatography (e.g., Pesticides, PCB, HPLC, etc.), GCMS	A college degree in an applied science or 2 years of college chemistry	or 5 years of prior analytical experience
Spectra Interpretation	A college degree in an applied science or 2 years of college chemistry	And 2 years relevant experience Or 5 years of prior analytical experience
Technical Managers – **General**	Bachelors Degree in an applied science or engineering with 24 semester hours in chemistry An advanced (MS, PhD.) degree may substitute for one year of experience	And 2 years experience in environmental analysis of representative analytes for which they will oversee
Technical Managers – **Wet Chem** only (no advanced instrumentation)	Associates degree in an applied science or engineering or 2 years of college with 16 semester hours in chemistry	And 2 years relevant experience

When an analyst does not meet these requirements, they can perform a task under the direct supervision of a qualified analyst, peer reviewer or Technical Manager, and are considered an analyst in training. The person supervising an analyst in training is accountable for the quality of the analytical data and must review and approve data and associated corrective actions.

17.3 Training

The laboratory is committed to furthering the professional and technical development of employees at all levels.

Orientation to the laboratory's policies and procedures, in-house method training, and employee attendance at outside training courses and conferences all contribute toward employee proficiency. Below are examples of various areas of required employee training:

Required Training	Time Frame	Employee Type
Environmental Health & Safety	Prior to lab work	All
Ethics – New Hires	1 week of hire	All
Ethics – Comprehensive	90 days of hire	All
Data Integrity	30 days of hire	Technical and PMs
Quality Assurance	90 days of hire	All
Ethics – Comprehensive Refresher	Annually	All
Initial Demonstration of Capability (DOC)	Prior to unsupervised method performance	Technical

The laboratory maintains records of relevant authorization/competence, education, professional qualifications, training, skills and experience of technical personnel (including contracted personnel) as well as the date that approval/authorization was given. These records are kept on file at the laboratory. Also refer to "Demonstration of Capability" in Section 19.

The training of technical staff is kept up to date by:

- Each employee must have documentation in their training file that they have read, understood and agreed to follow the most recent version of the laboratory QA Manual and SOPs in their area of responsibility. This documentation is updated as SOPs are updated.
- Documentation from any training courses or workshops on specific equipment, analytical techniques or other relevant topics are maintained in their training file.
- Documentation of proficiency (refer to Section 19).
- An Ethics Agreement signed by each staff member (renewed each year) and evidence of annual ethics training.
- A Confidentiality Agreement signed by each staff member signed at the time of employment.
- Human Resources maintains documentation and attestation forms on employment status & records; benefit programs; timekeeping/payroll; and employee conduct (e.g., ethics violations). This information is maintained in the employee's secured personnel file.

Evidence of successful training could include such items as:

- Adequate documentation of training within operational areas, including one-on-one technical training for individual technologies, and particularly for people cross-trained.
- Analyst knowledge to refer to QA Manual for quality issues.
- Analysts following SOPs, i.e., practice matches SOPs.
- Analysts regularly communicate to supervisors and QA if SOPs need revision, rather than waiting for auditors to find problems.

Further details of the laboratory's training program are described in the Laboratory Training SOP (WS-QA-0022, Employee Orientation and Training).

17.4 Data Integrity and Ethics Training Program

Establishing and maintaining a high ethical standard is an important element of a Quality System. Ethics and data integrity training is integral to the success of TestAmerica and is provided for each employee at TestAmerica. It is a formal part of the initial employee orientation within 1 week of hire followed by technical data integrity training within 30 days, comprehensive training within 90 days, and an annual refresher for all employees. Senior management at each facility performs the ethics training for their staff.

In order to ensure that all personnel understand the importance TestAmerica places on maintaining high ethical standards at all times; TestAmerica has established a Corporate Ethics Policy (Policy No. CW-L-P-004) and an Ethics Statement. All initial and annual training is documented by signature on the signed Ethics Statement demonstrating that the employee has participated in the training and understands their obligations related to ethical behavior and data integrity.

Violations of this Ethics Policy will not be tolerated. Employees who violate this policy will be subject to disciplinary actions up to and including termination. Criminal violations may also be referred to the Government for prosecution. In addition, such actions could jeopardize TestAmerica's ability to do work on Government contracts, and for that reason, TestAmerica has a Zero Tolerance approach to such violations.

Employees are trained as to the legal and environmental repercussions that result from data misrepresentation. Key topics covered in the presentation include:

- Organizational mission and its relationship to the critical need for honesty and full disclosure in all analytical reporting.
- Ethics Policy
- How and when to report ethical/data integrity issues. Confidential reporting.
- Record keeping.
- Discussion regarding data integrity procedures.
- Specific examples of breaches of ethical behavior (e.g. peak shaving, altering data or computer clocks, improper macros, etc., accepting/offering kickbacks, illegal accounting practices, unfair competition/collusion)
- Internal monitoring. Investigations and data recalls.
- Consequences for infractions including potential for immediate termination, debarment, or criminal prosecution.
- Importance of proper written narration / data qualification by the analyst and project manager with respect to those cases where the data may still be usable but are in one sense or another partially deficient.

Additionally, a data integrity hotline (1-800-736-9407) is maintained by TestAmerica and administered by the Corporate Quality Department.

SECTION 18. ACCOMMODATIONS AND ENVIRONMENTAL CONDITIONS

18.1 Overview

The laboratory is a 66,000 ft^2 secure laboratory facility with controlled access and designed to accommodate an efficient workflow and to provide a safe and comfortable work environment for employees. All visitors sign in and are escorted by laboratory personnel. Access is controlled by various measures.

The laboratory is equipped with structural safety features. Each employee is familiar with the location, use, and capabilities of general and specialized safety features associated with their workplace. The laboratory provides and requires the use of protective equipment including safety glasses, protective clothing, gloves, etc., OSHA and other regulatory agency guidelines regarding required amounts of bench and fume hood space, lighting, ventilation (temperature and humidity controlled), access, and safety equipment are met or exceeded.

Traffic flow through sample preparation and analysis areas is minimized to reduce the likelihood of contamination. Adequate floor space and bench top area is provided to allow unencumbered sample preparation and analysis space. Sufficient space is also provided for storage of reagents and media, glassware, and portable equipment. Ample space is also provided for refrigerated sample storage before analysis and archival storage of samples after analysis. Laboratory HVAC and deionized water systems are designed to minimize potential trace contaminants.

The laboratory is separated into specific areas for sample receiving, sample preparation, volatile organic sample analysis, non-volatile organic sample analysis, inorganic sample analysis, and administrative functions.

18.2 Environment

Laboratory accommodation, test areas, energy sources, lighting are adequate to facilitate proper performance of tests. The facility is equipped with heating, ventilation, and air conditioning (HVAC) systems appropriate to the needs of environmental testing performed at this laboratory.

The environment in which these activities are undertaken does not invalidate the results or adversely affect the required accuracy of any measurements.

The laboratory provides for the effective monitoring, control and recording of environmental conditions that may affect the results of environmental tests as required by the relevant specifications, methods, and procedures. Such environmental conditions include humidity, voltage, temperature, and vibration levels in the laboratory. In the event of a power outage, the laboratory can be equipped with a back up power supply for sample storage, as detailed in SOP No. WS-QA-0005, Temperature Monitoring and Corrective Action for Refrigerators and Freezers.

When any of the method or regulatory required environmental conditions change to a point where they may adversely affect test results, analytical testing will be discontinued until the environmental conditions are returned to the required levels.

Environmental conditions of the facility housing the computer network and LIMS are regulated to protect against raw data loss.

18.3 Work Areas

There is effective separation between neighboring areas when the activities therein are incompatible with each other. Examples include:

- Volatile organic chemical handling areas, including sample preparation and waste disposal, and volatile organic chemical analysis areas.

Access to and use of all areas affecting the quality of analytical testing is defined and controlled by secure access to the laboratory building as described below in the Building Security section.

Adequate measures are taken to ensure good housekeeping in the laboratory and to ensure that any contamination does not adversely affect data quality. These measures include regular cleaning to control dirt and dust within the laboratory. Work areas are available to ensure an unencumbered work area. Work areas include:

- Access and entryways to the laboratory.
- Sample receipt areas.
- Sample storage areas.
- Chemical and waste storage areas.
- Data handling and storage areas.
- Sample processing areas.
- Sample analysis areas.

18.4 Floor Plan

A floor plan can be found in Appendix 1.

18.5 Building Security

Building keys and alarm codes are distributed to employees as necessary.

Employees wear photographic identification name cards while on the premises.

Visitors to the laboratory sign in and out in a visitor's logbook. A visitor is defined as any person who visits the laboratory who is not an employee of the laboratory. In addition to signing into the laboratory, the Environmental, Health and Safety Manual contains requirements for visitors and vendors. There are specific safety forms that must be reviewed and signed. Visitors (with the exception of company employees) are escorted by laboratory personnel at all times, or the location of the visitor is noted in the visitor's logbook.

SECTION 19. TEST METHODS AND METHOD VALIDATION

19.1 Overview

The laboratory uses methods that are appropriate to meet our clients' requirements and that are within the scope of the laboratory's capabilities. These include sampling, handling, transport, storage and preparation of samples, and, where appropriate, an estimation of the measurement of uncertainty as well as statistical techniques for analysis of environmental data.

Instructions are available in the laboratory for the operation of equipment as well as for the handling and preparation of samples. All instructions, Standard Operating Procedures (SOPs), reference methods and manuals relevant to the working of the laboratory are readily available to all staff. Deviations from published methods are documented (with justification) in the laboratory's approved SOPs. SOPs are submitted to clients for review at their request. Significant deviations from published methods require client approval and regulatory approval where applicable.

19.2 Standard Operating Procedures (SOPS)

The laboratory maintains SOPs that accurately reflect all phases of the laboratory such as assessing data integrity, corrective actions, handling customer complaints as well as all analytical methods and sampling procedures. The method SOPs are derived from the most recently promulgated/approved, published methods and are specifically adapted to the laboratory facility. Modifications or clarifications to published methods are clearly noted in the SOPs. All SOPs are controlled in the laboratory.

- All SOPs contain a revision number, effective date, and appropriate approval signatures. Controlled copies are available to all staff.
- Procedures for writing an SOP are incorporated by reference to TestAmerica's Corporate SOP entitled 'Writing a Standard Operating Procedure', No. CW-Q-S-002 or the laboratory's SOP WS-QA-0021 (Preparation and Management of Standard Operating Procedures).
- SOPs are reviewed at a minimum of every 2 years (annually for Drinking Water and DoD/DOE SOPs), and where necessary, revised to ensure continuing suitability and compliance with applicable requirements.

19.3 Laboratory Methods Manual

For each test method, the laboratory shall have available the published referenced method as well as the laboratory developed SOP.

Note: If more stringent standards or requirements are included in a mandated test method or regulation than those specified in this manual, the laboratory shall demonstrate that such requirements are met. If it is not clear which requirements are more stringent, the standard from the method or regulation is to be followed. Any exceptions or deviations from the referenced methods or regulations are noted in the specific analytical SOP.

The laboratory maintains an SOP Index for both technical and non-technical SOPs. Technical SOPs are maintained to describe a specific test method. Non-technical SOPs are maintained to describe functions and processes not related to a specific test method.

19.4 Selection of Methods

Since numerous methods and analytical techniques are available, continued communication between the client and laboratory is imperative to assure the correct methods are utilized. Once client methodology requirements are established, this and other pertinent information is summarized by the Project Manager. These mechanisms ensure that the proper analytical methods are applied when the samples arrive for log-in. For non-routine analytical services (e.g., special matrices, non-routine compound lists), the method of choice is selected based on client needs and available technology. The methods selected should be capable of measuring the specific parameter of interest, in the concentration range of interest, and with the required precision and accuracy.

19.4.1 Sources of Methods

Routine analytical services are performed using standard EPA-approved methodology. In some cases, modification of standard approved methods may be necessary to provide accurate analyses of particularly complex matrices. When the use of specific methods for sample analysis is mandated through project or regulatory requirements, only those methods shall be used.

When clients do not specify the method to be used or methods are not required, the methods used will be clearly validated and documented in an SOP and available to clients and/or the end user of the data.

The analytical methods used by the laboratory are those currently accepted and approved by the U. S. EPA and the state or territory from which the samples were collected. Reference methods include:

- *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, US EPA, January 1996.*
- *Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act, Analysis and Sampling Procedures; 40 CFR Part 136 as amended by Method Update Rule; May 18, 2012.*
- *Methods for Chemical Analysis of Water and Wastes, EPA 600 (4-79-020), 1983.*
- *Methods for the Determination of Inorganic Substances in Environmental Samples, EPA-600/R-93/100, August 1993.*
- *Methods for the Determination of Metals in Environmental Samples, EPA/600/4-91/010, June 1991. Supplement I: EPA-600/R-94/111, May 1994.*
- *Methods for the Determination of Organic Compounds in Drinking Water, EPA-600/4-88-039, December 1988, Revised, July 1991, Supplement I, EPA-600-4-90-020, July 1990, Supplement II, EPA-600/R-92-129, August 1992. Supplement III EPA/600/R-95/131 - August 1995 (EPA 500 Series) (EPA 500 Series methods)*
- *Technical Notes on Drinking Water Methods, EPA-600/R94-173, October 1994*
- *NIOSH Manual of Analytical Methods, 4th ed., August 1994.*
- *Statement of Work for Inorganics & Organics Analysis, SOM, DLM, CBC, and ISM, current versions, USEPA Contract Laboratory Program Multi-media, Multi-concentration.*

- *Standard Methods for the Examination of Water and Wastewater, 18th/19th /20th/ on-line edition; Eaton, A.D. Clesceri, L.S. Greenberg, A.E. Eds; American Water Works Association, Water Pollution Control Federation, American Public Health Association: Washington, D.C.*
- *Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846), Third Edition, September 1986, Final Update I, July 1992, Final Update IIA, August 1993, Final Update II, September 1994; Final Update IIB, January 1995; Final Update III, December 1996; Final Update IV, January 2008; Final Update V, August 2015..*
- *Annual Book of ASTM Standards, American Society for Testing & Materials (ASTM), Philadelphia, PA.*
- *National Status and Trends Program, National Oceanographic and Atmospheric Administration, Volume I-IV, 1985-1994.*
- *Manual for the Certification of Laboratories Analyzing Drinking Water (EPA 815-R-05-004, January 2005)*
- *Code of Federal Regulations (CFR) 40, Parts 136, 141, 172, 173, 178, 179 and 261*
- *Underground Storage Tanks Procedures Manual, State of Alaska Department of Environmental Conservation, Division of Spill Prevention and Response Contaminated Sites Program, November 7, 2002*
- *Tri-Regional Board Staff Recommendations for Preliminary Investigation and Evaluation of Underground Tank Sites, North Coast Regional Water Quality Control Board, San Francisco Bay Regional Water Quality Control Board and Central Valley Regional Water Quality Control Board, August 10, 1990*
- *Analytical Methods for Petroleum Hydrocarbons, Washington State Department of Ecology, June 1997*
- *Compendium of Methods for the Determination of Air Pollutants in Indoor Air, (EPA 600/4-90-10, April 1990)*
- *Compendium of Methods for the Determination of Inorganic Compounds in Ambient Air, (EPA 625/R-96/010a, June 1999*
- *Methods for Determining Emissions of Toxic Air Contaminants from Stationary Sources, Stationary Source Test Methods, Volume 3, California Air Resources Board*
- *Leaking Underground Fuel Tank Guidance Manual, September 2012, California State Water Resources Control Board*

The laboratory reviews updated versions to all the aforementioned references for adaptation based upon capabilities, instrumentation, etc., and implements them as appropriate. As such, the laboratory strives to perform only the latest versions of each approved method as regulations allow or require.

Other reference procedures for non-routine analyses may include methods established by specific states (e.g., Underground Storage Tank methods), ASTM or equipment manufacturers. Sample type, source, and the governing regulatory agency requiring the analysis will determine the method utilized.

The laboratory shall inform the client when a method proposed by the client may be inappropriate or out of date. After the client has been informed, and they wish to proceed contrary to the laboratory's recommendation, it will be documented.

19.4.2 Demonstration of Capability

Before the laboratory may institute a new method and begin reporting results, the laboratory shall confirm that it can properly operate the method. In general, this demonstration does not test the performance of the method in real world samples, but in an applicable and available clean matrix sample. If the method is for the testing of analytes that are not conducive to spiking, demonstration of capability may be performed on quality control samples.

A demonstration of capability (DOC, Lab SOP # WS-QA-0022) is performed whenever there is a change in instrument type (e.g., new instrumentation), matrix, method or personnel (e.g., analyst hasn't performed the test within the last 12 months).

Note: The laboratory shall have a DOC for all analytes included in the methods that the laboratory performs, and proficiency DOCs for each analyst shall include all analytes that the laboratory routinely performs. Addition of non-routine analytes does not require new DOCs for all analysts if those analysts are already qualified for routine analytes tested using identical chemistry and instrument conditions.

The initial demonstration of capability must be thoroughly documented and approved by the Technical Manager and QA Manager prior to independently analyzing client samples. All associated documentation must be retained in accordance with the laboratories archiving procedures.

The laboratory must have an approved SOP, demonstrate satisfactory performance, and conduct an MDL study (when applicable). There may be other requirements as stated within the published method or regulations (i.e., retention time window study).

Note: In some instances, a situation may arise where a client requests that an unusual analyte be reported using a method where this analyte is not normally reported. If the analyte is being reported for regulatory purposes, the method must meet all procedures outlined within this QA Manual (SOP, MDL, and Demonstration of Capability). If the client states that the information is not for regulatory purposes, the result may be reported as long as the following criteria are met:

- The instrument is calibrated for the analyte to be reported using the criteria for the method and ICV/CCV criteria are met (unless an ICV/CCV is not required by the method or criteria are per project DQOs).
- The laboratory's nominal or default reporting limit (RL) is equal to the quantitation limit (QL), must be at or above the lowest non-zero standard in the calibration curve and must be reliably determined. Project RLs are client specified reporting levels which may be higher than the QL. Results reported below the QL must be qualified as estimated values. Also see Section 19.6.1.3, Relationship of Limit of Detection (LOD) to Quantitation Limit (QL).
- The client request is documented and the lab informs the client of its procedure for working with unusual compounds. The final report must be footnoted: *Reporting Limit based on the low standard of the calibration curve.*

19.4.3 Initial Demonstration of Capability (IDOC) Procedures

19.4.3.1 The spiking standard used must be prepared independently from those used in instrument calibration.

19.4.3.2 The analyte(s) shall be diluted in a volume of clean matrix sufficient to prepare four aliquots at the concentration specified by a method or the laboratory SOP. If the concentration is unspecified, the routine LCS spike level may be used.

19.4.3.3 At least four aliquots shall be prepared (including any applicable clean-up procedures) and analyzed according to the test method (either concurrently or over a period of days).

19.4.3.4 Using all of the results, calculate the mean recovery in the appropriate reporting units and the standard deviations for each parameter of interest.

19.4.3.5 When it is not possible to determine the mean and standard deviations, such as for presence, absence and logarithmic values, the laboratory will assess performance against criteria described in the Method SOP.

19.4.3.6 Compare the information obtained above to the corresponding acceptance criteria for precision and accuracy in the test method (if applicable) or in laboratory generated acceptance criteria (LCS or interim criteria) if there is no mandatory criteria established. If any one of the parameters do not meet the acceptance criteria, the performance is unacceptable for that parameter.

19.4.3.7 When one or more of the tested parameters fail at least one of the acceptance criteria, the analyst must proceed according to either option listed below:

- Locate and correct the source of the problem and repeat the test for all parameters of interest beginning with 19.4.3.3 above.
- Beginning with 19.4.3.3 above, repeat the test for all parameters that failed to meet criteria. Repeated failure, however, will confirm a general problem with the measurement system. If this occurs, locate and correct the source of the problem and repeat the test for all compounds of interest beginning with 19.4.3.1 above.

Note: Results of successive LCS analyses can be used to fulfill the DOC requirement.

A certification statement (refer to Figure 19-1 as an example) shall be used to document the completion of each initial demonstration of capability. A copy of the certification is archived in the analyst's training folder.

Methods on line prior to the effective date of this Section shall be updated to the procedures outlined above as new analysts perform their demonstration of capability. A copy of the new record will replace that which was used for documentation in the past. At a minimum, the precision and accuracy of four mid-level laboratory control samples must have been compared to the laboratory's quality control acceptance limits.

In accordance with Arizona Administrative Code R9-14-616.5f, documentation of each analyst's performance of proficiency testing, as applicable, will be maintained in the training record.

19.5 Laboratory Developed Methods and Non-Standard Methods

Any new method developed by the laboratory must be fully defined in an SOP and validated by qualified personnel with adequate resources to perform the method. Method specifications and the relation to client requirements must be clearly conveyed to the client if the method is a non-standard method (not a published or routinely accepted method). The client must also be in agreement to the use of the non-standard method.

19.6 Validation of Methods

Validation is the confirmation by examination and the provision of objective evidence that the particular requirements for a specific intended use are fulfilled.
All non-standard methods, laboratory designed/developed methods, standard methods used outside of their scope, and major modifications to published methods must be validated to confirm they are fit for their intended use. The validation will be as extensive as necessary to meet the needs of the given application. The results are documented with the validation procedure used and contain a statement as to the fitness for use.

19.6.1 Method Validation and Verification Activities for All New Methods

While method validation can take various courses, the following activities can be required as part of method validation. Method validation records are designated QC records and are archived accordingly.

19.6.1.1 Determination of Method Selectivity

Method selectivity is the demonstrated ability to discriminate the analyte(s) of interest from other compounds in the specific matrix or matrices from other analytes or interference. In some cases to achieve the required selectivity for an analyte, a confirmation analysis is required as part of the method.

19.6.1.2 Determination of Method Sensitivity

Sensitivity can be both estimated and demonstrated. Whether a study is required to estimate sensitivity depends on the level of method development required when applying a particular measurement system to a specific set of samples. Where estimations and/or demonstrations of sensitivity are required by regulation or client agreement, such as the procedure in 40 CFR Part 136 Appendix B, under the Clean Water Act, these shall be followed.

19.6.1.3 Relationship of Limit of Detection (LOD) to the Quantitation Limit (QL)

An important characteristic of expression of sensitivity is the difference in the LOD and the QL. The LOD is the minimum level at which the presence of an analyte can be reliably concluded. The QL is the minimum concentration of analyte that can be quantitatively determined with acceptable precision and bias. For most instrumental measurement systems, there is a region where semi-quantitative data is generated around the LOD (both above and below the estimated MDL or LOD) and below the QL. In this region, detection of an analyte may be confirmed but quantification of the analyte is unreliable within the accuracy and precision guidelines of the measurement system. When an analyte is detected below the QL, and the presence of the analyte is confirmed by meeting the qualitative identification criteria for the

analyte, the analyte can be reliably reported, but the amount of the analyte can only be estimated. If data is to be reported in this region, it must be done so with a qualification that denotes the semi-quantitative nature of the result.

19.6.1.4 Determination of Interferences

A determination that the method is free from interferences in a blank matrix is performed.

19.6.1.5 Determination of Range

Where appropriate to the method, the quantitation range is determined by comparison of the response of an analyte in a curve to established or targeted criteria. Generally the upper quantitation limit is defined by highest acceptable calibration concentration. The lower quantitation limit or QL cannot be lower than the lowest non-zero calibration level, and can be constrained by required levels of bias and precision.

19.6.1.6 Determination of Accuracy and Precision

Accuracy and precision studies are generally performed using replicate analyses, with a resulting percent recovery and measure of reproducibility (standard deviation, relative standard deviation) calculated and measured against a set of target criteria.

19.6.1.7 Documentation of Method

The method is formally documented in an SOP. If the method is a minor modification of a standard laboratory method that is already documented in an SOP. An SOP Attachment describing the specific differences in the new method is acceptable in place of a separate SOP.

19.6.1.8 Continued Demonstration of Method Performance

Continued demonstration of Method Performance is addressed in the SOP. Continued demonstration of method performance is generally accomplished by batch specific QC samples such as LCS, method blanks or PT samples.

19.7 Method Detection Limits (MDL) / Limits of Detection (LOD)

Method detection limits (MDL) are initially determined in accordance with 40 CFR Part 136, Appendix B or alternatively by other technically acceptable practices that have been accepted by regulators. MDL is also sometimes referred to as Limit of Detection (LOD). The MDL theoretically represents the concentration level for each analyte within a method at which the Analyst is 99% confident that the true value is not zero. The MDL is determined for each analyte initially during the method validation process and updated as required in the analytical methods, whenever there is a significant change in the procedure or equipment, or based on project specific requirements. Generally, the analyst prepares at least seven replicates of solution spiked at one to five times the estimated method detection limit (most often at the lowest standard in the calibration curve) into the applicable matrix with all the analytes of interest. Each of these aliquots is extracted (including any applicable clean-up procedures) and analyzed in the same manner as the samples. Where possible, the seven replicates should be analyzed over 2-4 days to provide a more realistic MDL.

Refer to the Corporate SOP No. CW-Q-S-006 or the laboratory's SOP No. WS-QA-0006 for details on the laboratory's MDL process.

19.8 Instrument Detection Limits (IDL)

The IDL is sometimes used to assess the reasonableness of the MDLs or in some cases required by the analytical method or program requirements. IDLs are most used in metals analyses but may be useful in demonstration of instrument performance in other areas.

IDLs are calculated to determine an instrument's sensitivity independent of any preparation method. IDLs are calculated either using 7 replicate spike analyses, like MDL but without sample preparation, or by the analysis of 10 instrument blanks and calculating 3 x the absolute value of the standard deviation.

If IDL is > than the MDL, it may be used as the reported MDL.

19.9 Verification of Detection and Reporting Limits

Once an MDL is established, it must be verified, on each instrument, by analyzing a quality control sample (prepared as a sample) at no more than 3 times the calculated MDL for single analyte analyses (e.g. most wet chemistry methods, Atomic Absorption, etc.) and no more than 4 times the calculated MDL for multiple analyte methods (e.g. GC, GCMS, ICP, etc.). The analytes must be qualitatively identified. This verification does not apply to methods that are not readily spiked (e.g. pH, turbidity, etc.) or where the lab does not report to the MDL. The analytes must be qualitatively identified or see SOP No. WS-QA-0006 for other options. If the MDL does not verify, then the lab will not report to the MDL, or redevelop their MDL or use the level where qualitative identification is established. MDLs must be verified at least annually.

For DoD ELAP certified methods, and methods utilized in support of DOE programs: Once the MDL is determined, it must be verified on each instrument used for the given method. TestAmerica defines the DoD/DOE QSM Detection Limit (DL) as being equal to the MDL. TestAmerica also defines the DoD/DOE QSM Limit of Detection (LOD) as being equal to the lowest concentration standard that successfully verifies the MDL, also referred to as the MDLV standard. MDL and MDLV standards are extracted/digested and analyzed through the entire analytical process. The MDL and MDLV determinations do not apply to methods that are not readily spiked (e.g. pH, turbidity, etc.) or where the lab does not report to the MDL. If the MDLV standard is not successful, then the laboratory will redevelop their MDL or perform and pass two consecutive MDLVs at a higher concentration and set the LOD at the higher concentration. Initial and quarterly verification is required for all methods listed in the laboratory's DoD ELAP Scope of Accreditation or utilized in support of DOE programs. Refer to the laboratory SOP WS-QA-0006, Method Detection Limits (MDL) and Instrument Detection Limits (IDL) for further details.

When the laboratory establishes a quantitation limit, it must be initially verified by the analysis of a low level standard or QC sample at 1-2 times the reporting limit and annually thereafter. The annual requirement is waived for methods that have an annually verified MDL. The laboratory will comply with any regulatory requirements.

For DoD ELAP certified methods and methods utilized in support of DOE programs: The laboratory quantitation limit is equivalent to the DoD/DOE Limit of Quantitation (LOQ), which is at a concentration equal to or greater than the lowest non-zero calibration standard. The DoD/DOE QSM requires the laboratory to perform an initial characterization of the bias and precision at the LOQ and quarterly LOQ verifications thereafter. If the quarterly verification results are not consistent with the three-standard deviation confidence limits established initially, then the bias and precision will be reevaluated and clients contacted for any on-going projects. For DoD/DOE projects, TestAmerica makes a distinction between the Reporting Limit (RL) and the LOQ. The RL is a level at or above the LOQ that is used for specific project reporting purposes, as agreed to between the laboratory and the client. The RL cannot be lower than the LOQ concentration, but may be higher.

19.10 Retention Time Windows

Most organic analyses and some inorganic analyses use chromatography techniques for qualitative and quantitative determinations. For every chromatography analysis or as specific in the reference method, each analyte will have a specific time of elution from the column to the detector. This is known as the analyte's retention time. The variance in the expected time of elution is defined as the retention time window. As the key to analyte identification in chromatography, retention time windows must be established on every column for every analyte used for that method. These records are kept with the files associated with an instrument for later quantitation of the analytes. Complete details are available in the laboratory SOPs.

19.11 Evaluation of Selectivity

The laboratory evaluates selectivity by following the checks within the applicable analytical methods, which include mass spectral tuning, second column confirmation, ICP interelement interference checks, chromatography retention time windows, sample blanks, spectrochemical, atomic absorption or fluorescence profiles, co-precipitation evaluations and specific electrode response factors.

19.12 Estimation of Uncertainty of Measurement

19.12.1 Uncertainty is "a parameter associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the measurand" (as defined by the International Vocabulary of Basic and General Terms in Metrology, ISO Geneva, 1993, ISBN 92-67-10175-1). Knowledge of the uncertainty of a measurement provides additional confidence in a result's validity. Its value accounts for all the factors which could possibly affect the result, such as adequacy of analyte definition, sampling, matrix effects and interferences, climatic conditions, variances in weights, volumes, and standards, analytical procedure, and random variation. Some national accreditation organizations require the use of an "expanded uncertainty": the range within which the value of the measurand is believed to lie within at least a 95% confidence level with the coverage factor k=2.

19.12.2 Uncertainty is not error. Error is a single value, the difference between the true result and the measured result. On environmental samples, the true result is never known. The measurement is the sum of the unknown true value and the unknown error. Unknown error is a combination of systematic error, or bias, and random error. Bias varies predictably, constantly,

and independently from the number of measurements. Random error is unpredictable, assumed to be Gaussian in distribution, and reducible by increasing the number of measurements.

19.12.3 The minimum uncertainty associated with results generated by the laboratory can be determined by using the Laboratory Control Sample (LCS) accuracy range for a given analyte. The LCS limits are used to assess the performance of the measurement system since they take into consideration all of the laboratory variables associated with a given test over time (except for variability associated with the sampling and the variability due to matrix effects). The percent recovery of the LCS is compared either to the method-required LCS accuracy limits or to the statistical, historical, in-house LCS accuracy limits.

19.12.4 To calculate the uncertainty for the specific result reported, multiply the result by the decimal of the lower end of the LCS range percent value for the lower end of the uncertainty range, and multiply the result by the decimal of the upper end of the LCS range percent value for the upper end of the uncertainty range. These calculated values represent uncertainties at approximately the 99% confidence level with a coverage factor of k = 3. As an example, for a reported result of 1.0 mg/L with an LCS recovery range of 50 to 150%, the estimated uncertainty in the result would be 1.0 +/- 0.5 mg/L.

19.12.5 In the case where a well recognized test method specifies limits to the values of major sources of uncertainty of measurement (e.g., 524.2, 525, etc.) and specifies the form of presentation of calculated results, no further discussion of uncertainty is required.

19.13 Sample Reanalysis Guidelines

Because there is a certain level of uncertainty with any analytical measurement, a sample re-preparation (where appropriate) and subsequent analysis (hereafter referred to as 'reanalysis') may result in either a higher or lower value from an initial sample analysis. There are also variables that may be present (e.g., sample homogeneity, analyte precipitation over time, etc.) that may affect the results of a reanalysis. Based on the above comments, the laboratory will reanalyze samples at a client's request with the following caveats. **Client specific Contractual Terms & Conditions for reanalysis protocols may supersede the following items.**

- Homogenous samples: If a reanalysis agrees with the original result to within the RPD limits for MS/MSD or Duplicate analyses, or within ± 1 reporting limit for samples ≤ 5x the reporting limit, the original analysis will be reported. At the client's request, both results may be reported on the same report but not on two separate reports.

- If the reanalysis does not agree (as defined above) with the original result, then the laboratory will investigate the discrepancy. If a problem is uncovered then the re-analysis will be repeated correctly. If no problem is uncovered then the laboratory will consult with the client to decide on actions needed.

- Any potential charges related to reanalysis are discussed in the contract terms and conditions or discussed at the time of the request. The client will typically be charged for reanalysis unless it is determined that the lab was in error.

- Due to the potential for increased variability, reanalysis may not be applicable to Non-homogenous, Encore, and Sodium Bisulfate preserved samples. See the Department Manager or Laboratory Director if unsure.

19.14 Control of Data

The laboratory has policies and procedures in place to ensure the authenticity, integrity, and accuracy of the analytical data generated by the laboratory.

19.14.1 Computer and Electronic Data Related Requirements

The three basic objectives of our computer security procedures and policies are shown below. More detail is outlined in SOP Nos. CW-I-P-006, "Computer Systems Account and Naming Policy", CW-I-P-007, "Computer Systems Password Policy and CA-I-S-006, "Software Testing, Validation and Verification." The laboratory is currently running the TestAmerica Laboratory Information Management System ("TALS") which is a custom in-house developed LIMS system that has been highly customized to meet the needs of the laboratory. It is referred to as LIMS for the remainder of this section. The LIMS utilizes Sequel Server which is an industry standard relational database platform. It is referred to as Database for the remainder of this section.

19.14.1.1 **Maintain the Database Integrity:** Assurance that data is reliable and accurate through data verification (review) procedures, password-protecting access, anti-virus protections, data change requirements, as well as an internal LIMS permissions procedure.

- LIMS Database Integrity is achieved through data input validation, internal user controls, and data change requirements.
- Spreadsheets and other software developed in-house must be verified with documentation through hand calculations prior to use. Cells containing calculations must be lock-protected and controlled.
- Instrument hardware and software adjustments are safeguarded through maintenance logs, audit trails and controlled access.

19.14.1.2 **Ensure Information Availability:** Protection against loss of information or service is ensured through scheduled back-ups, stable file server network architecture, secure storage of media, line filter, Uninterruptible Power Supply (UPS), and maintaining older versions of software as revisions are implemented.

19.14.1.3 **Maintain Confidentiality:** Ensure data confidentiality through physical access controls such as password protection or website access approval when electronically transmitting data.

19.14.2 Data Reduction

The complexity of the data reduction depends on the analytical method and the number of discrete operations involved (e.g., extractions, dilutions, instrument readings and concentrations). The analyst calculates the final results from the raw data or uses appropriate computer programs to assist in the calculation of final reportable values.

For manual data entry, e.g., Wet Chemistry, the data is reduced by the analyst and then verified by the Department Manager or alternate analyst prior to updating the data in LIMS. The

spreadsheets, or any other type of applicable documents, are signed by both the analyst and alternate reviewer to confirm the accuracy of the manual entry(s).

Manual integration of peaks will be documented and reviewed and the raw data will be flagged in accordance with the TestAmerica Corporate SOP No. CA-Q-S-002, *Acceptable Manual Integration Practices* and WS-PQA-011, Manual Integration Documentation Procedures.

Analytical results are reduced to appropriate concentration units specified by the analytical method, taking into account factors such as dilution, sample weight or volume, etc. Blank correction will be applied only when required by the method or per manufacturer's indication; otherwise, it should not be performed. Calculations are independently verified by appropriate laboratory staff. Calculations and data reduction steps for various methods are summarized in the respective analytical SOPs or program requirements.

19.14.2.1 All raw data must be retained in the worklist folder, computer file (if appropriate), and/or runlog. All criteria pertinent to the method must be recorded. The documentation is recorded at the time observations or calculations are made and must be signed or initialed/dated (month/day/year). It must be easily identifiable who performed which tasks if multiple people were involved.

19.14.2.2 In general, concentration results are reported in milligrams per liter (mg/L) or micrograms per liter (µg/L) for liquids and milligrams per kilogram (mg/kg) or micrograms per kilogram (µg/kg) for solids. For values greater than 10,000 mg/L, results can be reported in percent, i.e., 10,000 mg/L = 1**%.** Units are defined in each lab SOP.

19.14.2.3 In reporting, the analyst or the instrument output records the raw data result using values of known certainty plus one uncertain digit. If final calculations are performed external to LIMS, the results should be entered in LIMS with at least three significant figures. In general, results are reported to 2 significant figures on the final report.

19.14.2.4 For those methods that do not have an instrument printout or an instrumental output compatible with the LIMS System, the raw results and dilution factors are entered directly into LIMS by the analyst, and the software calculates the final result for the analytical report. LIMS has a defined significant figure criterion for each analyte.

19.14.2.5 The laboratory strives to import data directly from instruments or calculation spreadsheets to ensure that the reported data are free from transcription and calculation errors. For those analyses with an instrumental output compatible with the LIMS, the raw results and dilution factors are transferred into LIMS electronically after reviewing the quantitation report, and removing unrequested or poor spectrally-matched compounds. The analyst may print a copy of what has been entered to check for errors. This printout and the instrument's data file of calibrations, concentrations, retention times, chromatograms, and mass spectra, if applicable, are retained within Chrom or the LIMS, based on the type of data.

19.14.3 Logbook / Worksheet Use Guidelines

Logbooks and worksheets are filled out 'real time' and have enough information on them to trace the events of the applicable analysis/task. (e.g. calibrations, standards, analyst, sample

ID, date, time on short holding time tests, temperatures when applicable, calculations are traceable, etc.)

- Corrections are made following the procedures outlined in Section 12.
- Logbooks are controlled by the QA department. A record is maintained of all logbooks in the lab.
- Unused portions of pages must be "Z'd" out, signed and dated.
- Worksheets are created with the approval of the Technical Manager/QA Manager at the facility. The QA Manager controls all worksheets following the procedures in Section 6.

19.14.4 Review / Verification Procedures

Review procedures are outlined in several SOPs (WS-PQA-003, "Quality Control Program"**,** WS-PQA-012, "Technical Data Review Requirements***",*** WS-PM-0004, "Final Report Assembly and Third Level Data Review") to ensure that reported data are free from calculation and transcription errors, that QC parameters have been reviewed and evaluated before data is reported. The laboratory also has an SOP discussing Manual Integrations to ensure the authenticity of the data (WS-PQA-0011, "Manual Integration Documentation and Practices"). The general review concepts are discussed below, more specific information can be found in the SOPs.

19.14.4.1 Log-In Review - The data review process starts at the sample receipt stage. Sample control personnel review chain-of-custody forms and project instructions from the project management group. This is the basis of the sample information and analytical instructions entered into the LIMS. The log-in instructions are reviewed by the personnel entering the information, and a second level review is conducted by the project management staff.

19.14.4.2 First Level Data Review - The next level of data review occurs with the analysts. As data are generated, analysts review their work to ensure that the results meet project and SOP requirements. First level reviews include inspection of all raw data (e.g., instrument output for continuous analyzers, chromatograms, spectra, and manual integrations), evaluation of calibration/calibration verification data in the day's analytical run, evaluation of QC data, and reliability of sample results. The analyst transfers data into LIMS, data qualifiers are added as needed. All first level reviews are documented.

19.14.4.3 Second Level Data Review – All analytical data are subject to review by a second qualified analyst or supervisor. Second level reviews include inspection of all raw data (e.g., instrument output, chromatograms, and spectra) including 100% of data associated with any changes made by the primary analyst, such as manual integrations or reassignment of peaks to different analytes, or elimination of false negative analytes. The second review also includes evaluation of initial calibration/calibration verification data in the day's analytical run, evaluation of QC data, reliability of sample results, qualifiers and NCM narratives. Manual calculations are checked in second level review. All second level reviews are documented. Issues that deem further review include the following:

- QC data are outside the specified control limits for accuracy and precision
- Reviewed sample data does not match with reported results
- Unusual detection limit changes are observed
- Samples having unusually high results
- Samples exceeding a known regulatory limit
- Raw data indicating some type of contamination or poor technique
- Inconsistent peak integration
- Transcription errors
- Results outside of calibration range

19.14.4.4 Unacceptable analytical results may require reanalysis of the samples. Any problems are brought to the attention of the Laboratory Director, Project Manager, Quality Director/Manager, Technical Manager, or Supervisor for further investigation. Corrective action is initiated whenever necessary.

19.14.4.5 The results are then entered or directly transferred into the computer database and a hard copy (or .pdf) is printed for the client.

19.14.4.6 As a final review prior to the release of the report, the Project Manager reviews the results for appropriateness and completeness. This review and approval ensures that client requirements have been met and that the final report has been properly completed. The process includes, but is not limited to, verifying that the COC is followed, cover letters/ narratives are present, flags are appropriate, and project specific requirements are met. The project manager may also evaluate the validity of results for different test methods given expected chemical relationships.

19.14.4.7 Any project that requires a data package is subject to a tertiary data review for transcription errors and acceptable quality control requirements. The Project Manager then signs the final report. The accounting personnel also check the report for any clerical or invoicing errors. When complete, the report is sent out to the client.

19.14.4.8 A visual summary of the flow of samples and information through the laboratory, as well as data review and validation, is presented in Figure 19-2.

19.14.5 Manual Integrations

Computerized data systems provide the analyst with the ability to re-integrate raw instrument data in order to optimize the interpretation of the data. Though manual integration of data is an invaluable tool for resolving variations in instrument performance and some sample matrix problems, when used improperly, this technique would make unacceptable data appear to meet quality control acceptance limits. Improper re-integrations lead to legally indefensible data, a poor reputation, or possible laboratory decertification. Because guidelines for re-integration of data are not provided in the methods and most methods were written prior to widespread implementation of computerized data systems, the laboratory trains all analytical staff on proper manual integration techniques using TestAmerica's Corporate SOP (CA-Q-S-002) as the

guideline for our internal SOP No. WS-PQA-0011, entitled “Manual Integration Documentation and Practices”.

19.14.5.1 The analyst must adjust baseline or the area of a peak in some situations, for example when two compounds are not adequately resolved or when a peak shoulder needs to be separated from the peak of interest. The analyst must use professional judgment and common sense to determine when manual integrating is required. Analysts are encouraged to ask for assistance from a senior analyst or manager when in doubt.

19.14.5.2 Analysts shall not increase or decrease peak areas for the sole purpose of achieving acceptable QC recoveries that would have otherwise been unacceptable. The intentional recording or reporting of incorrect information (or the intentional omission of correct information) is against company principles and policy and is grounds for immediate termination.

19.14.5.3 Client samples, performance evaluation samples, and quality control samples are all treated equally when determining whether or not a peak area or baseline should be manually adjusted.

19.14.5.4 All manual integrations receive a second level review. Manual integrations must be indicated on an expanded scale “after” chromatograms such that the integration performed can be easily evaluated during data review. Expanded scale “before” chromatograms are also required for all manual integrations on QC parameters (calibrations, calibration verifications, laboratory control samples, internal standards, surrogates, etc.) unless the laboratory has another documented corporate approved procedure in place that can demonstrate an active process for detection and deterrence of improper integration practices. Instrument operators must assure that all manual integration documentation identifies the analyst, the date and the reason for the integration.

Figure 19-1. Example - Demonstration of Capability Documentation

Analyst Demonstration of Capability

TestAmerica Sacramento

Victoria Nihart

4/24/2017

Preparation Method(s):	3535
Analytical Method(s):	GCMSMS_NDMA
Matrix:	Water
Method Description:	Nitrosamines by Isotope Dilution and GC/CI/MS/MS
Preparation SOP No:	WS-IDP-0020 Rev. 3.3
Analytical SOP No:	WS-MS-0012 Rev. 2.1

We, the undersigned, CERTIFY that:

1. The analyst identified above, using the cited test method with the specifications in the cited SOP, which is in use at this facility for the analysis of samples under the laboratory's Quality Assurance Plan, has completed the Demonstration of Capability (DOC).
2. The test method(s) was performed by the analyst identified on this certificate.
3. A copy of test method(s) and laboratory SOPs are available for all personnel on-site.
4. The data associated with the demonstration of capability are true, accurate, complete and self-explanatory.
5. All raw data necessary to reconstruct and validate these analyses have been retained at the facility. The associated information is organized and available for review.

Technical Director	**Signature**	**Date** 5/3/17
Quality Assurance Officer	**Signature**	**Date** 5/3/17

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Analyst Demonstration of Capability

ANALYST DEMONSTRATION OF CAPABILITY

Method GCMSMS_NDMA **Laboratory:** TestAmerica Sacramento
Method Desc: Nitrosamines by Isotope Dilution and GC/CI/MS/MS
Analyst: Victoria Nihart **Limit Group:** MSS - NDMA - Water - QC

Current Limits (Recovery, Precision) | **Demonstration of Capability** (Recovery, Precision)

N-Nitrosodimethylamine
All values within Control limits

Analysis Dates: 6/1/2016 to 6/3/2016

LCL	UCL	Std Dev	Units
		20	%

Mean	Std Dev	Units		Amount	Amount/RL
90.09	8.53983	%	Pass	2.0	1

Laboratory ID	Anal Date	Batch	Smp	Analyst	Prep Analyst	Result	Units	Spike Amount	RL	% Rec		In Rec Limits?
LLCS 320-110927/3-A	06/01/2016	112005	17	Nihart, Victoria M	Mantri, Anil	1.618	ng/L	2.0	2.0	81		Pass
LLCSD 320-110927/4-A	06/01/2016	112005	18	Nihart, Victoria M	Mantri, Anil	1.962	ng/L	2.0	2.0	98	19	Pass
LLCS 320-111960/3-A	06/03/2016	112484	4	Nihart, Victoria M	Kuzmenko, Natalia	1.9311	ng/L	2.0	2.0	97		Pass
LLCSD 320-111960/4-A	06/03/2016	112484	5	Nihart, Victoria M	Kuzmenko, Natalia	1.695	ng/L	2.0	2.0	85	13	Pass

N-Nitrosodimethylamine-d6
All values within Control limits

Analysis Dates: 6/1/2016 to 6/3/2016

LCL	UCL	Std Dev	Units
25	150		%

Mean	Std Dev	Units		Amount
75.77	7.50265	%	Pass	100.0

Laboratory ID	Anal Date	Batch	Smp	Analyst	Prep Analyst	Result	Units	Spike Amount	% Rec		In Rec Limits?
LLCS 320-110927/3-A	06/01/2016	112005	17	Nihart, Victoria M	Mantri, Anil	80.88	ng/L	100.0	81		Pass
LLCSD 320-110927/4-A	06/01/2016	112005	18	Nihart, Victoria M	Mantri, Anil	81.20	ng/L	100.0	81	0.4	Pass
LLCS 320-111960/3-A	06/03/2016	112484	4	Nihart, Victoria M	Kuzmenko, Natalia	65.13	ng/L	100.0	65		Pass
LLCSD 320-111960/4-A	06/03/2016	112484	5	Nihart, Victoria M	Kuzmenko, Natalia	75.88	ng/L	100.0	76	15	Pass

Precision = standard deviation of percent recoveries of spiked control samples.

4/24/2017

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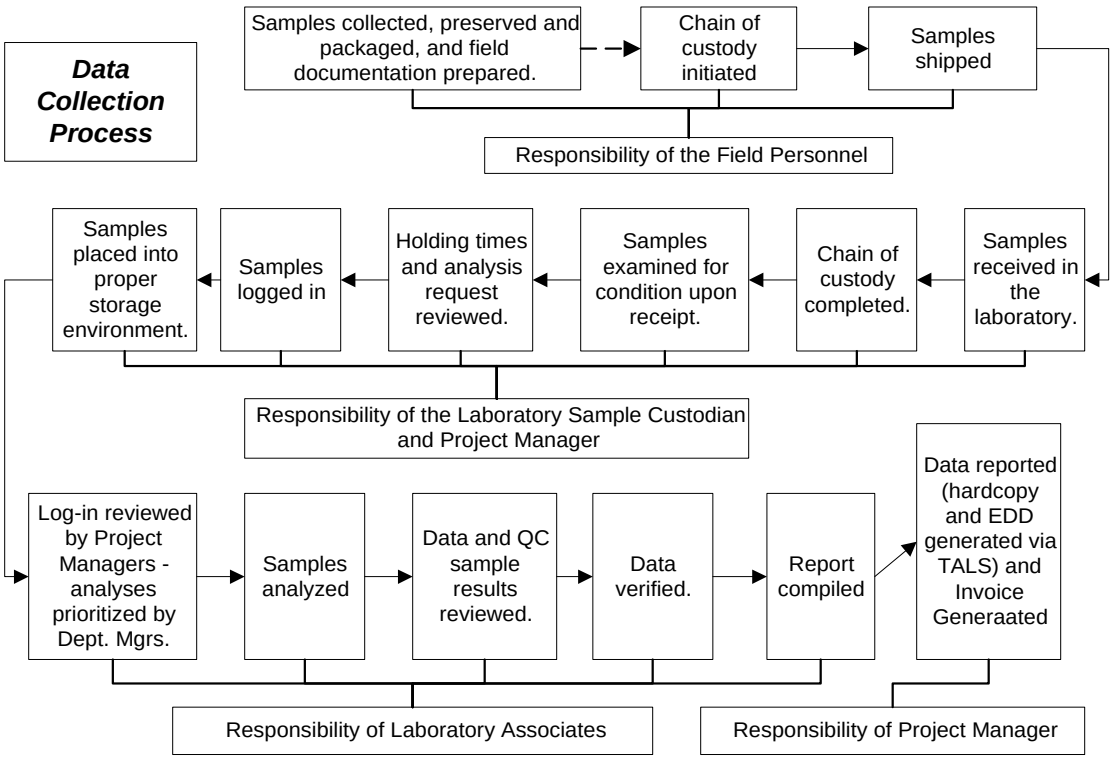
Figure 19-2. Example: Work Flow



SECTION 20. EQUIPMENT and CALIBRATIONS

20.1 Overview

The laboratory purchases the most technically advanced analytical instrumentation for sample analyses. Instrumentation is purchased on the basis of accuracy, dependability, efficiency and sensitivity. Each laboratory is furnished with all items of sampling, preparation, analytical testing and measurement equipment necessary to correctly perform the tests for which the laboratory has capabilities. Each piece of equipment is capable of achieving the required accuracy and complies with specifications relevant to the method being performed. Before being placed into use, the equipment (including sampling equipment) is calibrated and checked to establish that it meets its intended specification. The calibration routines for analytical instruments establish the range of quantitation. Calibration procedures are specified in laboratory SOPs. A list of laboratory instrumentation is presented in Table 20-1.

Equipment is only operated by authorized and trained personnel. Manufacturers' instructions for equipment use are readily accessible to all appropriate laboratory personnel.

20.2 Preventive Maintenance

The laboratory follows a well-defined maintenance program to ensure proper equipment operation and to prevent the failure of laboratory equipment or instrumentation during use. This program of preventive maintenance helps to avoid delays due to instrument failure.

Routine preventive maintenance procedures and frequency, such as cleaning and replacements, should be performed according to the procedures outlined in the manufacturer's manual. Qualified personnel must also perform maintenance when there is evidence of degradation of peak resolution, a shift in the calibration curve, loss of sensitivity, or failure to continually meet one of the quality control criteria.

Table 20-2 lists examples of scheduled routine maintenance. It is the responsibility of each Technical Manager to ensure that instrument maintenance logs are kept for all equipment in his/her department. Preventative maintenance procedures may be / are also outlined in analytical SOPs or instrument manuals. (Note: for some equipment, the log used to monitor performance is also the maintenance log. Multiple pieces of equipment may share the same log as long as it is clear as to which instrument is associated with an entry.)

Instrument maintenance logs are controlled and are used to document instrument problems, instrument repair and maintenance activities. Maintenance logs shall be kept for all major pieces of equipment. Instrument maintenance logs may also be used to specify instrument parameters.

- Documentation must include all major maintenance activities such as contracted preventive maintenance and service and in-house activities such as the replacement of electrical components, lamps, tubing, valves, columns, detectors, cleaning and adjustments.
- Each entry in the instrument log includes the Analyst's initials, the date, a detailed description of the problem (or maintenance needed/scheduled), a detailed explanation of the solution or maintenance performed, and a verification that the equipment is functioning properly (state what was used to determine a return to control. e.g. CCV run on *'date'* was acceptable, or

instrument recalibrated on 'date' with acceptable verification, etc.) must also be documented in the instrument records.

- When maintenance or repair is performed by an outside agency, service receipts detailing the service performed can be affixed into the logbooks adjacent to pages describing the maintenance performed. This stapled in page must be signed across the page entered and the logbook so that it is clear that a page is missing if only half a signature is found in the logbook.

If an instrument requires repair (subjected to overloading or mishandling, gives suspect results, or otherwise has shown to be defective or outside of specified limits) it shall be taken out of operation and tagged as out-of-service or otherwise isolated until such a time as the repairs have been made and the instrument can be demonstrated as operational by calibration and/or verification or other test to demonstrate acceptable performance. The laboratory shall examine the effect of this defect on previous analyses.

In the event of equipment malfunction that cannot be resolved, service shall be obtained from the instrument vendor manufacturer, or qualified service technician, if such a service can be tendered. If on-site service is unavailable, arrangements shall be made to have the instrument shipped back to the manufacturer for repair. Back up instruments, which have been approved, for the analysis shall perform the analysis normally carried out by the malfunctioning instrument. If the back up is not available and the analysis cannot be carried out within the needed timeframe, the samples shall be subcontracted.

At a minimum, if an instrument is sent out for service or transferred to another facility, it must be recalibrated and the laboratory MDL verified (using an MDLv) prior to return to lab operations.

20.3 Support Equipment

This section applies to all devices that may not be the actual test instrument, but are necessary to support laboratory operations. These include but are not limited to: balances, ovens, refrigerators, freezers, water baths, field sampling devices, temperature measuring devices, thermal/pressure sample preparation devices and volumetric dispensing devices if quantitative results are dependent on their accuracy, as in standard preparation and dispensing or dilution into a specified volume. All raw data records associated with the support equipment are retained to document instrument performance.

20.3.1 Weights and Balances

The accuracy of the balances used in the laboratory is checked every working day, before use. All balances are placed on stable counter tops.

Each balance is checked prior to initial serviceable use with at least two certified ASTM type 1 weights spanning its range of use (weights that have been calibrated to ASTM type 1 weights may also be used for daily verification). ASTM type 1 weights used only for calibration of other weights (and no other purpose) are inspected for corrosion, damage or nicks at least annually and if no damage is observed, they are calibrated at least every 5 years by an outside calibration laboratory. Any weights (including ASTM Type 1) used for daily balance checks or other purposes are recalibrated/recertified annually to NIST standards (this may be done internally if laboratory maintains "calibration only" ASTM type 1 weights).

All balances are serviced annually by an ISO 17025 qualified service representative, who supplies the laboratory with a certificate that identifies traceability of the calibration to the NIST standards.

All of this information is recorded in logs, and the recalibration/recertification certificates are kept on file. See SOP No. WS-QA-0041, "Calibration and Calibration Check of Balances" for more details.

20.3.2 pH, Conductivity, and Turbidity Meters

The pH meters used in the laboratory are accurate to ± 0.1 pH units, and have a scale readability of at least 0.05 pH units. The meters automatically compensate for the temperature, and are calibrated with at least two working range buffer solutions before each use.

Conductivity meters are also calibrated before each use with a known standard to demonstrate the meters do not exceed an error of 1% or one umhos/cm.

Turbidity meters are also calibrated before each use. All of this information is documented in their logs.

Consult pH and Conductivity, and Turbidity SOPs for further information.

20.3.3 Thermometers

All thermometers are calibrated on an annual basis with a NIST-traceable thermometer at temperatures bracketing the range of use.

- If the temperature measuring device is used over a range of 10℃ or less, then a single point verification within the range of use is acceptable;
- If the temperature measuring device is used over a range of greater than 10℃, then the verification must bracket the range of use.

IR thermometers, digital probes and thermocouples are calibrated quarterly. IR Thermometers should be calibrated over the full range of use, including ambient, iced (4 degrees) and frozen (0 to -5 degrees), per the Drinking Water Manual.

The digital NIST thermometer is recalibrated every five years by an approved outside service and the provided certificate of traceability is kept on file. Alternately a new NIST thermometer with certificate of traceability from the manufacturer may be purchased. The NIST thermometer(s) have increments of 1 degree (0.5 degree or less increments are required for drinking water microbiological laboratories), and have ranges applicable to method and certification requirements. The NIST traceable thermometer is used for no other purpose than to calibrate other thermometers.

All of this information is documented in logbooks. Monitoring method-specific temperatures, including heating blocks, water baths, and ovens, is documented in method-specific logbooks. More information on this subject can be found in the SOP No. WS-QA-0016, "Thermometer Calibration."

20.3.4 Refrigerators/Freezer Units, Waterbaths, Ovens and Incubators

The temperatures of all refrigerator units and freezers used for sample storage are monitored 7 days a week; and each working day for units used for standard storage.

Ovens and water baths are monitored on days of use. Drying oven temperature must be recorded before and at the end of use. For example, an oven used for moisture determination must have its temperature recorded at the start and end of the drying process. Temperature must be ± 5% of set temperature for DoD/DOEwork.

All of this equipment has a unique identification number, and is assigned a unique thermometer for monitoring.

Sample storage refrigerator temperatures are kept at > 0ºC and ≤ 6 ºC.

Specific temperature settings/ranges for other refrigerators, ovens, and water baths can be found in method specific SOPs.

All of this information is documented in Daily Temperature Logbooks and method-specific logbooks.

20.3.5 Autopipettors, Dilutors, and Syringes

Mechanical volumetric dispensing devices including burettes (except Class A Glassware and Glass microliter syringes) are given unique identification numbers and the delivery volumes are verified gravimetrically, at a minimum on a quarterly basis.

For those dispensers that are not used for analytical measurements, a label is applied to the device stating that it is not calibrated. Any device not regularly verified cannot be used for any quantitative measurements. See SOP WS-QA-0004, “Maintenance and Calibration Check of Fixed and Adjustable Volume Autopipettors, Autodispensers and Volumetric Containers”.

Micro-syringes are purchased from Hamilton Company. Each syringe is traceable to NIST. The laboratory keeps on file an “Accuracy and Precision Statement of Conformance” from Hamilton attesting established accuracy. The laboratory also assigns a unique ID# to each syringe. The delivery volume of each syringe is verified gravimetrically before initial use.

20.3.6 Autoclaves

Autoclaves used for sample digestion are capable of maintaining conditions of 15 psi at 120ºC for 15 minutes. The temperature of the autoclave is verified quarterly.

20.4 Instrument Calibrations

Calibration of analytical instrumentation is essential to the production of quality data. Strict calibration procedures are followed for each method. These procedures are designed to determine and document the method detection limits, the working range of the analytical instrumentation and any fluctuations that may occur from day to day.

Sufficient raw data records are retained to allow an outside party to reconstruct all facets of the initial calibration. Records contain, but are not limited to, the following: calibration date, method, instrument, analyst(s) initials or signatures, analysis date, analytes, concentration, response, type of calibration (Avg RF, curve, or other calculations that may be used to reduce instrument responses to concentration.)

Sample results must be quantitated from the initial calibration and may not be quantitated from any continuing instrument calibration verification unless otherwise required by regulation, method or program.

If the initial calibration results are outside of the acceptance criteria, corrective action is performed and any affected samples are reanalyzed if possible. If the reanalysis is not possible, any data associated with an unacceptable initial calibration will be reported with appropriate data qualifiers (refer to Section 12).

Note: Instruments are calibrated initially and as needed after that and at least annually however, the annual requirement does not apply to Isotope Dilution methods.

20.4.1 Calibration Standards

Calibration standards are prepared using the procedures indicated in the Reagents and Standards section of the determinative method SOP. If a reference method does not specify the number of calibration standards, a minimum of 3 calibration points (exception being ICP and ICP/MS methods) will be used.

Standards for instrument calibration are obtained from a variety of sources. All standards are traceable to national or international standards of measurement, or to national or international standard reference materials.

The lowest concentration calibration standard that is analyzed during an initial calibration must be at or below the stated reporting limit for the method based on the final volume of extract (or sample).

The other concentrations define the working range of the instrument/method or correspond to the expected range of concentrations found in actual samples that are also within the working range of the instrument/method. Results of samples not bracketed by initial instrument calibration standards (within calibration range to at least the same number of significant figures used to report the data) must be reported as having less certainty, e.g., defined qualifiers or flags (additional information may be included in the case narrative). The exception to these rules is ICP and ICPMS methods which define the working range with periodic linear dynamic range studies, rather than through the range of concentrations of daily calibration standards.

All initial calibrations are verified with a standard obtained from a second source and traceable to a national standard, when available (or vendor certified different lot if a second source is not available). For unique situations, such as air analysis where no other source or lot is available, a standard made by a different analyst at a different time or a different preparation would be considered a second source. This verification occurs immediately after the calibration curve has been analyzed, and before the analysis of any samples.

20.4.1.1 Calibration Verification

The calibration relationship established during the initial calibration must be verified initially and at least each daily as specified in the laboratory method SOPs in accordance with the referenced analytical methods and in the 2009 TNI Standard. The process of calibration verification applies to both external standard and internal standard calibration techniques, as well as to linear and non-linear calibration models. Initial calibration verification is with a standard source secondary (second source standard) to the calibration standards, but continuing calibration verifications may use the same source standards as the calibration curve.

Note: The process of calibration verification referred to here is fundamentally different from the approach called "calibration" in some methods. As described in those methods, the calibration factors or response factors calculated during calibration are used to update the calibration factors or response factors used for sample quantitation. This approach, while employed in other EPA programs, amounts to a daily single-point calibration.

All target analytes and surrogates, including those reported as non-detects, must be included in periodic calibration verifications for purposes of retention time confirmation and to demonstrate that calibration verification criteria are being met, i.e., RPD, per 2009 TNI Std. EL-V1M4 Sec. 1.7.2.

All samples must be bracketed by periodic analyses of standards that meet the QC acceptance criteria (e.g., calibration and retention time). The frequency is found in the determinative methods or SOPs.

Note: If an internal standard calibration is being used (basically GCMS) then bracketing standards are not required, only daily verifications are needed. (Exception: Some QC programs, such as the DoD/DOE QSM Version 5, require bracketing standards with internal standard calibration). The results from these verification standards must meet the calibration verification criteria and the retention time criteria (if applicable).

Generally, the initial calibrations must be verified at the beginning of each 12-hour analytical shift during which samples are analyzed. (Some methods may specify more or less frequent verifications). The 12-hour analytical shift begins with the injection of the calibration verification standard (or the MS tuning standard in MS methods). The shift ends after the completion of the analysis of the last sample, QC, or standard that can be injected within 12 hours of the beginning of the shift.

A continuing instrument calibration verification (CCV) must be repeated at the beginning and, for methods that have quantitation by external calibration models, at the end of each analytical batch. Some methods have more frequent CCV requirements - see specific SOPs. Most inorganic methods require the CCV to be analyzed after ever 10 samples or injections, including matrix or batch QC samples.

Note: If an internal standard calibration is being used (basically GCMS) then bracketing standards are not required, only daily verifications are needed. The results from these verification standards must meet the calibration verification criteria and the retention time criteria (if applicable).

If the results of a CCV are outside the established acceptance criteria and analysis of a second consecutive (and immediate) CCV fails to produce results within acceptance criteria, corrective action shall be performed. Once corrective actions have been completed & documented, the laboratory shall demonstrate acceptable instrument / method performance by analyzing two consecutive CCVs, or a new initial instrument calibration shall be performed.

Sample analyses and reporting of data may not occur or continue until the analytical system is calibrated or calibration verified. However, data associated with unacceptable calibration verification may be fully useable under the following special conditions and reported based upon discussion and approval of the client:

a). when the acceptance criteria for the CCV are exceeded high (i.e., high bias) and the associated samples within the batch are non-detects, then those non-detects may be reported with a footnote or case narrative explaining the high bias. Otherwise the samples affected by the unacceptable CCV shall be re-analyzed after a new calibration curve has been established, evaluated and accepted; or

b). when the acceptance criteria for the CCV are exceeded low (i.e., low bias), those sample results may be reported if they exceed a maximum regulatory limit/decision level. Otherwise the samples affected by the unacceptable CCV shall be re-analyzed after a new calibration curve has been established, evaluated and accepted.

Samples reported by the 2 conditions identified above will be appropriately flagged.

20.4.1.2 Verification of Linear and Non-Linear Calibrations

Calibration verification for calibrations involves the calculation of the percent drift or the percent difference of the instrument response between the initial calibration and each subsequent analysis of the verification standard. (These calculations are available in the laboratory method SOPs.) Verification standards are evaluated based on the % Difference from the average CF or RF of the initial calibration or based on % Drift or % Recovery if a linear or quadratic curve is used.

Regardless of whether a linear or non-linear calibration model is used, if initial verification criterion is not met, then no sample analyses may take place until the calibration has been verified or a new initial calibration is performed that meets the specifications listed in the method SOPs. If the calibration cannot be verified after the analysis of a single verification standard, then adjust the instrument operating conditions and/or perform instrument maintenance, and analyze another aliquot of the verification standard. If the calibration cannot be verified with the second standard, then a new initial calibration is performed.

- When the acceptance criteria for the calibration verification are exceeded high, i.e., high bias, and there are associated samples that are non-detects, then those non-detects may be reported. Otherwise, the samples affected by the unacceptable calibration verification shall be reanalyzed after a new calibration curve has been established, evaluated and accepted.

- When the acceptance criteria for the calibration verification are exceeded low, i.e., low bias, those sample results may be reported if they exceed a maximum regulatory limit/decision

level. Otherwise, the samples affected by the unacceptable verification shall be reanalyzed after a new calibration curve has been established, evaluated and accepted. Alternatively, a reporting limit standard may be analyzed to demonstrate that the laboratory can still support non-detects at their reporting limit.

20.5 Tentatively Identified Compounds (TICs) – GC/MS Analysis

For samples containing components not associated with the calibration standards, a library search may be made for the purpose of tentative identification. The necessity to perform this type of identification will be determined by the purpose of the analyses being conducted. Data system library search routines should not use normalization routines that would misrepresent the library or unknown spectra when compared to each other. Guidelines for evaluating and reporting TICs are in the specific laboratory SOPs.

Note: If the TIC compound is not part of the client target analyte list but is calibrated by the laboratory and is qualitatively and/or quantitatively identifiable, it should not be reported as a TIC. If the compound is reported on the same form as true TICs, it should be qualified and/or narrated that the reported compound is qualitatively and quantitatively (if verification in control) reported compared to a known standard that is in control (where applicable).

For example, the RCRA permit or waste delisting requirements may require the reporting of non-target analytes. Only after visual comparison of sample spectra with the nearest library searches may the analyst assign a tentative identification.

20.6 GC/MS Tuning

Prior to any GCMS analytical sequence, including calibration, the instrument parameters for the tune and subsequent sample analyses within that sequence must be set.

Prior to tuning/auto-tuning the mass spec, the parameters may be adjusted within the specifications set by the manufacturer or the analytical method. These generally don't need any adjustment but it may be required based on the current instrument performance. If the tune verification does not pass it may be necessary to clean the source or perform additional maintenance. Any maintenance is documented in the maintenance log.

Table 20-1. Example: Instrumentation List

Instrument Type	Number in Use
Autoanalyzer	1
Autotitrator	1
Cold-Vapor Analyzers	1
GC/HRMS	6
GC/MS - Semivolatiles	6
GC/MS - Volatiles	5
GC/MS – Volatile Air	5
GC/MS/MS	1
GC-ECD/ECD	7
GC-FID/FID	2
GC-FID	1
GC-FPD	1
GC-TCD/TCD	1
HPLC	5
HPLC/MS/MS	5
ICP	1
ICP/MS	1
Ion Chromatograph	3
Spectrometer	1

Table 20-2. Example: Schedule of Routine Maintenance

INSTRUMENT	MAINTENANCE	FREQUENCY
APCI/ESI LC/MS/MS	Change pump seals. Change in-line filters in autosampler (HPLC). Check/replace in-line frit if excessive pressure or poor performance. Replace column if no change following in-line frit change. Clean corona needle. Replace sample inlet tube in APCI (10.1 cm). Replace fused silica tube in ESI interface. Clean lenses. Clean skimmer. Ballast rough pump 30 minutes.	As Needed
	Check solvent reservoirs for sufficient level of solvent. Verify that pump is primed, operating pulse free. Check needle wash reservoir for sufficient solvent. Verify capillary heater temperature functioning. Verify vaporizer heater temperature. Verify rough pump oil levels. Verify turbo-pump functioning. Verify nitrogen pressure for auxiliary and sheath gasses. Verify that corona and multiplier are functioning.	Daily(2)
	Replace rough-pump oil (4-6 months). Replace oil mist and odor elements. Replace activated alumina filter if applicable.	Semi-Annually
	Vacuum system components including fans and fan covers. Clean/replace fan filters, if applicable.	Annually
HIGH PRESSURE LIQUID CHROMATOGRAPH(1)	Replace columns when peak shape and resolution indicate that chromatographic performance of column is below method requirements. Rinse flow cell with 1N nitric acid if dirty flow cell. Change pump seals when flow becomes inconsistent. Backflush column if applicable. Change in-line filters for solvents.	As Needed
	Check level of solution in reservoirs. If adding, verify that solvent is from the same source. If changing, rinse delivery lines to prevent contamination of the new solvent. Check gas supply if applicable. Flush with an appropriate solvent to remove all bubbles. Pre-filter all samples.	Daily(2)
	Change pump seals.	Every 6-9 Months

INSTRUMENT	MAINTENANCE	FREQUENCY
GAS CHROMATOGRAPH(1)	Replace septum. Clean injector port Cut off front portion of capillary columns. Replace column if this fails to restore column performance or when column performance (e.g. peak tailing, poor resolution, high backgrounds, etc.) indicates it is required. Change glass wool plug in injection port and/or replace injection port liner when front portion of capillary column is removed. Replace or repair flow controller if constant gas flow cannot be maintained. Detectors: clean when baseline indicates contamination or when response is low. FID: clean/replace jet, replace igniter. ECD: follow manufacturers suggested maintenance schedule PID: Clean lamp window or replace. Replace seals. Replace fuse. Reactivate external carrier gas dryers. HP 7673 Autosampler: replace syringe, fill wash bottle, dispose of waste bottle contents. Check inlets, septa.	As Needed
	Check for sufficient supply of carrier and detector gases. Check for correct column flow and/or inlet pressures. Check temperatures of injectors and detectors. Verify temperature programs. Check baseline level. Inspect chromatogram to verify symmetrical peak shape and adequate resolution between closely eluting peaks.	Daily(2)
	Oxidation and Reduction Catalysts: Perform leak checks. Replace/condition when poor response is observed.	Quarterly
	ECD: perform wipe test.	Semi-Annually
PURGE AND TRAP SYSTEMS	Change trap. Check purge flow. Flush lines (after foaming sample). Periodic leak checks (when replace traps/spargers) Replace/condition traps and/or spargers (when poor response or disappearance of reactive or poorly trapped compounds), clean sample lines, valves (if they become contaminated), and clean or replace glassware/spargers. Bake trap as needed to correct for high background. Change trap whenever loss of sensitivity, or erratic response or failing resolution is observed. Purge & trap autosamplers: leak check system, clean sample lines, valves.	As Needed
	Bake out trap & analyze primers (as needed) prior to commencing analysis.	Daily(2)
GAS CHROMATOGRAPHY/LOW-RESOLUTION MASS SPECTROMETER(1)	Replace septum. Clean injector port. Cut off front portion of capillary columns. Replace column if this fails to restore column performance or when column performance (e.g. peak tailing, poor resolution, high backgrounds, etc.) indicates it is required. Replace injection port liner when front portion of capillary column is removed. Check level of oil in mechanical pumps and diffusion pump if vacuum is insufficient. Add oil if needed.	As Needed

INSTRUMENT	MAINTENANCE	FREQUENCY
	Replace electron multiplier when the tuning voltage approaches the maximum and/or when sensitivity falls below required levels. Clean Source, including all ceramics and lenses - the source cleaning is indicated by a variety of symptoms including inability of the analyst to tune the instrument to specifications, poor response, and high background contamination. Replace filaments when both filaments burn out or performance indicates need for replacement. Check mass calibration (PFTBA or FC-43). Check ion source and analyzer (clean, replace parts as needed). Check vacuum, relays, gas pressures and flows. Change oil in the mechanical rough pump. Relubricate the turbomolecular pump-bearing wick. HP 7673 Autosampler: Replace syringe.	
	Check for sufficient gas supply. Check for correct column flow and/or inlet pressure. Check temperatures of injector, detector. Verify temperature programs. Check inlets, septa. Check baseline level. Check values of lens voltages, electron multiplier, and relative abundance and mass assignments of the calibration compounds. Inspect chromatogram to verify symmetrical peak shape and adequate resolution between closely eluting peaks. Autosampler: fill wash bottle, dispose of waste bottle contents. Air Autosampler: Check for proper operation. Leak check system.	Daily(2)
	Replace the exhaust filters on the mechanical rough pump every 1-2 years.	Annually
GAS CHROMATOGRAPHY/HIGH-RESOLUTION MASS SPECTROMETER(1)	Full Bake-Out. Change oil in rotary pump. Change oil in diffusion pump. Replace o-rings. Solvent rinse the flight tube. Clean the first field free region. Check detector voltages. Clean and dust connectors, etc on the outside of the instrument. Check the vacuum: ~5 x. 10^{-7} MBAR on both analyzer ion gauges, and ~5 x 10^{-6} MBAR on the source, with no helium flowing. Check isolation valve for leaks, correct if needed. Check for thermal trip by taking the magnet to maximum current, and verify that the coolant flow is acceptable. Replace septum. Clean injector port. Cut off front portion of capillary columns. Replace column if this fails to restore column performance or when column performance (e.g. peak tailing, poor resolution, high backgrounds, etc.) indicates it is required. Replace injection port liner when front portion of capillary column is removed. Clean Source, including all ceramics and lenses - the source cleaning is indicated by a variety of symptoms	As Needed

INSTRUMENT	MAINTENANCE	FREQUENCY
	including inability of the analyst to tune the instrument to specifications, poor response, and high background contamination. Replace filaments when performance indicates need for replacement.	
	Check resolution sensitivity. Check stability. Check for sufficient gas supply. Check for correct column flow and/or inlet pressure. Check temperatures of injector, detector. Verify temperature programs. Check inlets, septa. Check baseline level. Check values of lens voltages, electron multiplier, and relative abundance and mass assignments of the calibration compounds. Inspect chromatogram to verify symmetrical peak shape and adequate resolution between closely eluting peaks.	Daily(2)
COLD VAPOR ATOMIC ABSORPTION (LEEMAN PS 200) (1)	Change pump tubing. Check/change Hg lamp. Clean optical cell. Change drying tube. Grease pump.	As Needed
	Check sample tip for clogs. Check drying tube. Check pump tubing/drain tubing. Check gas pressure. Check liquid/gas separator. Check tubing.	Daily(2)
INDUCTIVELY COUPLED ARGON PLASMA/MASS SPECTROMETRY (ICAP/MS)(1)	Check electronic settings for optimum sensitivity: resolution, mass calibration, ion optics. Measure quartz torch for proper alignment when removed and cleaned. Clean spray chamber and nebulizer. Clean all filters and fans. Check chiller coolant level. Check and drain oil mist eliminator on roughing pumps.	As Needed
	Check sample waste container level. Check quartz torch condition. Check RF coil. Check peristaltic pump: proper roller pressure, sample introduction tubing, correct pump rotation, condition of drain tubing. Check condition of sampler and skimmer cones. Check oil level of roughing pumps.	Daily(2)
	Replace oil in roughing pumps.	Every 2-3 Months
ICP(1)	Check that argon feed pressure is 80-120 psi. Check that chiller coolant pressure is 45-80 psig, no leaks. Check purge and shear gasses. Nitrogen purge gas pressure 40-120 psig, compressed air shear gas pressure 80-120 psig. Check radial purge and axial windows for deposits. Check that nebulizer is not clogged. Check that capillary tubing is clean and in good condition. Check that peristaltic pump windings are secure. Check that exhaust vent is operational Check that torch, glassware, aerosol injector tube are clean.	Daily(2)

INSTRUMENT	MAINTENANCE	FREQUENCY
	Clean plasma torch assembly to remove accumulated deposits. Check RF coil. Clean nebulizer and drain chamber; keep free flowing to maintain optimum performance. Clean filters on back of power unit to remove dust. Replace when needed: peristaltic pump tubing. sample capillary tubing. autosampler sipper probe. Check performance with manganese. Check O-rings. Clean/lubricate pump rollers	Monthly or As Needed
	Check chiller coolant filter. (may require more or less frequently)	Semi-Annually
	Notify manufacturer service engineer for scheduled preventive maintenance service.	Annually
ION CHROMATOGRAPH(1)	Clean micromembrane suppressor when decreases in sensitivity are observed. Check fuses when power problems occur. Change column when peak shape and resolution deteriorate or when retention time shortening indicates that exchange sites have become deactivated. De-gas pump head when flow is erratic. Check all air and liquid lines for discoloration and crimping, if indicated. Check/change bed supports guard and analytical columns, if indicated.	As Needed
	Check plumbing/leaks. Check eluent level. Check gases. Check pump pressure. Check conductivity meter.	Daily(2)
	Check pump heads for leaks. Check filter (inlet).	Weekly
	Change pump seals. Change injection valve. Clean conductivity cell. Check conductivity cell for calibration.	Annually
ALPKEM COLORIMETRIC AUTO ANALYZER(1)	Prepare fresh reagents. Replace tubing. (About every 100 hours of use)	As Needed
	Check detector. Make sure there are no trapped bubbles in detector cell. Check Valves Check peristaltic tubing. Check sampler.	Daily(2)
	Clean pump, and XYZ Sampler.	Weekly
	Lubricate pump roller.	Monthly
	Clean pump rollers with steel wool and lubricate.	Semi-Annually
CHEMICAL OXYGEN DEMAND (COD) REACTOR(1)	Electronics serviced.	As Needed
	Check temperature with NIST reference thermometer.	Annually
AUTO TITRATOR(1)	Electronics serviced.	As Needed
	Calibrate with check standards.	Daily(2) (When Used)

INSTRUMENT	MAINTENANCE	FREQUENCY
	Inspect electrodes daily, clean as needed. Inspect electrode proper levels of filling solutions daily, fill as needed. Clean probe, each use. Prime buret Check rinse water reservoir.	
CONDUCTANCE METER(1)	Electronics serviced. Replace batteries	As Needed
SPECTROPHOTOMETER(1)	Replace lamp. Replace fuse.	As Needed
	Check instrument manual. Perform wavelength calibration. Replace lamp annually or when erratic response is observed.	Annually
PH METER(1)	Clean electrode. Refill reference electrode.	As Needed
	Inspect electrode. Verify electrodes are properly connected and filled. Inspect electrode proper levels of filling solutions. Make sure electrode is stored in buffer.	Daily(2)
TURBIDIMETER(1)	Electronics serviced.	As Needed
	Clean instrument housing.	Monthly
DIGESTION BLOCK	Check temperature with NIST thermometer.	Annually
SONICATOR (1)	Replace probe tip. Disassemble and clean sonicator probe tips. Tune sonicator assembly (if recommended by manufacturer)	As Needed
	Inspect probe tips for inconsistencies (etching/pitting).	Daily(2) (When Used)
ANALYTICAL/TOP LOADING BALANCES(1)	Check using ASTM Class 3 weights once daily or before use. Clean pan and weighing compartment.	Daily(2)
REFRIGERATORS/WALK-IN COOLERS(1)	Manufacturer cleaning and calibration.	Annually
	Refrigerant system and electronics serviced.	As Needed
	Temperatures checked and logged.	Daily(2)
OVENS(1)	Electronics serviced.	As Needed
	Temperatures checked and logged.	Daily(2)
ZYMARK PE WORKSTATION	Change O-rings whenever there are visible leaks or poor sealing on the SPE columns. Sample lines are clean after samples have been extracted by SPE with a program “Clean Sample Lines” with methanol followed by water. Occasionally for a more rigorous cleaning, or after a highly contaminated sample, a mixture of methanol/DCM at 50:50 may be used in place of methanol, follow by methanol, then water (never use acetone). Syringe pump may be primed using a program “Prime Solvent Lines” whenever air bubbles are suspected in the lines from running out of solvents and whenever solvents are changed. Syringe pump in good condition – replace if showing signs of wear or suspected of poor performance. Sample pumps may be re-calibrated whenever major	As Needed

INSTRUMENT	MAINTENANCE	FREQUENCY
	repairs are performed, or whenever the pumps are suspected to be out of calibration. Follow manufacturer's procedure for re-calibrating the sample pumps. For method 8330, the pump loads 1050 mL of sample on the SPE. It should used up the whole sample bottle (quart bottles and 1-L bottles).	
SONICATION WATER BATH(1)	If the water bath is dirty, empty and refill with tap water. A couple drops of anti-bacterial solution may be added to inhibit the growth of bacteria in the water. The water level in the sonication batch should be about 1.2 to 1 inch from the top while in operation. Do not allow sonication batch to operate with water bath at lower levels. If the level is low, add more water, if the levels is too high, remove water to the proper level.	As Needed

Footnotes to Preventive Maintenance Tables

(1) Refer to manufacturer's instructions for each instrument to identify and perform maintenance operations.

(2) Daily checks and verifications are performed prior to instrument startup and are not documented in maintenance logs unless problems are noted.

(3) Where there are differences between this table and the tables present in method SOPs, the table in the method SOP should be followed.

SECTION 21. MEASUREMENT TRACEABILITY

21.1 Overview

Traceability of measurements shall be assured using a system of documentation, calibration, and analysis of reference standards. Laboratory equipment that are peripheral to analysis and whose calibration is not necessarily documented in a test method analysis or by analysis of a reference standard shall be subject to ongoing certifications of accuracy. At a minimum, these must include procedures for checking specifications of ancillary equipment: balances, thermometers, temperature, Deionized (DI) and Reverse Osmosis (RO) water systems, automatic pipettes and other volumetric measuring devices (Refer to Section 20.3). With the exception of Class A Glassware and Glass microliter syringes, quarterly accuracy checks are performed for all mechanical volumetric devices. Wherever possible, subsidiary or peripheral equipment is checked against standard equipment or standards that are traceable to national or international standards. Class A Glassware and Glass microliter syringes should be routinely inspected for chips, acid etching or deformity (e.g., bent needle). If the Class A glassware or syringe is suspect, the accuracy of the glassware will be assessed prior to use.

21.2 NIST-Traceable Weights and Thermometers

Reference standards of measurement shall be used for calibration only and for no other purpose, unless it can be shown that their performance as reference standards would not be invalidated.

For NIST-traceable weights and thermometers, the laboratory requires that all calibrations be conducted by a calibration laboratory accredited by A2LA, NVLAP (National Voluntary Laboratory Accreditation Program) or another accreditation organization that is a signatory to a MRA (Mutual Recognition Arrangement) of one or more of the following cooperations – ILAC (International al Laboratory Accreditation Cooperation) or APLC (Asia-Pacific Laboratory Accreditation Cooperation). A calibration certificate and scope of accreditation is kept on file at the laboratory. Refer to Section 21 for calibration of weights and thermometers.

The calibration laboratory's policy for achieving measurement traceability is defined and includes the subsequent elements of uncertainty.

The uncertainty calculations of the calibration laboratory are supported by uncertainty budgets and are represented by expanded uncertainties typically using a coverage factor of k=2 to approximate the 95% confidence level. This explanation accompanies the measurement result and the associated uncertainty.

The tolerance uncertainty ratio (TUR) is calculated using the expanded uncertainty of the measurement, not the collective uncertainty of the measurement standards. A statement to this effect accompanies the TUR along with the coverage factor and confidence level.

The calibration report or certificate submitted to TestAmerica Sacramento contains, in a well designed format, a traceability statement, the conditions under which the calibrations were made in the context of any potential influence, a compliance statement with an identified metrological specification and the pertinent clauses, a clearly identified record of the quantities and functional test results before and after re-calibration, and no recommendation on the calibration interval. Opinions and interpretations of results are presented along with the basis

upon which they were made and identified as such. The report may be submitted by facsimile or other electronic means as long as the requirements of the International Standard are achieved. If significant amendments are made to a calibration certificate, a supplemental certificate for the serial-number-specified piece of equipment is so identified. When a new certificate is offered, it uniquely identifies and references the one it replaces. All calibration reports are filed in the QA Office.

The calibration laboratory supports in-house calibration systems: documented procedures for in-house calibrations, evidence by a report, certificate, or sticker, for an appropriate amount of time; training records of calibration personnel; certificates from accreditation services demonstrating traceability to national or international standards of measurement; procedures for evaluating measurement uncertainty; timely and documented recalibration of reference standards. When subcontracting to a calibration laboratory, TestAmerica Sacramento does not use a firm who subcontracts the work.

An external certified service engineer services laboratory balances on an annual basis. This service is documented on each balance with a signed and dated certification sticker. Balance calibrations are checked each day of use. All mercury thermometers are calibrated annually against a traceable reference thermometer. Temperature readings of ovens, refrigerators, and incubators are checked on each day of use.

21.3 Reference Standards / Materials

Reference standards/materials, where commercially available, are traceable to certified reference materials. Commercially prepared reference standards are purchased from vendors that are accredited to ISO Guide 34 and ISO/IEC Guide 17025. All reference standards from commercial vendors shall be accompanied with a certificate that includes at least the following information:

- Manufacturer
- Analytes or parameters calibrated
- Identification or lot number
- Calibration method
- Concentration with associated uncertainties
- Purity

.

If a standard cannot be purchased from a vendor that supplies a Certificate of Analysis, the purity of the standard is documented by analysis. The receipt of all reference standards must be documented. Reference standards are labeled with a unique Standard Identification Number and expiration date. All documentation received with the reference standard is retained as a QC record and references the Standard Identification Number.

All reference, primary and working standards/materials, whether commercially purchased or laboratory prepared, must be checked regularly to ensure that the variability of the standard or material from the 'true' value does not exceed method requirements. The accuracy of calibration standards is checked by comparison with a standard from a second source. In cases where a second standard manufacturer is not available, a vendor certified different lot is acceptable for use as a second source. For unique situations, such as air analysis where no other source or lot is available, a standard made by a different analyst would be considered a

second source. The appropriate Quality Control (QC) criteria for specific standards are defined in laboratory SOPs. In most cases, the analysis of an Initial Calibration Verification (ICV) or LCS (where there is no sample preparation) is used as the second source confirmation. These checks are generally performed as an integral part of the analysis method (e.g. calibration checks, laboratory control samples).

All standards and materials must be stored and handled according to method or manufacturer's requirements in order to prevent contamination or deterioration. Refer to the Corporate Environmental Health & Safety Manual or laboratory SOPs. For safety requirements, please refer to method SOPs and the laboratory Environmental Health and Safety Manual.

Standards and reference materials shall not be used after their expiration dates unless their reliability is verified by the laboratory and their use is approved by the Quality Assurance Manager. The laboratory must have documented contingency procedures for re-verifying expired standards.

21.4 Documentation and Labeling of Standards, Reagents, and Reference Materials

Reagents must be at a minimum the purity required in the test method. The date of reagent receipt and the expiration date are documented. The lots for most of the common solvents and acids are tested for acceptability prior to company wide purchase. [Refer to TestAmerica's Corporate SOP (CA-Q-S-001), Solvent and Acid Lot Testing and Approval.]

All manufacturer or vendor supplied Certificate of Analysis or Purity must be retained, stored appropriately, and readily available for use and inspection. These records are scanned and retained on the local server. Records must be kept of the date of receipt and date of expiration of standards, reagents and reference materials. In addition, records of preparation of laboratory standards, reagents, and reference materials must be retained, stored appropriately, and be readily available for use and inspection. For detailed information on documentation and labeling, please refer to method specific SOPs and SOP No. WS-QA-0017, "Standards and Reagents and Quality Control Check Procedures".

Commercial materials purchased for preparation of calibration solutions, spike solutions, etc., are usually accompanied with an assay certificate or the purity is noted on the label. If the assay purity is 96% or better, the weight provided by the vendor may be used without correction. If the assay purity is less than 96% a correction will be made to concentrations applied to solutions prepared from the stock commercial material (for 1613B dioxin/furan analyses the purity must be 98% or corrections must be made). Blended gas standard cylinders use a nominal concentration if the certified value is within +/-15%, otherwise the certified values is used for the canister concentration.

21.4.1 All standards, reagents, and reference materials must be labeled in an unambiguous manner. Standards are logged into the laboratory's LIMS system, and are assigned a unique identification number. The following information is typically recorded in the electronic database or standards logbook.

- Standard ID
- Description of Standard

- Department
- Preparer's name
- Final volume and number of vials prepared
- Solvent type and lot number
- Preparation Date
- Expiration Date
- Standard source type (stock or daughter)
- Standard type (spike, surrogate, other)
- Parent standard ID (if applicable)
- Parent Standard Analyte Concentration (if applicable)
- Parent Standard Amount used (if applicable)
- Component Analytes
- Final concentration of each analyte
- Comment box (text field)

Records are maintained electronically or in logbooks for standard and reference material preparation. These records show the traceability to purchased stocks or neat compounds. These records also include method of preparation, date of preparation, expiration date and preparer's name or initials. Preparation procedures are provided in the Method SOPs.

21.4.2 All standards, reagents, and reference materials must be clearly labeled with a minimum of the following information:

- Expiration Date (include prep date for reagents)
- Standard ID (from the preparation logbook)
- Special Health/Safety warnings if applicable

Records must also be maintained of the date of receipt for commercially purchased items or date of preparation for laboratory prepared items. Special Health/Safety warnings must also be available to the analyst. This information is maintained in the SDS section of OASIS.

21.4.3 In addition, the following information may be helpful:

- Date opened (for multi-use containers, if applicable)
- Description of standard (if different from manufacturer's label or if standard was prepared in the laboratory)
- Recommended Storage Conditions.
- Concentration (if applicable)
- Initials of analyst preparing standard or opening container

All containers of prepared reagents must include an expiration date and an ID number to trace back to preparation.

Procedures for preparation of reagents can be found in the Method SOPs.

Standard ID numbers must be traceable through associated logbooks, worksheets and preparation/analytical batch records.

All reagents and standards must be stored in accordance to the following priority: 1) with the manufacturer's recommendations; 2) with requirements in the specific analytical methods as specified in the laboratory SOP.

SECTION 22. SAMPLING

22.1 Overview

The laboratory does not provide sampling services. The laboratory's responsibility in the sample collection process lies in supplying the sampler with the necessary coolers, reagent water, sample containers, preservatives, sample labels, custody seals, COC forms, ice, and packing materials required to properly preserve, pack, and ship samples to the laboratory

22.2 Sampling Containers

The laboratory offers clean sampling containers for use by clients. These containers are obtained from reputable container manufacturers and meet EPA specifications as required. Certificates of cleanliness for bottles and preservatives are provided by the supplier and are maintained at the laboratory. Alternatively, the certificate may be maintained by the supplier and available to the laboratory on-line.

22.2.1 Preservatives

Upon request, preservatives are provided to the client in pre-cleaned sampling containers. In some cases containers may be purchased pre-preserved from the container supplier. Whether prepared by the laboratory or bought pre-preserved, the grades of the preservatives are at a minimum:

- Hydrochloric Acid – Reagent ACS (Certified VOA Free) or equivalent
- Methanol – Purge and Trap grade
- Nitric Acid – Instra-Analyzed or equivalent
- Sodium Bisulfate – ACS Grade or equivalent
- Sodium Hydroxide – Instra-Analyzed or equivalent
- Sulfuric Acid – Instra-Analyzed or equivalent
- Sodium Thiosulfate – ACS Grade or equivalent

22.3 Definition of Holding Time

The date and time of sampling documented on the COC form establishes the day and time zero. As a general rule, when the maximum allowable holding time is expressed in "days" (e.g., 14 days, 28 days), the holding time is based on calendar day measured. Holding times expressed in "hours" (e.g., 6 hours, 24 hours, etc.) are measured from date and time zero. Holding times for analysis include any necessary reanalysis. However, there are some programs and regulators, which determine holding time compliance based on the date and specific time of analysis compared to the time of sampling regardless of how long the holding time is.

22.4 Sampling Containers, Preservation Requirements, Holding Times

The preservation and holding time criteria specified in the laboratory SOPs are derived from the source documents for the methods. If method required holding times or preservation requirements are not met, the reports will be qualified using a flag, footnote or case narrative.

As soon as possible or “ASAP” is an EPA designation for tests for which rapid analysis is advised, but for which neither EPA nor the laboratory have a basis for a holding time.

22.5 Sample Aliquots / Subsampling

Taking a representative sub-sample from a container is necessary to ensure that the analytical results are representative of the sample collected in the field. The size of the sample container, the quantity of sample fitted within the container, and the homogeneity of the sample need consideration when sub-sampling for sample preparation. It is the laboratory’s responsibility to take a representative subsample or aliquot of the sample provided for analysis.

Analysts should handle each sample as if it is potentially dangerous. At a minimum, safety glasses, gloves, and lab coats must be worn when preparing aliquots for analysis.

Guidelines on taking sample aliquots & subsampling are located SOP Nos. WS-QA-0018, “Subsampling and Compositing of Samples (Method ASTM D 6323-98)” and WS-QA-0028, “Incremental Sampling Methodology of Soils and Sediments”.

SECTION 23. HANDLING OF SAMPLES

Sample management procedures at the laboratory ensure that sample integrity and custody are maintained and documented from sampling/receipt through disposal.

23.1 Chain of Custody (COC)

The COC form is the written documented history of any sample and is initiated when bottles are sent to the field, or at the time of sampling. This form is completed by the sampling personnel and accompanies the samples to the laboratory where it is received and stored under the laboratory's custody. The purpose of the COC form is to provide a legal written record of the handling of samples from the time of collection until they are received at the laboratory. It also serves as the primary written request for analyses from the client to the laboratory. The COC form acts as a purchase order for analytical services when no other contractual agreement is in effect. An example of a COC form may be found in Figure 23-1.

23.1.1 Field Documentation

The information the sampler needs to provide at the time of sampling on the container label is:

- Sample identification
- Date and time
- Preservative

During the sampling process, the COC form is completed and must be legible (see Figure 23-1). This form includes information such as:

- Client name, address, phone number and fax number (if available)
- Project name and/or number
- The sample identification
- Date, time and location of sampling
- Sample collectors name
- The matrix description
- The container description
- The total number of each type of container
- Preservatives used
- Analysis requested
- Requested turnaround time (TAT)
- Any special instructions
- Purchase Order number or billing information (e.g. quote number) if available
- The date and time that each person received or relinquished the sample(s), including their signed name.

When the sampling personnel deliver the samples directly to TestAmerica personnel, the samples are stored in a cooler with ice, as applicable, and remain solely in the possession of the client's field technician until the samples are delivered to the laboratory personnel. The sample collector must assure that each container is in his/her physical possession or in his/her

view at all times, or stored in such a place and manner to preclude tampering. The field technician relinquishes the samples in writing on the COC form to the sample control personnel at the laboratory or to a TestAmerica courier. When sampling personnel deliver the samples through a common carrier (Fed-Ex, UPS), the COC relinquished date/time is completed by the field personnel and samples are released to the carrier. Samples are only considered to be received by lab when personnel at the fixed laboratory facility have physical contact with the samples.

Note: Independent couriers are not required to sign the COC form. The COC is usually kept in the sealed sample cooler. The receipt from the courier is stored in log-in by date; it lists all receipts each date.

23.1.2 Legal / Evidentiary Chain-of-Custody

If samples are identified for legal/evidentiary purposes on the COC, legal COCs will be generated per the Manual for Certification of Laboratories Analyzing Drinking Water, Fifth Edition, January 2005, Appendix A, and SOP No. WS-QA-0003, “Sample Receipt and Procedures”.

23.2 Sample Receipt

Samples are received at the laboratory by designated sample receiving personnel and a unique laboratory project identification number is assigned. Each sample container shall be assigned a unique sample identification number that is cross-referenced to the client identification number such that traceability of test samples is unambiguous and documented. Each sample container is affixed with a durable sample identification label. Sample acceptance, receipt, tracking and storage procedures are summarized in the following sections and in SOP No. WS-QA-0003, “Sample Receipt and Procedures”.

23.2.1 Laboratory Receipt

When samples arrive at the laboratory, sample receiving personnel inspect the coolers and samples. The integrity of each sample must be determined by comparing sample labels or tags with the COC and by visual checks of the container for possible damage. Any non-conformance, irregularity, or compromised sample receipt must be documented on the lot receipt checklist and within the non-conformance program and brought to the immediate attention of the client. The COC, shipping documents, documentation of any non-conformance, irregularity, or compromised sample receipt, record of client contact, and resulting instructions become part of the project record. Laboratory receipt procedures are described in more detail in SOP No. WS-QA-0003.

23.2.1.1 Unique Sample Identification

All samples that are processed through the laboratory receive a unique sample identification to ensure that there can be no confusion regarding the identity of such samples at anytime. This system includes identification for all samples, subsamples and subsequent extracts and/or digestates.

The laboratory assigns a unique identification (e.g., Sample ID) code to each sample container received at the laboratory. This Primary ID is made up of the following information (consisting of 4 components):

Example: 320 - 9608 - A - 1

Location ID | Login ID | Container Occurrence | Sample Number

The above example states that TestAmerica Sacramento Laboratory (Location 320) is the receiving laboratory. Login ID is 9608 (unique to a particular client/job occurrence). The container code indicates it is the first container ("A") of Sample #1.

If the primary container goes through a prep step that creates a "new" container, then the new container is considered secondary and gets another ID. An example of this being a client sample in a 1-Liter amber bottle is sent through a Liquid/Liquid Extraction and an extraction vial is created from this step. The vial would be a SECONDARY container. The secondary ID has 5 components.

Example: 320 - 9608 - A - 1 - **A** ← **Secondary Container Occurrence**

Example: 320-9608-A-1-A would indicate the PRIMARY container listed above that went through a step that created the 1st occurrence of a Secondary container.

With this system, a client sample can literally be tracked throughout the laboratory in every step from receipt to disposal.

23.3 Sample Acceptance Policy

The laboratory has a written sample acceptance policy (Figure 23-2) that clearly outlines the circumstances under which samples shall be accepted or rejected. These include:

- a COC filled out completely;
- samples must be properly labeled;
- proper sample containers with adequate volume for the analysis (Sampling Guide) and necessary QC;
- samples must be preserved according to the requirements of the requested analytical method (Sampling Guide);
- sample holding times must be adhered to (Sampling Guide);
- the project manager will be notified if any sample is received in damaged condition.

Data from samples which do not meet these criteria are flagged and the nature of the variation from policy is defined.

23.3.1 After inspecting the samples, the sample receiving personnel sign and date the COC form, make any necessary notes of the samples' conditions and store them in appropriate refrigerators or storage locations.

23.3.2 Any deviations from these checks that question the suitability of the sample for analysis, or incomplete documentation as to the tests required will be resolved by consultation with the client. If the sample acceptance policy criteria are not met, the laboratory shall either:

- Retain all correspondence and/or records of communications with the client regarding the disposition of rejected samples, or
- Fully document any decision to proceed with sample analysis that does not meet sample acceptance criteria.

Note: North Carolina requires that they be notified when samples are processed that do not meet sample acceptance criteria.

Once sample acceptance is verified, the samples are logged into the LIMS according SOP No. WS-QA-0003.

23.4 Sample Storage

In order to avoid deterioration, contamination or damage to a sample during storage and handling, from the time of receipt until all analyses are complete, samples are stored in refrigerators, freezers or protected locations suitable for the sample matrix. In addition, samples to be analyzed for volatile organic parameters are stored in separate refrigerators designated for volatile organic parameters only. Samples are never to be stored with reagents, standards or materials that may create contamination.

To ensure the integrity of the samples during storage, refrigerator blanks are maintained in the volatile sample refrigerators and analyzed every two weeks.

Analysts and technicians retrieve the sample container allocated to their analysis from the designated refrigerator and place them on carts, analyze the sample, and return the remaining sample or empty container to the refrigerator from which it originally came. All unused portions of samples are returned to the secure sample control area. Empty sample containers are marked as “DIT” (destroyed in testing) on the sample receiving check out form and are disposed by the analytical staff. All samples are kept in the refrigerators for 30 days past invoicing, unless other arrangements have been made with the client.

Access to the laboratory is controlled such that sample storage need not be locked at all times unless a project specifically demands it. Samples are accessible to laboratory personnel only. Visitors to the laboratory are prohibited from entering the refrigerator and laboratory areas unless accompanied by an employee of TestAmerica.

23.5 Hazardous Samples and Foreign Soils

Foreign soil samples are sent out for incineration by a USDA-approved waste disposal facility.

23.6 Sample Shipping

In the event that the laboratory needs to ship samples, the samples are placed in a cooler with enough ice to ensure the samples remain just above freezing and at or below 6.0°C during transit. The samples are carefully surrounded by packing material to avoid breakage (yet maintain appropriate temperature). A trip blank is enclosed for those samples requiring water/solid volatile organic analyses (see Note). The chain-of-custody form is signed by the sample control technician and attached to the shipping paperwork. Samples are generally shipped overnight express or hand-delivered by a TestAmerica courier to maintain sample integrity. All personnel involved with shipping and receiving samples must be trained to maintain the proper chain-of-custody documentation and to keep the samples intact and on ice. The Environmental, Health and Safety Manual contains additional shipping requirements.

Note: If a client does not request trip blank analysis on the COC or other paperwork, the laboratory will not analyze the trip blanks that were supplied. However, in the interest of good client service, the laboratory will advise the client at the time of sample receipt that it was noted that they did not request analysis of the trip blank; and that the laboratory is providing the notification to verify that they are not inadvertently omitting a key part of regulatory compliance testing.

23.7 Sample Disposal

Samples should be retained for a minimum of 30 days after the project report is sent, however, provisions may be made for earlier disposal of samples once the holding time is exceeded. An exception is samples contained in laboratory-owned air sample canisters. These are held for a minimum of 24 hours after the project report is sent, prior to evacuating the canister and returning it to the equipment pool. Some samples are required to be held for longer periods based on regulatory or client requirements (e.g., 60 days after project report is sent). The laboratory must follow the longer sample retention requirements where required by regulation or client agreement. Several possibilities for sample disposal exist: the sample may be consumed completely during analysis, the sample may be returned to the customer or location of sampling for disposal, or the sample may be disposed of in accordance with the laboratory's waste disposal procedures (SOP: WS-EHS-001, "Waste Disposal"). All procedures in the laboratory Environmental, Health and Safety Manual are followed during disposal. Samples are normally maintained in the laboratory no longer than two months from receipt unless otherwise requested. Unused portions of samples found or suspected to be hazardous according to state or federal guidelines may be returned to the client upon completion of the analytical work.

All documentation and correspondence concerning the disposal decision process must be kept on file. Pertinent information includes the date of disposal, nature of disposal (such as sample depletion, hazardous waste facility disposal, return to client), names of individuals who conducted the arrangements and physically completed the task. The laboratory will remove or deface sample labels prior to disposal unless this is accomplished through the disposal method (e.g., samples are incinerated). A Waste Disposal Record should be completed.

Figure 23-1. Example: Chain of Custody (COC)

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Test America West Sacramento
880 Riverside Parkway

West Sacramento, CA 95605
Tel 916 373-5600 Fax 916 372-1059

Chain of Custody Record

Client Contact	Project Manager:	Site Contact:	Date:	COC No:
Your Company Name here	Tel/Fax:	Lab Contact:	Carrier:	____ of ____ COCs
Address	Analysis Turnaround Time			Job No.
City/State/Zip	Calendar (C) or Work Days (W) _____			
(xxx) xxx-xxxx Phone	TAT if different from Below _____			
(xxx) xxx-xxxx FAX	☐ Standard			SDG No.
Project Name:	☐ 1 week			
Site:	☐ 3 days			
P O #	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type	Matrix	# of Cont.	Filtered Sample																Sample Specific Notes:

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6=Other _____

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For _____ Months*

Special Instructions/QC Requirements & Comments:

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:

Figure 23-2. Example: Sample Acceptance Policy

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

SACRAMENTO LABORATORY
SAMPLE ACCEPTANCE POLICY
(Effective 02/02/2015)

Page 1 of 2

The TNI Standard and TestAmerica Sacramento have specific requirements under which all samples will be received by the laboratory for analysis. TestAmerica Sacramento will review your sample shipment against those requirements as listed below, and will communicate any discrepancies to you. Your project manager will assist you in the appropriate resolution of any issues related to sample receipt. Please contact your project manager with any questions.

VOA vials should be stored in controlled conditions. Exposure of trip blanks to temperature fluctuations is likely to cause development of bubbles in the trip blanks.

When completing the chain of custody form, please note that you must sign your name in the "relinquished by" box.

Requirements are as follows:

- Proper, full and complete documentation, which includes sample identification, the location, date and time of collection, the collector's name, the preservation type, the sample matrix type, the requested testing method, and any special remarks concerning the samples, shall be provided.
- Samples must be accompanied by written disclosure of the known or suspected presence of any hazardous substances, as defined by applicable federal or state law.
- Per State and/or Federal Regulation, the client is responsible to ensure that samples are shipped in accordance with DOT/IATA requirements, and that radioactive materials may only be delivered to licensed facilities. Any samples containing (or suspected to contain) Source, Byproduct, or Special Nuclear Material as defined by 10 CFR should be delivered directly to facilities licensed to handle such radioactive material. Natural material or ores containing naturally occurring radionuclides may be delivered to any TestAmerica facility or courier as long as the activity concentration of the material does not exceed 270 pCi/g alpha or 2700 pCi/g beta (49 CFR Part 173).
- Each sample shall be collected in the appropriate sample container and labeled with unique, durable and indelible identification.
- Drinking water samples for Method 1613B that may have residual chlorine must be checked and treated in the field, or collected in sodium thiosulfate preserved containers.
- Containers of water meant for perchlorate analysis should have adequate headspace to prevent anaerobic microbial degradation. A void approximately 1/3 of the container volume is sufficient.
- The samples shall arrive at the laboratory with adequate remaining holding time for the analyses requested.
- Sufficient sample volume must be available to perform the requested analyses.
- Received samples must not exhibit obvious signs of damage, contamination or inadequate preservation.
- Most analytical methods require chilling samples to 4° C (other than water samples for metals analysis). For these methods, the criteria are met if the samples are chilled to below 6° C and above freezing (0°C). For methods with other temperature criteria (e.g. some bacteriological methods require ≤ 10 °C), the samples must arrive within ± 2° C of the required temperature or within the method specified range.

  1. Samples that are delivered to the laboratory on the same day they are collected may not meet the requirements above. In these cases, the samples shall be considered acceptable if the samples were received on ice.
  2. If sample analysis is begun within fifteen (15) minutes of collection, thermal preservation is not required.
  3. Thermal preservation is not required in the field if the laboratory receives and refrigerates the sample within fifteen (15) minutes of collection.

- Chemical preservation (pH) will be verified prior to analysis and documented, either in sample control or at the analyst's level. The project manager will be notified immediately if there is a discrepancy. If analyses will still be performed, all affected results will be flagged to indicate improper preservation.

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TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

SACRAMENTO LABORATORY
SAMPLE ACCEPTANCE POLICY
(Effective 02/02/2015)

- For samples undergoing chemical warfare degradate analysis, the sample must be screened for agent prior to shipment in accordance with appendix 10 of our Sample Receipt Procedure (WS-QA-0003).
- Samples containing mammalian tissue will not be accepted without prior coordination with a project manager. Additional conditions for receipt and handling of tissue are outlined in appendix 11 of our Sample Receipt Procedure (WS-QA-0003).
- Air canisters (SUMMA® and other brands) have additional requirements:
  - Never write or affix a label directly on a canister. A special tag is attached to each canister for this purpose.
  - Complete the Canister Field Data Record with the initial and final vacuum/pressure reading for each canister during sampling.
  - Close all valves completely prior to shipping or transporting.
  - Return canisters, filters, flow controllers, vacuum flow regulators, and any other supplied equipment must be returned even if they were not used. Pack equipment carefully to minimize in-transit damage Sampling equipment that is damaged, lost or not returned will be invoiced to the client at the replacement cost. Delayed return of equipment to the laboratory may result in additional rental charges.
  - Do not attempt to adjust or alter any equipment, as it may result in loss of sample integrity as well as equipment damage that may be invoiced to the client.

The laboratory will notify the client/Project Manager upon sample receipt if the samples fail to meet any of the above requirements.

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Figure 23-3. Example: Cooler Receipt Form

TestAmerica
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Sacramento
Sample Receiving Notes

Job:_____

Tracking #_____

Use this form to record Sample Custody Seal, Cooler Custody Seal, Temperature & corrected Temperature & other observations. File in the job folder with the COC.

Notes:_____

Therm. ID: **AK-1** / **AK-2** / **HACCP** /Other_____

Ice_____ Wet_____ Dry_____ Other_____

Cooler Custody Seal: _____

Sample Custody Seal: _____

Cooler ID:_____

Temp: Observed_____

Corrected: _____

From: Temp Blank ☐ Sample ☐
NCM Filed: Yes ☐ No ☐

	Yes	No	NA
Perchlorate has headspace?	☐	☐	☐
CoC is complete w/o discrepancies?	☐	☐	☐
Samples received within holding time?	☐	☐	☐
Sample preservatives verified?	☐	☐	☐
Cooler compromised/tampered with?	☐	☐	☐
Samples compromised/tampered with?	☐	☐	☐
COC and Samples w/o discrepancies?	☐	☐	☐
Sample containers have legible labels?	☐	☐	☐
Containers are not broken or leaking?	☐	☐	☐
Sample date/times are provided.	☐	☐	☐
Appropriate containers are used?	☐	☐	☐
Sample bottles are completely filled?	☐	☐	☐
Zero headspace?*	☐	☐	☐
Multiphasic samples are not present?	☐	☐	☐

Initials:_____ Date:_____

*Containers requiring zero headspace have no headspace, or bubble < 6 mm (1/4")

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Bottle Lot Inventory

Lot ID:_____

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
VOA*																				
VOAh*																				
AGB																				
AGBs																				
250AGB																				
250AGBs																				
250AGBn																				
500AGB																				
____AGJ																				
500AGJ																				
250AGJ																				
125AGJ																				
____CGJ																				
500CGJ																				
250CGJ																				
125CGJ																				
PJ																				
PJn																				
500PJ																				
500PJn																				
500PJna																				
500PJzn/na																				
250PJ																				
250PJn																				
250PJna																				
250PJzn/na																				
Acetate Tube																				
_____"CT																				
Encore																				
Folder/filter																				
PUF																				
Petri/Filter																				
XAD Trap																				
Ziploc																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

h = hydrochloric acid s = sulfuric acid na = sodium hydroxide n = nitric acid zn = zinc acetate

Number of VOAs with air bubbles present / total number of VOA's

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SECTION 24. ASSURING THE QUALITY OF TEST RESULTS

24.1 Overview

In order to assure our clients of the validity of their data, the laboratory continuously evaluates the quality of the analytical process. The analytical process is controlled not only by instrument calibration as discussed in Section 20, but also by routine process quality control measurements (e.g. Blanks, Laboratory Control Samples (LCS), Matrix Spikes (MS), duplicates (DUP), surrogates, Internal Standards (IS)). These quality control checks are performed as required by the method or regulations to assess precision and accuracy. In addition to the routine process quality control samples, Proficiency Testing (PT) Samples (concentrations unknown to laboratory) are analyzed to help ensure laboratory performance.

24.2 Controls

Sample preparation or pre-treatment is commonly required before analysis. Typical preparation steps include homogenization, grinding, solvent extraction, sonication, acid digestion, reflux, evaporation, and drying. During these pre-treatment steps, samples are arranged into discreet manageable groups referred to as preparation (prep) batches. Prep batches provide a means to control variability in sample treatment. Control samples are added to each prep batch to monitor method performance and are processed through the entire analytical procedure with investigative/field samples.

24.3 Negative Controls

Table 24-1. Example – Negative Controls

Control Type	Details
Method Blank (MB)	are used to assess preparation and analysis for possible contamination during the preparation and processing steps.
	The specific frequency of use for method blanks during the analytical sequence is defined in the specific standard operating procedure for each analysis. Generally it is 1 for each batch of samples; not to exceed 20 environmental samples.
	The method blank is prepared from a clean matrix similar to that of the associated samples that is free from target analytes (e.g., Reagent water, Ottawa sand, glass beads, etc.) and is processed along with and under the same conditions as the associated samples. The method blank goes through all of the steps of the process (including as necessary: filtration, clean-ups, etc.).
	Reanalyze or qualify associated sample results when the concentration of a targeted analyte in the blank is at or above the reporting limit as established by the method or by regulation, AND is greater than 1/10 of the amount measured in the sample.
Calibration Blanks	are prepared and analyzed along with calibration standards where applicable. They are prepared using the same reagents that are used to prepare the standards. In some analyses the calibration blank may be included in the calibration curve.
Instrument Blanks	are blank reagents or reagent water that may be processed during an analytical sequence in order to assess contamination in the analytical system. In general, instrument blanks are used to differentiate between contamination caused by the analytical system and that caused by the sample handling or sample prep process. Instrument blanks may also be inserted throughout the analytical sequence to minimize the effect of carryover from samples with high analyte content.

Table 24-1. Example – Negative Controls

Control Type	Details
Trip Blank [1]	are required to be submitted by the client with each shipment of samples requiring aqueous and solid volatiles analyses (or as specified in the client's project plan). Additionally, trip blanks may be prepared and analyzed for volatile analysis of air samples, when required by the client. A trip blank may be purchased (certified clean) or is prepared by the laboratory by filling a clean container with pure deionized water that has been purged to remove any volatile compounds. Appropriate preservatives are also added to the container. The trip blank is sent with the bottle order and is intended to reflect the environment that the containers are subjected to throughout shipping and handling and help identify possible sources if contamination is found. The field sampler returns the trip blank in the cooler with the field samples.
Field Blanks [1]	are sometimes used for specific projects by the field samplers. A field blank prepared in the field by filling a clean container with pure reagent water and appropriate preservative, if any, for the specific sampling activity being undertaken. (EPA OSWER)
Equipment Blanks [1]	are also sometimes created in the field for specific projects. An equipment blank is a sample of analyte-free media which has been used to rinse common sampling equipment to check effectiveness of decontamination procedures. (TNI)
Holding Blanks	also referred to as refrigerator or freezer blanks, are used to monitor the sample storage units for volatile organic compounds during the storage of VOA samples in the laboratory

[1] When known, these field QC samples should not be selected for matrix QC as it does not provide information on the behavior of the target compounds in the field samples. Usually, the client sample ID will provide information to identify the field blanks with labels such as "FB", "EB", or "TB."

Evaluation criteria and corrective action for these controls are defined in the specific standard operating procedure for each analysis.

24.4 Positive Controls

Control samples (e.g., QC indicators) are analyzed with each batch of samples to evaluate data based upon (1) Method Performance (Laboratory Control Sample (LCS) or Blank Spike (BS)), which entails both the preparation and measurement steps; and (2) Matrix Effects (Matrix Spike (MS) (Matrix spikes are not applicable to air) or Sample Duplicate (MD, DUP), which evaluates field sampling accuracy, precision, representativeness, interferences, and the effect of the matrix on the method performed. Each regulatory program and each method within those programs specify the control samples that are prepared and/or analyzed with a specific batch

Note that frequency of control samples vary with specific regulatory, methodology and project specific criteria. Complete details on method control samples are as listed in each analytical SOP.

24.4.1 Method Performance Control - Laboratory Control Sample (LCS)

The LCS measures the accuracy of the method in a blank matrix and assesses method performance independent of potential field sample matrix affects in a laboratory batch.

The LCS is prepared from a clean matrix similar to that of the associated samples that is free from target analytes (for example: Reagent water, Ottawa sand, glass beads, etc.) and is processed along with and under the same conditions as the associated samples. The LCS is spiked with verified known amounts of analytes or is made of a material containing known and verified amounts of analytes, taken through all preparation and analysis steps along with the field samples. Where there is no preparation taken for an analysis (such as in aqueous

volatiles), or when all samples and standards undergo the same preparation and analysis process (such as Phosphorus), a calibration verification standard is reported as the LCS. In some instances where there is no practical clean solid matrix available, aqueous LCS's may be processed for solid matrices; final results may be calculated as mg/kg or ug/kg, assuming 100% solids and a weight equivalent to the aliquot used for the corresponding field samples, to facilitate comparison with the field samples.

Certified pre-made reference material purchased from a NIST/A2LA accredited vendor may also be used for the LCS when the material represents the sample matrix or the analyte is not easily spiked (e.g. solid matrix LCS for metals, TDS, etc.).

The specific frequency of use for LCS during the analytical sequence is defined in the specific standard operating procedure for each analysis. It is generally 1 for each batch of samples; not to exceed 20 environmental samples.

If the mandated or requested test method, or project requirements, do not specify the spiking components, the laboratory shall spike all reportable components to be reported in the Laboratory Control Sample (and Matrix Spike) where applicable (e.g. no spike of pH). However, in cases where the components interfere with accurate assessment (such as simultaneously spiking chlordane, toxaphene and PCBs in Method 608), the test method has an extremely long list of components or components are incompatible, at a minimum, a representative number of the listed components (see below) shall be used to control the test method. The selected components of each spiking mix shall represent all chemistries, elution patterns and masses, permit specified analytes and other client requested components. However, the laboratory shall ensure that all reported components are used in the spike mixture within a two-year time period.

- For methods that have 1-10 target analytes, spike all components.
- For methods that include 11-20 target analytes, spike at least 10 or 80%, whichever is greater.
- For methods with more than 20 target analytes, spike at least 16 components.
- Exception: Due to analyte incompatibility in pesticides, Toxaphene and Chlordane are only spiked at client request based on specific project needs.
- Exception: Due to analyte incompatibility between the various PCB Aroclors, Aroclors 1016 and 1260 are used for spiking as they cover the range of all of the Aroclors. Specific Aroclors may be used by request on a project specific basis.

24.5 Sample Matrix Controls

Table 24-3. Sample Matrix Control

Control Type	Details	
Matrix Spikes (MS)	Use	used to assess the effect sample matrix of the spiked sample has on the precision and accuracy of the results generated by the method used;
	Typical Frequency [1]	At a minimum, with each matrix-specific batch of samples processed, an MS is carried through the complete analytical procedure. Unless specified by the client, samples used for spiking are randomly selected and rotated between different client projects. If the mandated or requested test method does not specify the spiking components, the laboratory shall spike all reportable components to be reported in the Laboratory Control Sample and Matrix Spike. Refer to the method SOP for complete details
	Description	essentially a sample fortified with a known amount of the test analyte(s).
Surrogate	Use	Measures method performance to sample matrix (organics only).
	Typical Frequency [1]	Are added to all samples, standards, and blanks, for all organic chromatography methods except when the matrix precludes its use or when a surrogate is not available. The recovery of the surrogates is compared to the acceptance limits for the specific method. Poor surrogate recovery may indicate a problem with sample composition and shall be reported, with data qualifiers, to the client whose sample produced poor recovery.
	Description	Are similar to matrix spikes except the analytes are compounds with properties that mimic the analyte of interest and are unlikely to be found in environment samples.
Duplicates[2]	Use	For a measure of analytical precision, with each matrix-specific batch of samples processed, a matrix duplicate (MD or DUP) sample, matrix spike duplicate (MSD), or LCS duplicate (LCSD) is carried through the complete analytical procedure.
	Typical Frequency [1]	Duplicate samples are usually analyzed with methods that do not require matrix spike analysis.
	Description	Performed by analyzing two aliquots of the same field sample independently or an additional LCS.
Internal Standards	Use	Are spiked into all environmental and quality control samples (including the initial calibration standards) to monitor the qualitative aspect of organic and some inorganic analytical measurements.
	Typical Frequency [1]	All organic and ICP methods as required by the analytical method.
	Description	Used to correct for matrix effects and to help troubleshoot variability in analytical response and are assessed after data acquisition. Possible sources of poor internal standard response are sample matrix, poor analytical technique or instrument performance.

[1] See the specific analytical SOP for type and frequency of sample matrix control samples.

[2] LCSD's are normally not performed except when regulatory agencies or client specifications require them. The recoveries for the spiked duplicate samples must meet the same laboratory established recovery limits as the accuracy QC samples. If an LCSD is analyzed both the LCS and LCSD must meet the same recovery criteria and be included in the final report. The precision measurement is reported as "Relative Percent Difference" (RPD). Poor precision between duplicates (except LCS/LCSD) may indicate non-homogeneous matrix or sampling.

24.6 Acceptance Criteria (Control Limits)

As mandated by the test method and regulation, each individual analyte in the LCS, MS, or Surrogate Spike is evaluated against the control limits published in the test method. Where there are no established acceptance criteria, the laboratory calculates in-house control limits with the use of control charts or, in some cases, utilizes client project specific control limits. When this occurs, the regulatory or project limits will supersede the laboratory's in-house limits.

Note: For methods, analytes and matrices with very limited data (e.g., unusual matrices not analyzed often), interim limits are established using available data or by analogy to similar methods or matrices.

Once control limits have been established, they are verified, reviewed, and updated if necessary on an annual basis unless the method requires more frequent updating. Control limits are established per method (as opposed to per instrument) regardless of the number of instruments utilized.

Laboratory generated % Recovery acceptance (control) limits are generally established by taking ± 3 Standard Deviations (99% confidence level) from the average recovery of a minimum of 30 data points (more points are preferred, however, fewer (minimum of 20) may be used to establish tentative acceptance limits in select circumstances).

- Regardless of the calculated limit, the limit should be no tighter than the Calibration Verification (ICV/CCV). (Unless the analytical method specifies a tighter limit).

- In-house limits cannot be any wider than those mandated in a regulated analytical method. Client or contract required control limits are evaluated against the laboratory's statistically derived control limits to determine if the data quality objectives (DQOs) can be achieved. If laboratory control limits are not consistent with DQOs, then alternatives must be considered, such as method improvements or use of an alternate analytical method.

- The lowest acceptable recovery limit will be 10% (the analyte must be detectable and identifiable). Exception: The lowest acceptable recovery limit for Benzidine will be 5% and the analyte must be detectable and identifiable.

- The maximum acceptable recovery limit will be 150%. Some specific methods or SOPs may allow for higher recoveries.

- The maximum acceptable RPD limit will be 35% for waters and 40% for soils. The minimum RPD limit is 10%.

- If either the high or low end of the control limit changes by ≤ 5% from previous, the control chart is visually inspected and, using professional judgment, they may be left unchanged if there is no affect on laboratory ability to meet the existing limits.

24.6.1 The lab must be able to generate a current listing of their control limits and track when the updates are performed. In addition, the laboratory must be able to recreate historical control limits. See SOP WS-QA-0035 for further details.

24.6.2 A LCS that is within the acceptance criteria establishes that the analytical system is in control and is used to validate the process. Samples that are analyzed with an LCS with recoveries outside of the acceptance limits may be determined as out of control and should be reanalyzed if possible. If reanalysis is not possible, then the results for all affected analytes for samples within the same batch must be qualified when reported. The internal corrective action process (see Section 12) is also initiated if an LCS exceeds the acceptance limits. Sample results may be qualified and reported without reanalysis if:

- The analyte results are below the reporting limit and the LCS is above the upper control limit.

- If the analytical results are above the relevant regulatory limit and the LCS is below the lower control limit.

Or, for TNI and DoD/DOE work, there are an allowable number of random Marginal Exceedances (ME):

<11 analytes	0 marginal exceedances are allowed.
11 – 30 Analytes	1 marginal exceedance is allowed
31-50 Analytes	2 marginal exceedances are allowed
51-70 Analytes	3 marginal exceedances are allowed
71-90 Analytes	4 marginal exceedances are allowed
> 90 Analytes	5 marginal exceedances are allowed

- Marginal exceedances are recovery exceedances between 3 SD and 4 SD from the mean recovery limit (TNI).

- Marginal exceedances must be random. If the same analyte exceeds the LCS control limit repeatedly, it is an indication of a systematic problem. The source of the error must be located and corrective action taken. The laboratory has a system to monitor marginal exceedances to ensure that they are random.

Though marginal exceedances may be allowed, the data must still be qualified to indicate it is outside of the normal limits.

24.6.3 If the MS/MSDs do not meet acceptance limits, the MS/MSD and the associated spiked sample is reported with a qualifier for those analytes that do not meet limits. If obvious preparation errors are suspected, or if requested by the client, unacceptable MS/MSDs are reprocessed and reanalyzed to prove matrix interference. A more detailed discussion of acceptance criteria and corrective action can be found in the lab's method SOPs and in Section 12.

24.6.4 If a surrogate standard falls outside the acceptance limits, if there is not obvious chromatographic matrix interference, reanalyze the sample to confirm a possible matrix effect. If the recoveries confirm or there was obvious chromatographic interference, results are reported from the original analysis and a qualifier is added. If the reanalysis meets surrogate recovery criteria, the second run is reported (or both are reported if requested by the client). Under certain circumstances, where all of the samples are from the same location and share similar chromatography, the reanalysis may be performed on a single sample rather than all of the samples and if the surrogate meets the recovery criteria in the reanalysis, all of the affected samples would require reanalysis.

24.7 Additional Procedures to Assure Quality Control

The laboratory has written and approved method SOPs to assure the accuracy of the test method including calibration (see Section 20), use of certified reference materials (see Section 21) and use of PT samples (see Section 15).

A discussion regarding MDLs, Limit of Detection (LOD) and Limit of Quantitation (LOQ) can be found in Section 19.

- Use of formulae to reduce data is discussed in the method SOPs and in Section 20.
- Selection of appropriate reagents and standards is included in Section 9 and 21.
- A discussion on selectivity of the test is included in Section 5.
- Constant and consistent test conditions are discussed in Section 18.
- The laboratories sample acceptance policy is included in Section 23.

SECTION 25. REPORTING RESULTS

25.1 Overview

The results of each test are reported accurately, clearly, unambiguously, and objectively in accordance with State and Federal regulations as well as client requirements. Analytical results are issued in a format that is intended to satisfy customer and laboratory accreditation requirements as well as provide the end user with the information needed to properly evaluate the results. Where there is conflict between client requests and laboratory ethics or regulatory requirements, the laboratory's ethical and legal requirements are paramount, and the laboratory will work with the client during project set up to develop an acceptable solution. Refer to Section 7.

A variety of report formats are available to meet specific needs.

In cases where a client asks for simplified reports, there must be a written request from the client. There still must be enough information that would show any analyses that were out of conformance (QC out of limits) and there should be a reference to a full report that is made available to the client. Review of reported data is included in Section 19.

25.2 Test Reports

Analytical results are reported in a format that is satisfactory to the client and meets all requirements of applicable accrediting authorities and agencies. A variety of report formats are available to meet specific needs. The report is printed or prepared electronically on laboratory letterhead, reviewed, and signed by the appropriate project manager. At a minimum, the standard laboratory report shall contain the following information:

25.2.1 A report title (e.g. Analytical Report for Samples) with a "sample results" column header.

25.2.2 Each report cover page printed on company letterhead, which includes the laboratory name, address and telephone number.

25.2.3 A unique identification of the report (e.g. work order number) and on each page an identification in order to ensure the page is recognized as part of the report and a clear identification of the end.

Note: Page numbers of report are represented as page # of ##, where the first number is the page number and the second is the total number of pages.

25.2.4 A copy of the chain of custody (COC).

- Any COCs involved with Subcontracting are included.
- In most cases, the applicable COC is an integral part of the report.
- Any additional addenda to the report must be treated in a similar fashion so it is a recognizable part of the report and cannot accidentally get separated from the report (e.g., Sampling information).

25.2.5 The name and address of client and a project name/number, if applicable.

25.2.6 Client project manager or other contact

25.2.7 Description and unambiguous identification of the tested sample(s) including the client identification code.

25.2.8 Date of receipt of sample, date and time of collection, and date(s) of test preparation and performance, and time of preparation or analysis if the required holding time for either activity is less than or equal to 72 hours.

25.2.9 Date reported or date of revision, if applicable.

25.2.10 Method of analysis including method code (EPA, Standard Methods, etc).

25.2.11 Reporting limit.

25.2.12 Method detection limits (if requested)

25.2.13 Definition of Data qualifiers and reporting acronyms (e.g. ND).

25.2.14 Sample results.

25.2.15 QC data consisting of method blank, surrogate, LCS, and MS/MSD recoveries and control limits.

25.2.16 Condition of samples at receipt including temperature. This may be accomplished in a narrative or by attaching sample login sheets (Refer to Sec. 25.2.4 – Item 3 regarding additional addenda).

25.2.17 A statement expressing the validity of the results, that the source methodology was followed and all results were reviewed for error.

25.2.18 A statement to the effect that the results relate only to the items tested and the sample as received by the laboratory.

25.2.19 A statement that the report shall not be reproduced except in full, without prior express written approval by the laboratory coordinator.

25.2.20 A signature and title of the person(s) accepting responsibility for the content of the report and date of issue. Authorized signatories are qualified Project Managers appointed by the Manager of Project Managers.

25.2.21 When TNI accreditation is required, the lab shall certify that the test results meet all requirements of TNI or provide reasons and/or justification if they do not.

25.2.22 Where applicable, a narrative to the report that explains the issue(s) and corrective action(s) taken in the event that a specific accreditation or certification requirement was not met.

25.2.23 When soil samples are analyzed, a specific identification as to whether soils are reported on a “wet weight” or “dry weight” basis.

25.2.24 Appropriate laboratory certification number for the state of origin of the sample, if applicable.

25.2.25 If only part of the report is provided to the client (client requests some results before all of it is complete), it must be clearly indicated on the report (e.g., preliminary report). A complete report must be sent once all of the work has been completed.

25.2.26 Any non-TestAmerica subcontracted analysis results are provided as a separate report on the official letterhead of the subcontractor. All TestAmerica subcontracting is clearly identified on the report as to which laboratory performed a specific analysis.

25.2.27 A clear statement notifying the client that non-accredited tests were performed and directing the client to the laboratory’s accreditation certificates of approval shall be provided when non-accredited tests are included in the report.

25.2.28 A Certification Summary Report, where required, will document that, unless otherwise noted, all analytes tested and reported by the laboratory were covered by the noted certifications.

Note: Refer to the Corporate SOP on Electronic Reporting and Signature Policy (No. CA-I-P-002) for details on internally applying electronic signatures of approval.

25.3 Reporting Level or Report Type

The laboratory offers four levels of quality control reporting. Each level, in addition to its own specific requirements, contains all the information provided in the preceding level. The packages provide the following information in addition to the information described above:

- Level II is a report with the features described in Section 25.2 above, plus summary information, including results for the method blank reported to the laboratory MDL if required, percent recovery for laboratory control samples and matrix spike samples, and the RPD values for all MSD and sample duplicate analyses.
- Level III contains all the information supplied in Level II, but presented on the CLP-like summary forms, and relevant calibration information. No raw data is provided unless it is necessary to provide the relevant calibration information.
- Level IV is the same as Level III with the addition of all raw supporting data.

In addition to the various levels of QC packaging, the laboratory also provides reports in electronic deliverable form via e-mail, posting to an FTP site, or CD ROM. Initial reports may be provided to clients by facsimile. All faxed reports are followed by hardcopy. Procedures used to ensure client confidentiality are outlined in Section 25.6.

25.3.1 Electronic Data Deliverables (EDDs)

EDDs are routinely offered as part of TestAmerica's services in addition to the test report as described in section 25.2. When NELAP accreditation is required and both a test report and EDD are provided to the client, the official version of the test report will be the combined information of the report and the EDD. TestAmerica Sacramento offers a variety of EDD formats including Environmental Restoration Information Management System (ERPIMS), New Agency Standard (NAS), Format A, Excel, Dbase, GISKEY, and Text Files.

EDD specifications are submitted to the IT department by the PM for review and undergo the contract review process. Once the facility has committed to providing data in a specific electronic format, the coding of the format may need to be performed. This coding is documented and validated. The validation of the code is retained by the IT staff coding the EDD, and a copy filed on the QA share of the local server.

EDDs shall be subject to a review to ensure their accuracy and completeness. If EDD generation is automated, review may be reduced to periodic screening if the laboratory can demonstrate that it can routinely generate that EDD without errors. Any revisions to the EDD format must be reviewed until it is demonstrated that it can routinely be generated without errors. If the EDD can be reproduced accurately and if all subsequent EDDs can be produced error-free, each EDD does not necessarily require a review.

25.4 Supplemental Information for Test

The lab identifies any unacceptable QC analyses or any other unusual circumstances or observations such as environmental conditions and any non-standard conditions that may have affected the quality of a result. This is typically in the form of a footnote or a qualifier and/or a narrative explaining the discrepancy in the front of the report.

Numeric results with values outside of the calibration range, either high or low are qualified as 'estimated'.

Where quality system requirements are not met, a statement of compliance/non-compliance with requirements and/or specifications is required, including identification of test results derived from any sample that did not meet TNI sample acceptance requirements such as improper container, holding time, or temperature.

Where applicable, a statement on the estimated uncertainty of measurements; information on uncertainty is needed when a client's instructions so require.

Opinions and Interpretations - The test report contains objective information, and generally does not contain subjective information such as opinions and interpretations. If such information is required by the client, the Laboratory Director will determine if a response can be prepared. If so, the Laboratory Director will designate the appropriate member of the management team to prepare a response. The response will be fully documented, and reviewed by the Laboratory Director, before release to the client. There may be additional fees charged to the client at this time, as this is a non-routine function of the laboratory.

Note: Review of data deliverable packages for submittal to regulatory authorities requires responses to non-conforming data concerning potential impact on data quality. This necessitates a limited scope of interpretation, and this work is performed by the QA Department. This is the only form of "interpretation" of data that is routinely performed by the laboratory.

When opinions or interpretations are included in the report, the laboratory provides an explanation as to the basis upon which the opinions and interpretations have been made. Opinions and interpretations are clearly noted as such and where applicable, a comment should be added suggesting that the client verify the opinion or interpretation with their regulator.

25.5 Environmental Testing Obtained From Subcontractors

If the laboratory is not able to provide the client the requested analysis, the samples would be subcontracted following the procedures outlined in the Corporate SOP on Subcontracting (SOP No. CW-L-S-004).

Data reported from analyses performed by a subcontractor laboratory are clearly identified as such on the analytical report provided to the client. Results from a subcontract laboratory outside of TestAmerica are reported to the client on the subcontract laboratory's original report stationery and the report includes any accompanying documentation.

25.6 Client Confidentiality

In situations involving the transmission of environmental test results by telephone, facsimile or other electronic means, client confidentiality must be maintained.

TestAmerica will not intentionally divulge to any person (other than the Client or any other person designated by the Client in writing) any information regarding the services provided by TestAmerica or any information disclosed to TestAmerica by the Client. Furthermore, information known to be potentially endangering to national security or an entity's proprietary rights will not be released.

Note: This shall not apply to the extent that the information is required to be disclosed by TestAmerica under the compulsion of legal process. TestAmerica will, to the extent feasible, provide reasonable notice to the client before disclosing the information.

Note: Authorized representatives of an accrediting authority are permitted to make copies of any analyses or records relevant to the accreditation process, and copies may be removed from the laboratory for purposes of assessment.

25.6.1 Report deliverable formats are discussed with each new client. If a client requests that reports be faxed or e-mailed, the reports are to meet all requirements of this document and to include a cover letter.

25.7 Format of Reports

The format of reports is designed to accommodate each type of environmental test carried out and to minimize the possibility of misunderstanding or misuse.

25.8 Amendments to Test Reports

Corrections, additions, or deletions to reports are only made when justification arises through supplemental documentation. Justification is documented using the laboratory's corrective action system (refer to Section 12).

The revised report is retained on the Archive data server, as is the original report. The revised report is stored in the Archive data server under the sample number followed by "R". Every page will have the report generation date present, to prevent confusion between report versions.

When the report is re-issued, a notation of "Revision "with the revision number is placed on the cover/signature page of the report. The case narrative is updated *with* a brief explanation of reason for the re-issue and a reference back to the last final report generated. *For Example*: *Report was revised on 11/3/11 to include toluene in sample NQA1504 per client's request. This final report replaces the final report generated on 10/27/11.*

25.9 Policies on Client Requests for Amendments

25.9.1 Policy on Data Omissions or Reporting Limit Increases

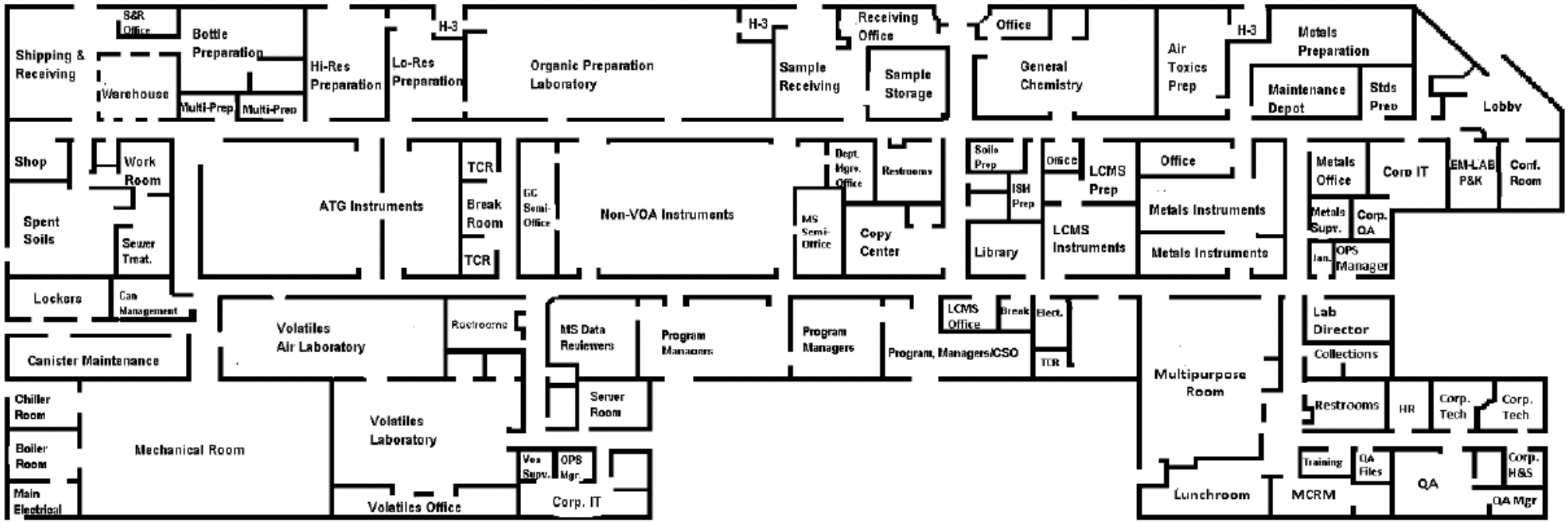
Fundamentally, our policy is simply to not omit previously reported results (including data qualifiers) or to not raise reporting limits and report sample results as ND. This policy has few exceptions. Exceptions are:

- Laboratory error.
- Sample identification is indeterminate (confusion between COC and sample labels).
- An incorrect analysis (not analyte) was requested (e.g., COC lists 8315 but client wanted 8310). A written request for the change is required.
- Incorrect limits reported based on regulatory requirements.
- The requested change has absolutely *no possible* impact on the interpretation of the analytical results and there is *no possibility* of the change being interpreted as misrepresentation by anyone inside or outside of our company.

25.9.2 Multiple Reports

TestAmerica does not issue multiple reports for the same work order where there is different information on each report (this does not refer to copies of the same report) unless required to meet regulatory needs and approved by QA.

Appendix 1. Laboratory Floor Plan



Facility Size	Square Feet
Total Area	66.000
Lab Area	44,725
Storage Area	5200
	Linear Feet
Bench Top	3036
Hoods	464

Appendix 2. Glossary/Acronyms (EL-V1M2 Sec. 3.1)

Glossary:

Acceptance Criteria: Specified limits placed on characteristics of an item, process, or service defined in requirement documents. (ASQC)

Accreditation: The process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications or standards, thereby accrediting the laboratory.

Accuracy: The degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator. (QAMS)

Air Sample Bag: A sampling container for air samples, commonly referred to as Flex-Film or Tedlar bag, in 1.0-L or 3.0-L volumes, that is constructed of proprietary material (E.G., SKC or ESS).

Analyst: The designated individual who performs the "hands-on" analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality.

Analytical Uncertainty: A subset of Measurement Uncertainty that includes all laboratory activities performed as part of the analysis. (TNI)

Anomaly: A condition or event, other than a deficiency, that may affect the quality of the data, whether in the laboratory's control or not.

Assessment: The evaluation process used to measure or establish the performance, effectiveness, and conformance of an organization and/or its systems to defined criteria (to the standards and requirements of laboratory accreditation). (TNI)

Audit: A systematic and independent examination of facilities, equipment, personnel, training, procedures, record-keeping, data validation, data management, and reporting aspects of a system to determine whether QA/QC and technical activities are being conducted as planned and whether these activities will effectively achieve quality objectives. (TNI)

Batch: Environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A **preparation batch** is composed of one (1) to twenty (20) environmental samples of the same quality systems matrix, meeting the above mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be twenty-four (24) hours. An **analytical batch** is composed of prepared environmental samples (extracts, digestates or concentrates) which are analyzed together as a group. An analytical batch can include prepared samples originating from various quality system matrices and can exceed twenty (20) samples. (TNI)

Bias: The systematic or persistent distortion of a measurement process, which causes errors in one direction (i.e., the expected sample measurement is different from the sample's true value). (TNI)

Blank: A sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results. (ASQC)

Calibration: A set of operations that establish, under specified conditions, the relationship between values of quantities indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material, and the corresponding values realized by standards. (TNI)

1) In calibration of support equipment the values realized by standards are established through the use of reference standards that are traceable to the International System of Units (SI).

2) In calibration according to methods, the values realized by standards are typically established through the use of Reference Materials that are either purchased by the laboratory with a certificate of analysis or purity, or prepared by the laboratory using support equipment that has been calibrated or verified to meet specifications.

Calibration Curve: The mathematical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response. (TNI)

Calibration Standard: A substance or reference material used to calibrate an instrument (QAMS)

Certified Reference Material (CRM): A reference material accompanied by certificate, having a value, measurement uncertainty, and stated metrological traceability chain to a national metrology institute. (TNI)

Chain of Custody (COC) Form: Record that documents the possession of the samples from the time of collection to receipt in the laboratory. This record generally includes: the number and types of containers; the mode of collection; the collector; time of collection; preservation; and requested analyses. (TNI)

Compromised Samples: Those samples which are improperly sampled, insufficiently documented (chain of custody and other sample records and/or labels), improperly preserved, collected in improper containers, or exceeding holding times when delivered to a laboratory. Under normal conditions, compromised samples are not analyzed. If emergency situation require analysis, the results must be appropriately qualified.

Confidential Business Information (CBI): Information that an organization designates as having the potential of providing a competitor with inappropriate insight into its management, operation or products. TNI and its representatives agree to safeguarding identified CBI and to maintain all information identified as such in full confidentiality.

Confirmation: Verification of the identity of a component through the use of an approach with a different scientific principle from the original method. These may include, but are not limited to Second Column Confirmation; Alternate wavelength; Derivatization; Mass spectral interpretation; Alternative detectors or Additional Cleanup procedures. (TNI)

Conformance: An affirmative indication or judgment that a product or service has met the requirements of the relevant specifications, contract, or regulation; also the state of meeting the requirements. (ANSI/ASQC E4-1994)

Correction: Actions necessary to correct or repair analysis specific non-conformances. The acceptance criteria for method specific QC and protocols as well as the associated corrective actions. The analyst will most frequently be the one to identify the need for this action as a result of calibration checks and QC sample analysis. No significant action is taken to change behavior, process or procedure.

Corrective Action: The action taken to eliminate the causes of an existing nonconformity, defect or other undesirable situation in order to prevent recurrence. (ISO 8402)

Data Audit: A qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data re of acceptable quality (i.e., that they meet specified acceptance criteria).

Data Reduction: The process of transforming the number of data items by arithmetic or statistical calculations, standard curves, and concentration factors, and collation into a more useable form. (TNI)

Deficiency: An unauthorized deviation from acceptable procedures or practices, or a defect in an item. (ASQC), whether in the laboratory's control or not.

Demonstration of Capability: A procedure to establish the ability of the analyst to generate analytical results of acceptable accuracy and precision. (TNI)

Document Control: The act of ensuring that documents (and revisions thereto) are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly, and controlled to ensure use of the correct version at the location where the prescribed activity if performed. (ASQC)

Duplicate Analyses: The analyses or measurements of the variable of interest performed identically on two subsamples of the same sample. The results from duplicate analyses are used to evaluate analytical or measurement precision but not the precision of sampling, preservation or storage internal to the laboratory. (EPA-QAD)

Equipment Blank: Sample of analyte-free media which has been used to rinse common sampling equipment to check effectiveness of decontamination procedures.

External Standard Calibration: Calibrations for methods that do not utilize internal standards to compensate for changes in instrument conditions.

Field Blank: Blank prepared in the field by filing a clean container with pure de-ionized water and appropriate preservative, if any, for the specific sampling activity being undertaken (EPA OSWER)

Field of Accreditation: Those matrix, technology/method, and analyte combinations for which the accreditation body offers accreditation.

Holding Times: The maximum time that samples may be held prior to analyses and still be considered valid or not compromised. (40 CFR Part 136)

Internal Standard: A known amount of standard added to a test portion of a sample as a reference for evaluating and controlling the precision and bias of the applied analytical test method. (TNI)

Internal Standard Calibration: Calibrations for methods that utilize internal standards to compensate for changes in instrument conditions.

Instrument Blank: A clean sample (e.g., distilled water) processed through the instrumental steps of the measurement process; used to determine instrument contamination. (EPA-QAD)

Instrument Detection Limit (IDL): The minimum amount of a substance that can be measured with a specified degree of confidence that the amount is greater than zero using a specific instrument. The IDL is associated with the instrumental portion of a specific method only, and sample preparation steps are not considered in its derivation. The IDL is a statistical estimation at a specified confidence interval of the concentration at which the relative uncertainty is ± 100%. The IDL represents a <u>range</u> where <u>qualitative</u> detection occurs on a specific instrument. Quantitative results are not produced in this range.

Laboratory Control Sample (however named, such as laboratory fortified blank, spiked blank, or QC check sample): A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes, taken through all preparation and analysis steps of the procedure unless otherwise noted in a reference method. It is generally used to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system.

An LCS shall be prepared at a minimum of 1 per batch of 20 or less samples per matrix type per sample extraction or preparation method except for analytes for which spiking solutions are not available such as total suspended solids, total dissolved solids, total volatile solids, total solids, pH, color, odor, temperature, dissolved oxygen or turbidity. The results of these samples shall be used to determine batch acceptance.

Least Squares Regression (1st Order Curve): The least squares regression is a mathematical calculation of a straight line over two axes. The y axis represents the instrument response (or Response ratio) of a standard or sample and the x axis represents the concentration. The regression calculation will generate a correlation coefficient (r) that is a measure of the "goodness of fit" of the regression line to the data. A value of 1.00 indicates a perfect fit. In order to be used for quantitative purposes, r must be greater than or equal to 0.99 for organics and 0.995 for inorganics.

Limit(s) of Detection (LOD) [a.k.a., Method Detection Limit (MDL)]: A laboratory's estimate of the minimum amount of an analyte in a given matrix that an analytical process can reliably detect in their facility. (TNI)

LOD Verification [a.k.a., MDL Verification]: A processed QC sample in the matrix of interest, spiked with the analyte at no more than 3X the LOD for single analyte tests and 4X the LOD for multiple analyte tests and processed through the entire analytical procedure.

Limit(s) of Quantitation (LOQ) [a.k.a., Reporting Limit]: The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. (TNI)

Matrix Spike (spiked sample or fortified sample): A sample prepared, taken through all sample preparation and analytical steps of the procedure unless otherwise noted in a referenced method, by adding a known amount of target analyte to a specified amount of sample for which an independent test result of target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency.

Matrix Spike Duplicate (spiked sample or fortified sample duplicate): A replicate matrix spike prepared and analyzed to obtain a measure of the precision of the recovery for each analyte.

Method Blank: A sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses.

Method Detection Limit: The minimum concentration of a substance (an analyte) that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. (40 CFR Part 136, Appendix B)

Negative Control: Measures taken to ensure that a test, its components, or the environment do not cause undesired effects, or produce incorrect test results.

Non-conformance: An indication, judgment, or state of not having met the requirements of the relevant specifications, contract, or regulation.

Observation: A record of phenomena that (1) may assist in evaluation of the sample data; (2) may be of importance to the project manager and/or the client, and yet not at the time of the observation have any known effect on quality.

Passivated Canister: A sampling container for air samples; commonly referred to as a SUMMA canister, SilcoCan or T.O.-Can in 1.0, 1.8 6, or 15 L volumes.

1) SUMMA canister: A spherical stainless steel canister, of which the interior has been specially treated by a process (SUMMA passivation) that renders all surfaces inert to VOCs.

2) SilcoCan: A sampling canister manufactured by Restek Corporation using the Restek Silcosteel® process to coat the interior of the canister with fused silica, rendering it inactive to most VOCs.

3) T.O.-Can: A spherical stainless steel container (which is the equivalent of a SUMMA canister) that is manufactured by Restek using a proprietary electropolishing process and is extensively cleaned using an ultrasonic method that ensures a high-quality passivated surface that maintains the stability of VOCs during storage.

Performance Audit: The routine comparison of independently obtained qualitative and quantitative measurement system data with routinely obtained data in order to evaluate the proficiency of an analyst or laboratory.

Positive Control: Measures taken to ensure that a test and/or its components are working properly and producing correct or expected results from positive test subjects.

Precision: The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms. (TNI)

Preservation: Any conditions under which a sample must be kept in order to maintain chemical and/or biological integrity prior to analysis. (TNI)

Proficiency Testing: A means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source. (TNI)

Proficiency Testing Program: The aggregate of providing rigorously controlled and standardized environmental samples to a laboratory for analysis, reporting of results, statistical evaluation of the results and the collective demographics and results summary of all participating laboratories. (TNI)

Proficiency Test Sample (PT): A sample, the composition of which is unknown to the laboratory and is provided to test whether the laboratory can produce analytical results within specified acceptance criteria. (TNI)

Quality Assurance: An integrated system of management activities involving planning, implementation, assessment, reporting and quality improvement to ensure that a process, item, or service is of the type of quality needed and expected by the client. (TNI)

Quality Assurance [Project] Plan (QAPP): A formal document describing the detailed quality control procedures by which the quality requirements defined for the data and decisions pertaining to a specific project are to be achieved. (EAP-QAD)

Quality Control: The overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the customer; operational techniques and activities that are used to fulfill requirements for quality; also the system of activities and checks used to ensure that measurement systems are maintained within prescribed limits, providing protection against "out of control" conditions and ensuring that the results are of acceptable quality. (TNI)

Quality Control Sample: A sample used to assess the performance of all or a portion of the measurement system. One of any number of samples, such as Certified Reference Materials, a quality system matrix fortified by spiking, or actual samples fortified by spiking, intended to demonstrate that a measurement system or activity is in control. (TNI)

Quality Manual: A document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users. (TNI)

Quality System: A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA and QC activities. (TNI)

Quality System Matrix: The component or substrate that contains the analyte of interest. For purposes of batch and QC requirement determinations, the following matrix distinctions shall be used:

Aqueous: Any aqueous sample excluded from the definition of Drinking Water or Saline/Estuarine. Includes surface water, groundwater, effluents, and TCLP or other extracts.

Drinking Water: Any aqueous sample that has been designated as a potable or potential potable water source.

Saline/Estuarine: Any aqueous sample from an ocean or estuary, or other salt water source such as the Great Salt Lake.

Non-Aqueous Liquid: Any organic liquid with <15% settleable solids.

Biological Tissue: Any sample of a biological origin such as fish tissue, shellfish, or plant material. Such samples shall be grouped according to origin.

Solids: Includes soils, sediments, sludges, and other matrices with >15% settleable solids.

Chemical Waste: A product or by-product of an industrial process that results in a matrix not previously defined.

Air & Emissions: Whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas or vapor that are collected with a sorbant tube, impinger solution, filter, or other device. (TNI)

Raw Data: The documentation generated during sampling and analysis. This documentation includes, but is not limited to, field notes, electronic data, magnetic tapes, untabulated sample results, QC sample results, print outs of chromatograms, instrument outputs, and handwritten records. (TNI)

Record Retention: The systematic collection, indexing and storing of documented information under secure conditions.

Reference Material: Material or substance one or more properties of which are sufficiently homogeneous and well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials. (TNI)

Reference Standard: Standard used for the calibration of working measurement standards in a given organization or a given location. (TNI)

Sampling: Activity related to obtaining a representative sample of the object of conformity assessment, according to a procedure.

Second Order Polynomial Curve (Quadratic): The 2nd order curves are a mathematical calculation of a slightly curved line over two axis. The y axis represents the instrument response (or Response ratio) of a standard or sample and the x axis represents the concentration. The 2nd order regression will generate a coefficient of determination (COD or r^2) that is a measure of the "goodness of fit" of the quadratic curvature the data. A value of 1.00 indicates a perfect fit. In order to be used for quantitative purposes, r^2 must be greater than or equal to 0.99.

Selectivity: The ability to analyze, distinguish, and determine a specific analyte or parameter from another component that may be a potential interferent or that may behave similarly to the target analyte or parameter within the measurement system. (TNI)

Sensitivity: The capability of a method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest. (TNI)

Spike: A known mass of target analyte added to a blank, sample or sub-sample; used to determine recovery efficiency or for other quality control purposes.

Standard: The document describing the elements of laboratory accreditation that has been developed and established within the consensus principles of standard setting and meets the approval requirements of standard adoption organizations procedures and policies. (TNI)

Standard Operating Procedures (SOPs): A written document which details the method for an operation, analysis, or action, with thoroughly prescribed techniques and steps. SOPs are officially approved as the methods for performing certain routine or repetitive tasks. (TNI)

Storage Blank: A blank matrix stored with field samples of a similar matrix (volatiles only) that measures storage contribution to any source of contamination.

Surrogate: A substance with properties that mimic the analyte of interest. It is unlikely to be found in environment samples and is added to them for quality control purposes.

Surrogate compounds must be added to all samples, standards, and blanks, for all organic chromatography methods except when the matrix precludes its use or when a surrogate is not available. Poor surrogate recovery may indicate a problem with sample composition and shall be reported to the client whose sample produced poor recovery. (QAMS)

Systems Audit (also Technical Systems Audit): A thorough, systematic, qualitative on-site assessment of the facilities, equipment, personnel, training, procedures, record keeping, data validation, data management, and reporting aspects of a total measurement system. (EPA-QAD)

Technical Manager: A member of the staff of an environmental laboratory who exercises actual day-to-day supervision of laboratory operations for the appropriate fields of accreditation and reporting of results

Technology: A specific arrangement of analytical instruments, detection systems, and/or preparation techniques.

Traceability: The ability to trace the history, application, or location of an entity by means of recorded identifications. In a calibration sense, traceability relates measuring equipment to national or international standards, primary standards, basic physical constants or properties, or reference materials. In a data collection sense, it relates calculations and data generated throughout the project back to the requirements for the quality of the project. (TNI)

Trip Blank: A blank matrix placed in a sealed container at the laboratory that is shipped, held unopened in the field, and returned to the laboratory in the shipping container with the field samples.

Uncertainty: A parameter associated with the result of a measurement that characterizes the dispersion of the value that could reasonably be attributed to the measured value.

Acronyms:

A2LA – American Association for Laboratory Accreditation
ANSI – American National Standards Institute
ASQ – American Society for Quality
CAR – Corrective Action Report
CCB – Continuing Calibration Blank
CCV – Continuing Calibration Verification
CF – Calibration Factor
CFR – Code of Federal Regulations
COC – Chain of Custody
DOC – Demonstration of Capability
DQO – Data Quality Objectives
DUP - Duplicate
EHS – Environment, Health and Safety
EPA – Environmental Protection Agency
GC - Gas Chromatography
GC/MS - Gas Chromatography/Mass Spectrometry
HPLC - High Performance Liquid Chromatography
ICB – Initial Calibration Blank
ICP - Inductively Coupled Plasma Atomic Emission Spectroscopy
ICP/MS – ICP/Mass Spectrometry
ICV – Initial Calibration Verification
IDL – Instrument Detection Limit
IH – Industrial Hygiene
IS – Internal Standard
LCS – Laboratory Control Sample
LCSD – Laboratory Control Sample Duplicate
LIMS – Laboratory Information Management System
LOD – Limit of Detection
LOQ – Limit of Quantitation
MDL – Method Detection Limit
MDLCK – MDL Check Standard
MDLV – MDL Verification Check Standard
MRL – Method Reporting Limit Check Standard
MS – Matrix Spike
MSD – Matrix Spike Duplicate
NELAP - National Environmental Laboratory Accreditation Program
PT – Performance Testing
TNI – The NELAC Institute
QAM – Quality Assurance Manual
QA/QC – Quality Assurance / Quality Control
QAPP – Quality Assurance Project Plan
RF – Response Factor
RPD – Relative Percent Difference
RSD – Relative Standard Deviation
SD – Standard Deviation
SDS - Safety Data Sheet
SOP – Standard Operating Procedure
TAT – Turn-Around-Time
TALS – TestAmerica LIMS system
VOA – Volatiles
VOC – Volatile Organic Compound

Appendix 3. Laboratory Certifications, Accreditations, Validations

TestAmerica Sacramento maintains accreditations, certifications, and approvals with numerous state and national entities. Programs vary but may include on-site audits, reciprocal agreements with another entity, performance testing evaluations, review of the QA Manual, Standard Operating Procedures, Method Detection Limits, training records, etc. At the time of this QA Manual revision, the laboratory has accreditation/certification/licensing with the following organizations:

The certificates and accredited parameter lists are available, for each State/Program organization at www.testamericainc.com under Analytical Services Search – Certifications.

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TestAmerica Certifications

Laboratory	Program	Authority	Identification	Expiration Date
TestAmerica Sacramento	DoD ELAP	L-A-B	L2468	01/20/2018
TestAmerica Sacramento	Federal	US Fish & Wildlife	LE148388-0	10/31/2017
TestAmerica Sacramento	Federal	USDA	P330-11-00436	12/30/2017
TestAmerica Sacramento	Federal	USEPA UCMR	CA00044	11/06/2018
TestAmerica Sacramento	NELAP	Florida	E87570	06/30/2017
TestAmerica Sacramento	NELAP	Illinois	200060	03/17/2018
TestAmerica Sacramento	NELAP	Kansas	E-10375	10/31/2017
TestAmerica Sacramento	NELAP	Louisiana	30612	06/30/2017
TestAmerica Sacramento	NELAP	New Hampshire	2997	04/18/2018
TestAmerica Sacramento	NELAP	New Jersey	CA005	06/30/2017
TestAmerica Sacramento	NELAP	New York	11666	04/01/2018
TestAmerica Sacramento	NELAP	Oregon	4040	01/28/2018
TestAmerica Sacramento	NELAP	Pennsylvania	68-01272	03/31/2018
TestAmerica Sacramento	NELAP	Texas	T104704399	07/31/2017
TestAmerica Sacramento	NELAP	Utah	CA00044	02/28/2018
TestAmerica Sacramento	NELAP	Virginia	460278	03/14/2018
TestAmerica Sacramento	State Program	Alaska (UST)	UST-055	12/18/2017
TestAmerica Sacramento	State Program	Arizona	AZ0708	08/11/2017
TestAmerica Sacramento	State Program	Arkansas DEQ	88-0691	06/17/2018
TestAmerica Sacramento	State Program	California	2897	01/31/2018
TestAmerica Sacramento	State Program	Colorado	CA00044	08/31/2017
TestAmerica Sacramento	State Program	Connecticut	PH-0691	06/30/2017
TestAmerica Sacramento	State Program	Hawaii	N/A	01/29/2018
TestAmerica Sacramento	State Program	Maine	CA0004	04/18/2018
TestAmerica Sacramento	State Program	Michigan	9947	01/31/2018
TestAmerica Sacramento	State Program	Nevada	CA00044	07/31/2017
TestAmerica Sacramento	State Program	Washington	C581	05/05/2018
TestAmerica Sacramento	State Program	West Virginia (DW)	9930C	12/31/2017
TestAmerica Sacramento	State Program	Wyoming	8TMS-L	01/29/2017 *

Appendix 4: Listing of Methods Performed

Preparation Only Methods

Method	Aqueous	Solid	Waste	Biological	Air
Organics					
Calif. CAM-WET	X	X	X		
EPA 1311	X	X	X		
EPA 3510C	X				
EPA 3535	X				
EPA 3540B		X			
EPA 3542					X
EPA 3546		X			
EPA 3550B		X		X	
EPA 3580A			X		
EPA 3600C	X	X	X		
EPA 3620B	X	X	X		
EPA 3630C	X	X	X		
EPA 3640A	X	X		X	
EPA 5030B	X	X	X		
EPA 5035	X	X	X		
Inorganics					
Calif. CAM WET	X	X	X		
EPA 1311	X	X	X		
EPA 1312 (E/W)	X	X	X		
EPA 3005A	X				
EPA 3010A	X				
EPA 3050B		X	X	X	

Organics Methods Performed

Parameter	Method	Aqueous	Solid	Waste	Biological	Air
Volatile Organics	SW846 8260B	X	X	X		
	SW846 8260C	X	X	X		
	EPA 624	X				
	TO-14A					X
	TO-15					X
Sulfur Containing Compounds	EPA 15/16					X
Fixed Gases	ASTM D1946					X
	EPA 3C					X
Base Neutrals and Acids (BNAs)	SW846 8270C	X	X	X	X	
	SW846 8270D	X	X	X	X	
	EPA 625	X				
	TO-13A					X
	IP-7					X
	EPA 23					X
Organochlorine Pesticides	SW846 8081A	X	X	X	X	
	SW846 8081B	X	X	X	X	
	EPA 608	X				
	TO-4A					X
	TO-10A					X
PCBs (Aroclors)	EPA 8082	X	X	X	X	
	EPA 8082A	X	X	X	X	
	EPA 608	X				
	TO-4A					X
	TO-10A					X
PCB Congeners	EPA 1668A	X	X	X	X	X
	EPA 1668C	X	X	X	X	X
Petroleum Hydrocarbons	EPA 8015B	X	X	X		
	EPA 8015D	X	X	X		
	CA LUFT	X	X	X		
	AK101	X	X	X		
	Ak102	X	X	X		
	AK103	X	X	X		
	GRO/DRO	X	X	X		
Nitroaromatics and Nitroamines	EPA 8330A	X	X	X		
	EPA 8330B	X	X	X		
	WS-LC-0010	X	X	X		
Nitrosamines	WS-MS-0012	X	X			

Parameter	Method	Aqueous	Solid	Waste	Biological	Air
PAHs	EPA 8270C (SIM Isotope dilution)	X	X	X	X	X
	EPA 8270C (SIM)	X	X	X		
	CARB 429	X	X	X	X	X
	TO-13A					X
1,4-Dioxane	WS-MS-0010	X				
Alkyl Phenols	WS-MS-0013	X	X		X	
Perfluorinated Compounds	WS-LC-0025	X	X	X	X	
	ISO 25101	X				
(including PFOA/PFOS)	EPA 537	X				
Dioxins & Furans	EPA 1613B	X	X			
	EPA 8290	X	X	X	X	
	EPA 8290A	X	X	X	X	
	EPA 8280A	X	X	X	X	
	EPA 8280B	X	X	X	X	
	EPA 0023A					X
	EPA 23					X
	TO-9					X

Metals Methods Performed

Parameter	Methods	Aqueous	Solid	Waste	Biological	Air
Trace Metals	EPA 6010B	X	X	X	X	X
	EPA 6020	X	X	X	X	X
	EPA 0060					X
	EPA 200.7	X				
	EPA 200.8	X				
	EPA 12					X
	CARB 12					X
	EPA 29					X
	CARB 436					X
Hardness	SM 2340B	X				
Mercury	EPA 7470A	X				
	EPA 245.1	X				
	EPA 7471A		X	X	X	X
	EPA 101A					X
	ASTM D6784-02					X
	EPA 0060					X
	EPA 29					X
	CARB 436					X

Inorganics Methods Performed

Parameter	Method	Aqueous	Solid	Waste	Biological	Air
Alkalinity (Carbonate, Bicarbonate, Total)	SM 2320B	X				
Bromide, Chloride, and Fluoride	EPA 300.0	X				
	EPA 9056	X	X			
	EPA 9057					X
	EPA 26A					X
	CARB 421					X
Chromium, Hexavalent	EPA 7196A	X				
	EPA 0061					X
	EPA 306					X
	CARB 426					X
Conductivity	EPA 9050A	X				
	SM 2510 B	X				
Demand, Chemical Oxygen	EPA 410.4	X				
Moisture	ASTM 2216		X			
Nitrate	EPA 353.2	X				
	EPA 300.0	X				
	EPA 9056	X	X			
	CARB 421					X
Nitrate-Nitrite	EPA 353.2	X				
Nitrite	EPA 353.2	X				
	EPA 300.0	X				
	EPA 9056	X	X			
	CARB 421					X
Nitrocellulose	EPA 353.2	X	X			
	WS-WC-0050	X	X			
Orthophosphate	EPA 300.0	X				
	EPA 9056	X	X			
Particulates in Air	EPA 5					X
	40 CFR Part 50					X
Perchlorate	EPA 314.0	X				
	EPA 331.0	X				
	EPA 6850	X	X			
pH	SM 4500 H+ B	X				
	EPA 150.2	X				
	EPA 9040A	X				
	EPA 9041A	X				
	EPA 9045C		X	X		
Solids, Total	SM 2540 B	X				
Solids, Total Dissolved	SM 2540 C	X				

Solids, Total Suspended	SM 2540 D	X				
Sulfate	EPA 300.0	X				
	EPA 9056	X	X			

Appendix 5. Data Qualifiers

Qualifier Organic	Qualifier Inorganic	Footnote
U	U	Analyte analyzed for but was not detected.
J	B	Estimated result. Result is less than RL.
E	I	Estimated result. Result concentration exceeds the calibration range.
B	J	Method blank contamination. The associated method blank contains the target analyte at a reportable level.
P	*	Relative percent difference (RPD) is outside stated control limits.
a	N	Spiked analyte recovery is outside stated control limits.
*		Surrogate recovery is outside stated control limits.
PG		The percent difference between the original and confirmation analyses is greater than 40%.

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TestAmerica Seattle

WA100007

5755 8th Street East

Tacoma, WA 98424

IS GRANTED APPROVAL BY ORELAP UNDER THE 2009 TNI STANDARDS, TO PERFORM ANALYSES ON ENVIRONMENTAL SAMPLES IN MATRICES AS LISTED BELOW :

Air	*Drinking Water*	*Non Potable Water*	*Solids and Chem. Waste*	*Tissue*
	Chemistry	Chemistry	Chemistry	

AND AS RECORDED IN THE LIST OF APPROVED ANALYTES, METHODS, ANALYTICAL TECHNIQUES, AND FIELDS OF TESTING ISSUED CONCURRENTLY WITH THIS CERTIFICATE AND REVISED AS NECESSARY.

ACCREDITED STATUS DEPENDS ON SUCCESSFUL ONGOING PARTICIPATION IN THE PROGRAM AND CONTINUED COMPLIANCE WITH THE STANDARDS.

CUSTOMERS ARE URGED TO VERIFY THE LABORATORY'S CURRENT ACCREDITATION STATUS IN OREGON.

Lizbeth Garcia for

Christopher L. Redman, BA
Oregon State Public Health Laboratory
ORELAP Program Manager
3150 NW. 229th Ave, Suite 100
Hillsboro, OR 97124

EFFECTIVE DATE : 11/6/2017

EXPIRATION DATE : 11/5/2018

Certificate No : WA100007 - 012

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Environmental Laboratory Accreditation Program

ORELAP Fields of Accreditation

ORELAP ID: WA100007

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EPA CODE: WA00050

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MATRIX	Reference	Code	Analyte	Code	Description
Drinking Water					
	EPA 504.1 1.1			10082801	EDB/DBCP/TCP micro-extraction, GC/ECD
		5180	1,2,3-Trichloropropane		
		4570	1,2-Dibromo-3-chloropropane (DBCP)		
		4585	1,2-Dibromoethane (EDB, Ethylene dibromide)		
	EPA 8011			10173009	1,2-Dibromoethane and 1,2-Dibromo-3-chloropropane by Microextraction and GC/ECD
		5180	1,2,3-Trichloropropane		
		4570	1,2-Dibromo-3-chloropropane (DBCP)		
		4585	1,2-Dibromoethane (EDB, Ethylene dibromide)		
Non-Potable Water					
	AK102 DRO-SV			90015228	Determination of Diesel Range Organics Small Volume - Alaska DEC
		9369	Diesel range organics (DRO)		
	EPA 1020A			10117007	Ignitability Setaflash Closed-cup Method
		1780	Ignitability		
	EPA 120.1			10006209	Conductance - Specific @ 25 C
		1610	Conductivity		
	EPA 130.2 1978			10255604	Hardness - Titrimetric, EDTA
		1755	Total hardness as CaCO3		
	EPA 1311			10118806	Toxicity Characteristic Leaching Procedure
		9822	Extraction/Preparation		
	EPA 1312			10119003	Synthetic Precipitation Leaching Procedure
		9822	Extraction/Preparation		
	EPA 150.1			10008409	pH - Electrometric Measurement
		1900	pH		
	EPA 160.1			10009208	Total Dissolved Solids, dried @ 180 C.
		1955	Residue-filterable (TDS)		
	EPA 160.2			10256403	Total Suspended Solids, 0.2um dried @105C
		1960	Residue-nonfilterable (TSS)		
	EPA 160.3			10010001	Total Solids, dried @ 103-105 C.
		1950	Residue-total		
	EPA 160.5			10010603	Settleable solids
		1965	Residue-settleable		

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EPA 1664A (HEM)			10127807	N-Hexane Extractable Material (Oil and Grease) by Extraction and Gravimetry
	1860	Oil & Grease		
	1935	Total recoverable petroleum hydrocarbons (TRPH)		
EPA 180.1 2			10011800	Turbidity - Nephelometric
	2055	Turbidity		
EPA 200.7 4.4			10013806	ICP - metals
	1000	Aluminum		
	1005	Antimony		
	1010	Arsenic		
	1015	Barium		
	1020	Beryllium		
	1025	Boron		
	1030	Cadmium		
	1035	Calcium		
	1550	Calcium hardness as CaCO3		
	1040	Chromium		
	1050	Cobalt		
	1055	Copper		
	1070	Iron		
	1075	Lead		
	1085	Magnesium		
	1090	Manganese		
	1100	Molybdenum		
	1105	Nickel		
	1125	Potassium		
	1140	Selenium		
	1990	Silica as SiO2		
	1145	Silicon		
	1150	Silver		
	1155	Sodium		
	1160	Strontium		
	1165	Thallium		
	1175	Tin		
	1180	Titanium		
	1755	Total hardness as CaCO3		
	1185	Vanadium		
	1190	Zinc		
EPA 200.8 5.4			10014605	Metals by ICP-MS
	1005	Antimony		
	1010	Arsenic		
	1015	Barium		

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EPA 200.8 5.4				
	1020	Beryllium		
	1030	Cadmium		
	1040	Chromium		
	1050	Cobalt		
	1055	Copper		
	1075	Lead		
	1090	Manganese		
	1100	Molybdenum		
	3055	Natural uranium		
	1105	Nickel		
	1140	Selenium		
	1150	Silver		
	1160	Strontium		
	1165	Thallium		
	1180	Titanium		
	1185	Vanadium		
	1190	Zinc		
EPA 245.1 3			10036609	Mercury by Cold Vapor Atomic Absorption
	1095	Mercury		
EPA 300.0 2.1			10053200	Methods for the Determination of Inorganic Substances in Environmental Samples
	1540	Bromide		
	1575	Chloride		
	1730	Fluoride		
	1810	Nitrate as N		
	1820	Nitrate-nitrite		
	1840	Nitrite as N		
	2000	Sulfate		
EPA 3005A			10133207	Acid Digestion of waters for Total Recoverable or Dissolved Metals
	9822	Extraction/Preparation		
EPA 3010A			10133605	Acid Digestion of Aqueous samples and Extracts for Total Metals
	9822	Extraction/Preparation		
EPA 310.1			10054805	Alkalinity as CaCO3
	1505	Alkalinity as CaCO3		
EPA 335.1			10060001	Cyanides, amenable to chlorination
	1510	Amenable cyanide		
EPA 335.4 1.0			10061402	Methods for the Determination of Inorganic Substances in Environmental Samples
	1645	Total cyanide		

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EPA 350.1 2			10063602	Ammonia Nitrogen - Colorimetric, Auto Phenate
	1515	Ammonia as N		
EPA 3510C			10138202	Separatory Funnel Liquid-liquid extraction
	8031	Extraction/Preparation		
	9822	Extraction/Preparation		
EPA 3520C			10139001	Continuous Liquid-liquid extraction
	9822	Extraction/Preparation		
EPA 353.2 2			10067604	Nitrate/Nitrite Nitrogen - Automated, Cadmium
	1810	Nitrate as N		
	1820	Nitrate-nitrite		
	1840	Nitrite as N		
EPA 3610B			10144602	Alumina Cleanup
	8031	Extraction/Preparation		
EPA 3620B			10145809	Florisil Cleanup
	9822	Extraction/Preparation		
EPA 3630C			10146802	Silica gel cleanup
	9822	Extraction/Preparation		
EPA 365.1 2			10070005	Phosphorous - Colorimetric, Automated persulfate
	1870	Orthophosphate as P		
	1910	Phosphorus, total		
EPA 3660B			10148400	Sulfur cleanup
	9822	Extraction/Preparation		
EPA 3665A			10148808	Sulfuric Acid / permanganate Cleanup
	9822	Extraction/Preparation		
EPA 405.1			10075408	Biochemical Oxygen Demand (5 days @ 20 C).
	1530	Biochemical oxygen demand		
	1555	Carbonaceous BOD, CBOD		
EPA 410.2			10076401	Chemical Oxygen Demand - Titrimetric (low-level).
	1565	Chemical oxygen demand		
EPA 415.1			10078407	Organic carbon - Combustion or Oxidation
	2040	Total organic carbon		
EPA 5030B			10153409	Purge and trap for aqueous samples
	9822	Extraction/Preparation		
EPA 504.1 1.1			10082801	EDB/DBCP/TCP micro-extraction, GC/ECD
	5180	1,2,3-Trichloropropane		

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EPA 504.1 1.1	4570	1,2-Dibromo-3-chloropropane (DBCP)		
	4585	1,2-Dibromoethane (EDB, Ethylene dibromide)		
EPA 6010B			10155609	ICP - AES
	1000	Aluminum		
	1005	Antimony		
	1010	Arsenic		
	1015	Barium		
	1020	Beryllium		
	1025	Boron		
	1030	Cadmium		
	1035	Calcium		
	1550	Calcium hardness as CaCO3		
	1040	Chromium		
	1050	Cobalt		
	1055	Copper		
	1070	Iron		
	1075	Lead		
	1085	Magnesium		
	1090	Manganese		
	1100	Molybdenum		
	1105	Nickel		
	1125	Potassium		
	1140	Selenium		
	1990	Silica as SiO2		
	1145	Silicon		
	1150	Silver		
	1155	Sodium		
	1160	Strontium		
	1165	Thallium		
	1175	Tin		
	1180	Titanium		
	1755	Total hardness as CaCO3		
	1185	Vanadium		
	1190	Zinc		
EPA 6010C 3			10155905	Inductively Coupled Plasma - Atomic Emission Spectrometry
	1000	Aluminum		
	1005	Antimony		
	1010	Arsenic		
	1015	Barium		
	1020	Beryllium		
	1025	Boron		
	1030	Cadmium		

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EPA 6010C 3	1035	Calcium	
	1550	Calcium hardness as CaCO3	
	1040	Chromium	
	1050	Cobalt	
	1055	Copper	
	1070	Iron	
	1075	Lead	
	1085	Magnesium	
	1090	Manganese	
	1100	Molybdenum	
	1105	Nickel	
	1125	Potassium	
	1140	Selenium	
	1990	Silica as SiO2	
	1145	Silicon	
	1150	Silver	
	1155	Sodium	
	1160	Strontium	
	1165	Thallium	
	1175	Tin	
	1180	Titanium	
	1755	Total hardness as CaCO3	
	1185	Vanadium	
	1190	Zinc	
EPA 6010D 4			10155916 Metals by ICP - AES
	1000	Aluminum	
	1005	Antimony	
	1010	Arsenic	
	1015	Barium	
	1020	Beryllium	
	1025	Boron	
	1030	Cadmium	
	1035	Calcium	
	1040	Chromium	
	1050	Cobalt	
	1055	Copper	
	1760	Hardness (calc.)	
	1070	Iron	
	1075	Lead	
	1085	Magnesium	
	1090	Manganese	
	1100	Molybdenum	
	1105	Nickel	

Non-Potable Water

EPA 6010D 4				
	1125	Potassium		
	1140	Selenium		
	1990	Silica as SiO2		
	1145	Silicon		
	1150	Silver		
	1155	Sodium		
	1160	Strontium		
	1165	Thallium		
	1175	Tin		
	1180	Titanium		
	1185	Vanadium		
	1190	Zinc		
EPA 6020			10156000	Inductively Coupled Plasma-Mass Spectrometry
	1005	Antimony		
	1010	Arsenic		
	1015	Barium		
	1020	Beryllium		
	1030	Cadmium		
	1040	Chromium		
	1050	Cobalt		
	1055	Copper		
	1075	Lead		
	1090	Manganese		
	1095	Mercury		
	1100	Molybdenum		
	3055	Natural uranium		
	1105	Nickel		
	1140	Selenium		
	1150	Silver		
	1160	Strontium		
	1165	Thallium		
	1180	Titanium		
	3035	Uranium		
	1185	Vanadium		
	1190	Zinc		
EPA 6020A 1			10156419	Inductively Coupled Plasma -Mass Spectrometry
	1005	Antimony		
	1010	Arsenic		
	1015	Barium		
	1020	Beryllium		
	1030	Cadmium		
	1040	Chromium		

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EPA 6020A 1				
	1050	Cobalt		
	1055	Copper		
	1075	Lead		
	1090	Manganese		
	1095	Mercury		
	1100	Molybdenum		
	3055	Natural uranium		
	1105	Nickel		
	1140	Selenium		
	1150	Silver		
	1160	Strontium		
	1165	Thallium		
	1180	Titanium		
	1185	Vanadium		
	1190	Zinc		
EPA 6020B 2014			10156420	Inductively Coupled Plasma-Mass Spectrometry
	1005	Antimony		
	1010	Arsenic		
	1015	Barium		
	1020	Beryllium		
	1030	Cadmium		
	1040	Chromium		
	1050	Cobalt		
	1055	Copper		
	1075	Lead		
	1090	Manganese		
	1095	Mercury		
	1100	Molybdenum		
	1105	Nickel		
	1140	Selenium		
	1150	Silver		
	1160	Strontium		
	1165	Thallium		
	1180	Titanium		
	3035	Uranium		
	1185	Vanadium		
	1190	Zinc		
EPA 608			10103603	Organochlorine Pesticides & PCBs by GC/ECD
	7355	4,4'-DDD		
	7360	4,4'-DDE		
	7365	4,4'-DDT		
	7025	Aldrin		

Non-Potable Water

EPA 608	7110	alpha-BHC (alpha-Hexachlorocyclohexane)	
	7240	alpha-Chlordane	
	8880	Aroclor-1016 (PCB-1016)	
	8885	Aroclor-1221 (PCB-1221)	
	8890	Aroclor-1232 (PCB-1232)	
	8895	Aroclor-1242 (PCB-1242)	
	8900	Aroclor-1248 (PCB-1248)	
	8905	Aroclor-1254 (PCB-1254)	
	8910	Aroclor-1260 (PCB-1260)	
	8912	Aroclor-1262 (PCB-1262)	
	8913	Aroclor-1268 (PCB-1268)	
	7115	beta-BHC (beta-Hexachlorocyclohexane)	
	7250	Chlordane (tech.)	
	7105	delta-BHC	
	7470	Dieldrin	
	7510	Endosulfan I	
	7515	Endosulfan II	
	7520	Endosulfan sulfate	
	7540	Endrin	
	7530	Endrin aldehyde	
	7535	Endrin ketone	
	7120	gamma-BHC (Lindane, gamma-HexachlorocyclohexanE)	
	7245	gamma-Chlordane	
	7685	Heptachlor	
	7690	Heptachlor epoxide	
	7810	Methoxychlor	
	8250	Toxaphene (Chlorinated camphene)	
EPA 624		10107207	Volatile Organic Compounds by purge and trap GC/MS
	5105	1,1,1,2-Tetrachloroethane	
	5160	1,1,1-Trichloroethane	
	5110	1,1,2,2-Tetrachloroethane	
	5195	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	
	5165	1,1,2-Trichloroethane	
	4630	1,1-Dichloroethane	
	4640	1,1-Dichloroethylene	
	4670	1,1-Dichloropropene	
	5150	1,2,3-Trichlorobenzene	
	5180	1,2,3-Trichloropropane	
	5155	1,2,4-Trichlorobenzene	
	5210	1,2,4-Trimethylbenzene	

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EPA 624	4570	1,2-Dibromo-3-chloropropane (DBCP)
	4585	1,2-Dibromoethane (EDB, Ethylene dibromide)
	4610	1,2-Dichlorobenzene
	4635	1,2-Dichloroethane (Ethylene dichloride)
	4655	1,2-Dichloropropane
	5215	1,3,5-Trimethylbenzene
	4615	1,3-Dichlorobenzene
	4660	1,3-Dichloropropane
	4675	1,3-Dichloropropene
	4620	1,4-Dichlorobenzene
	4665	2,2-Dichloropropane
	4410	2-Butanone (Methyl ethyl ketone, MEK)
	4500	2-Chloroethyl vinyl ether
	4535	2-Chlorotoluene
	4860	2-Hexanone (MBK)
	4540	4-Chlorotoluene
	4910	4-Isopropyltoluene (p-Cymene)
	4995	4-Methyl-2-pentanone (MIBK)
	4315	Acetone
	4320	Acetonitrile
	4325	Acrolein (Propenal)
	4340	Acrylonitrile
	4375	Benzene
	4385	Bromobenzene
	4390	Bromochloromethane
	4395	Bromodichloromethane
	4400	Bromoform
	4450	Carbon disulfide
	4455	Carbon tetrachloride
	4475	Chlorobenzene
	4575	Chlorodibromomethane
	4485	Chloroethane (Ethyl chloride)
	4505	Chloroform
	4645	cis-1,2-Dichloroethylene
	4680	cis-1,3-Dichloropropene
	4600	cis-1,4-Dichloro-2-butene
	4595	Dibromomethane (Methylene bromide)
	4625	Dichlorodifluoromethane (Freon-12)
	9375	Di-isopropylether (DIPE)
	4765	Ethylbenzene
	4770	Ethyl-t-butylether (ETBE) (2-Ethoxy-2-methylpropane)
	4835	Hexachlorobutadiene

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EPA 624	4840	Hexachloroethane	
	4870	Iodomethane (Methyl iodide)	
	4875	Isobutyl alcohol (2-Methyl-1-propanol)	
	4900	Isopropylbenzene (Cumene)	
	5240	m+p-xylene	
	4925	Methacrylonitrile	
	4940	Methyl acetate	
	4950	Methyl bromide (Bromomethane)	
	4960	Methyl chloride (Chloromethane)	
	5000	Methyl tert-butyl ether (MTBE)	
	4965	Methylcyclohexane	
	4975	Methylene chloride (Dichloromethane)	
	5005	Naphthalene	
	4425	n-Butyl alcohol (1-Butanol, n-Butanol)	
	4435	n-Butylbenzene	
	5090	n-Propylbenzene	
	5250	o-Xylene	
	4440	sec-Butylbenzene	
	5100	Styrene	
	4445	tert-Butylbenzene	
	5115	Tetrachloroethylene (Perchloroethylene)	
	5120	Tetrahydrofuran (THF)	
	5140	Toluene	
	4700	trans-1,2-Dichloroethylene	
	4685	trans-1,3-Dichloropropylene	
	4605	trans-1,4-Dichloro-2-butene	
	5170	Trichloroethene (Trichloroethylene)	
	5175	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	
	5225	Vinyl acetate	
	5235	Vinyl chloride	
	5260	Xylene (total)	
EPA 625		10300002	Base/Neutrals and Acids by GC/MS
	5155	1,2,4-Trichlorobenzene	
	4610	1,2-Dichlorobenzene	
	4615	1,3-Dichlorobenzene	
	4620	1,4-Dichlorobenzene	
	6380	1-Methylnaphthalene	
	4659	2,2-Oxybis(1-chloropropane)	
	6735	2,3,4,6-Tetrachlorophenol	
	6738	2,3,4-Trichlorophenol	
	6740	2,3,5,6-Tetrachlorophenol	
	6742	2,3,5-Trichlorophenol	

Non-Potable Water

EPA 625	6830	2,3,6-Trichlorophenol (4C)
	6835	2,4,5-Trichlorophenol
	6840	2,4,6-Trichlorophenol
	6000	2,4-Dichlorophenol
	6130	2,4-Dimethylphenol
	6175	2,4-Dinitrophenol
	6185	2,4-Dinitrotoluene (2,4-DNT)
	6190	2,6-Dinitrotoluene (2,6-DNT)
	5795	2-Chloronaphthalene
	5800	2-Chlorophenol
	6360	2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)
	6385	2-Methylnaphthalene
	6400	2-Methylphenol (o-Cresol)
	6460	2-Nitroaniline
	6490	2-Nitrophenol
	6412	3 & 4 Methylphenol
	5945	3,3'-Dichlorobenzidine
	6818	3,4,5-Trichlorophenol
	6465	3-Nitroaniline
	5660	4-Bromophenyl phenyl ether (BDE-3)
	5700	4-Chloro-3-methylphenol
	5745	4-Chloroaniline
	5825	4-Chlorophenyl phenylether
	6470	4-Nitroaniline
	6500	4-Nitrophenol
	5500	Acenaphthene
	5505	Acenaphthylene
	5510	Acetophenone
	5545	Aniline
	5555	Anthracene
	5595	Benzidine
	5575	Benzo(a)anthracene
	5580	Benzo(a)pyrene
	5590	Benzo(g,h,i)perylene
	5600	Benzo(k)fluoranthene
	5585	Benzo[b]fluoranthene
	5610	Benzoic acid
	5630	Benzyl alcohol
	5760	bis(2-Chloroethoxy)methane
	5765	bis(2-Chloroethyl) ether
	5670	Butyl benzyl phthalate
	5680	Carbazole
	5855	Chrysene

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EPA 625	6065	Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate, DEHP)		
	5895	Dibenz(a,h) anthracene		
	5905	Dibenzofuran		
	6070	Diethyl phthalate		
	6135	Dimethyl phthalate		
	5925	Di-n-butyl phthalate		
	6200	Di-n-octyl phthalate		
	6265	Fluoranthene		
	6270	Fluorene		
	6275	Hexachlorobenzene		
	4835	Hexachlorobutadiene		
	6285	Hexachlorocyclopentadiene		
	4840	Hexachloroethane		
	6315	Indeno(1,2,3-cd) pyrene		
	6320	Isophorone		
	5005	Naphthalene		
	5875	n-Decane		
	5015	Nitrobenzene		
	6530	n-Nitrosodimethylamine		
	6545	n-Nitrosodi-n-propylamine		
	6535	n-Nitrosodiphenylamine		
	6580	n-Octadecane		
	6605	Pentachlorophenol		
	6615	Phenanthrene		
	6625	Phenol		
	6665	Pyrene		
	5095	Pyridine		
EPA 7196A			10162400	Chromium Hexavalent colorimetric
	1045	Chromium VI		
EPA 7470A			10165807	Mercury in Liquid Waste by Cold Vapor Atomic Absorption
	1095	Mercury		
EPA 7471A			10166208	Mercury in Solid Waste by Cold Vapor Atomic Absorption
	1095	Mercury		
EPA 8000B			10172200	Determinative Chromatographic Separations
	9822	Extraction/Preparation		
EPA 8000C			10305201	Determinative Chromatographic Separations
	8031	Extraction/Preparation		

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EPA 8011			10173009	1,2-Dibromoethane and 1,2-Dibromo-3-chloropropane by Microextraction and GC/ECD
	5180	1,2,3-Trichloropropane		
	4570	1,2-Dibromo-3-chloropropane (DBCP)		
	4585	1,2-Dibromoethane (EDB, Ethylene dibromide)		
	4580	Dibromochloropropane		
EPA 8015B			10173601	Non-halogenated organics using GC/FID
	9369	Diesel range organics (DRO)		
	9408	Gasoline range organics (GRO)		
	9499	Motor Oil		
EPA 8081A			10178606	Organochlorine Pesticides by GC/ECD
	7355	4,4'-DDD		
	7360	4,4'-DDE		
	7365	4,4'-DDT		
	7025	Aldrin		
	7110	alpha-BHC (alpha-Hexachlorocyclohexane)		
	7240	alpha-Chlordane		
	7115	beta-BHC (beta-Hexachlorocyclohexane)		
	7250	Chlordane (tech.)		
	7105	delta-BHC		
	7470	Dieldrin		
	7510	Endosulfan I		
	7515	Endosulfan II		
	7520	Endosulfan sulfate		
	7540	Endrin		
	7530	Endrin aldehyde		
	7535	Endrin ketone		
	7120	gamma-BHC (Lindane, gamma-HexachlorocyclohexanE)		
	7245	gamma-Chlordane		
	7685	Heptachlor		
	7690	Heptachlor epoxide		
	6275	Hexachlorobenzene		
	4835	Hexachlorobutadiene		
	7810	Methoxychlor		
	8250	Toxaphene (Chlorinated camphene)		
EPA 8081B			10178800	Organochlorine Pesticides by GC/ECD
	7355	4,4'-DDD		
	7360	4,4'-DDE		
	7365	4,4'-DDT		

Non-Potable Water

EPA 8081B	7025	Aldrin		
	7110	alpha-BHC (alpha-Hexachlorocyclohexane)		
	7240	alpha-Chlordane		
	7115	beta-BHC (beta-Hexachlorocyclohexane)		
	7250	Chlordane (tech.)		
	7105	delta-BHC		
	7470	Dieldrin		
	7510	Endosulfan I		
	7515	Endosulfan II		
	7520	Endosulfan sulfate		
	7540	Endrin		
	7530	Endrin aldehyde		
	7535	Endrin ketone		
	7120	gamma-BHC (Lindane, gamma-HexachlorocyclohexanE)		
	7245	gamma-Chlordane		
	7685	Heptachlor		
	7690	Heptachlor epoxide		
	6275	Hexachlorobenzene		
	4835	Hexachlorobutadiene		
	7810	Methoxychlor		
	8250	Toxaphene (Chlorinated camphene)		
EPA 8082			10179007	Polychlorinated Biphenyls (PCBs) by GC/ECD
	8880	Aroclor-1016 (PCB-1016)		
	8885	Aroclor-1221 (PCB-1221)		
	8890	Aroclor-1232 (PCB-1232)		
	8895	Aroclor-1242 (PCB-1242)		
	8900	Aroclor-1248 (PCB-1248)		
	8905	Aroclor-1254 (PCB-1254)		
	8910	Aroclor-1260 (PCB-1260)		
	8912	Aroclor-1262 (PCB-1262)		
	8913	Aroclor-1268 (PCB-1268)		
EPA 8082A			10179201	Polychlorinated Biphenyls (PCBs) by GC/ECD
	8880	Aroclor-1016 (PCB-1016)		
	8885	Aroclor-1221 (PCB-1221)		
	8890	Aroclor-1232 (PCB-1232)		
	8895	Aroclor-1242 (PCB-1242)		
	8900	Aroclor-1248 (PCB-1248)		
	8905	Aroclor-1254 (PCB-1254)		
	8910	Aroclor-1260 (PCB-1260)		
	8912	Aroclor-1262 (PCB-1262)		

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EPA 8082A	8913	Aroclor-1268 (PCB-1268)		
EPA 8151A (GC/MS)			10183230	Chlorinated Herbicides by GC/MS Using Methylation or Pentafluorobenzylation Derivitization
	8655	2,4,5-T		
	8545	2,4-D		
	8560	2,4-DB		
	6500	4-Nitrophenol		
	8555	Dalapon		
	8595	Dicamba		
	8605	Dichloroprop (Dichlorprop)		
	8620	Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)		
	7775	MCPA		
	7780	MCPP		
	6605	Pentachlorophenol		
	8650	Silvex (2,4,5-TP)		
EPA 8260B			10184802	Volatile Organic Compounds by purge and trap GC/MS
	5105	1,1,1,2-Tetrachloroethane		
	5160	1,1,1-Trichloroethane		
	5110	1,1,2,2-Tetrachloroethane		
	5195	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)		
	5165	1,1,2-Trichloroethane		
	4630	1,1-Dichloroethane		
	4640	1,1-Dichloroethylene		
	4670	1,1-Dichloropropene		
	5150	1,2,3-Trichlorobenzene		
	5180	1,2,3-Trichloropropane		
	5182	1,2,3-Trimethylbenzene		
	5155	1,2,4-Trichlorobenzene		
	5210	1,2,4-Trimethylbenzene		
	4570	1,2-Dibromo-3-chloropropane (DBCP)		
	4585	1,2-Dibromoethane (EDB, Ethylene dibromide)		
	4610	1,2-Dichlorobenzene		
	4635	1,2-Dichloroethane (Ethylene dichloride)		
	4655	1,2-Dichloropropane		
	5215	1,3,5-Trimethylbenzene		
	4615	1,3-Dichlorobenzene		
	4660	1,3-Dichloropropane		
	4620	1,4-Dichlorobenzene		
	4665	2,2-Dichloropropane		

Non-Potable Water

EPA 8260B

4410	2-Butanone (Methyl ethyl ketone, MEK)
4500	2-Chloroethyl vinyl ether
4535	2-Chlorotoluene
4860	2-Hexanone (MBK)
4540	4-Chlorotoluene
4910	4-Isopropyltoluene (p-Cymene)
4995	4-Methyl-2-pentanone (MIBK)
4315	Acetone
4320	Acetonitrile
4325	Acrolein (Propenal)
4340	Acrylonitrile
4375	Benzene
4385	Bromobenzene
4390	Bromochloromethane
4395	Bromodichloromethane
4400	Bromoform
4450	Carbon disulfide
4455	Carbon tetrachloride
4475	Chlorobenzene
4575	Chlorodibromomethane
4485	Chloroethane (Ethyl chloride)
4505	Chloroform
4645	cis-1,2-Dichloroethylene
4680	cis-1,3-Dichloropropene
4600	cis-1,4-Dichloro-2-butene
4595	Dibromomethane (Methylene bromide)
4625	Dichlorodifluoromethane (Freon-12)
9375	Di-isopropylether (DIPE)
4765	Ethylbenzene
4770	Ethyl-t-butylether (ETBE) (2-Ethoxy-2-methylpropane)
4835	Hexachlorobutadiene
4870	Iodomethane (Methyl iodide)
4875	Isobutyl alcohol (2-Methyl-1-propanol)
4900	Isopropylbenzene (Cumene)
5240	m+p-xylene
4925	Methacrylonitrile
4940	Methyl acetate
4950	Methyl bromide (Bromomethane)
4960	Methyl chloride (Chloromethane)
5000	Methyl tert-butyl ether (MTBE)
4965	Methylcyclohexane
4975	Methylene chloride (Dichloromethane)
5005	Naphthalene

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EPA 8260B	4425	n-Butyl alcohol (1-Butanol, n-Butanol)		
	4435	n-Butylbenzene		
	5090	n-Propylbenzene		
	5250	o-Xylene		
	4440	sec-Butylbenzene		
	5100	Styrene		
	4370	T-amylmethylether (TAME)		
	4445	tert-Butylbenzene		
	5115	Tetrachloroethylene (Perchloroethylene)		
	5120	Tetrahydrofuran (THF)		
	5140	Toluene		
	4700	trans-1,2-Dichloroethylene		
	4685	trans-1,3-Dichloropropylene		
	4605	trans-1,4-Dichloro-2-butene		
	5170	Trichloroethene (Trichloroethylene)		
	5175	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)		
	5225	Vinyl acetate		
	5235	Vinyl chloride		
	5260	Xylene (total)		
EPA 8260B SIM			10184904	Volatile Organic Compounds by purge and trap GC/MS-SIM
	5105	1,1,1,2-Tetrachloroethane		
	5110	1,1,2,2-Tetrachloroethane		
	5165	1,1,2-Trichloroethane		
	4640	1,1-Dichloroethylene		
	4585	1,2-Dibromoethane (EDB, Ethylene dibromide)		
	4635	1,2-Dichloroethane (Ethylene dichloride)		
	9318	1,3-Butadiene		
	4620	1,4-Dichlorobenzene		
	4860	2-Hexanone (MBK)		
	4375	Benzene		
	4395	Bromodichloromethane		
	4400	Bromoform		
	4575	Chlorodibromomethane		
	4505	Chloroform		
	4645	cis-1,2-Dichloroethylene		
	4680	cis-1,3-Dichloropropene		
	4595	Dibromomethane (Methylene bromide)		
	4835	Hexachlorobutadiene		
	4895	Isopropyl alcohol (2-Propanol, Isopropanol)		
	4950	Methyl bromide (Bromomethane)		
	5005	Naphthalene		

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Non-Potable Water

EPA 8260B SIM	5115	Tetrachloroethylene (Perchloroethylene)		
	4685	trans-1,3-Dichloropropylene		
	5170	Trichloroethene (Trichloroethylene)		
	5235	Vinyl chloride		
EPA 8260C			10307003	Volatile Organics: GC/MS (capillary column)
	5105	1,1,1,2-Tetrachloroethane		
	5160	1,1,1-Trichloroethane		
	5110	1,1,2,2-Tetrachloroethane		
	5195	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)		
	5165	1,1,2-Trichloroethane		
	4630	1,1-Dichloroethane		
	4640	1,1-Dichloroethylene		
	4670	1,1-Dichloropropene		
	5150	1,2,3-Trichlorobenzene		
	5180	1,2,3-Trichloropropane		
	5182	1,2,3-Trimethylbenzene		
	5155	1,2,4-Trichlorobenzene		
	5210	1,2,4-Trimethylbenzene		
	4570	1,2-Dibromo-3-chloropropane (DBCP)		
	4585	1,2-Dibromoethane (EDB, Ethylene dibromide)		
	4610	1,2-Dichlorobenzene		
	4635	1,2-Dichloroethane (Ethylene dichloride)		
	4655	1,2-Dichloropropane		
	5215	1,3,5-Trimethylbenzene		
	4615	1,3-Dichlorobenzene		
	4660	1,3-Dichloropropane		
	4620	1,4-Dichlorobenzene		
	4665	2,2-Dichloropropane		
	4410	2-Butanone (Methyl ethyl ketone, MEK)		
	4500	2-Chloroethyl vinyl ether		
	4535	2-Chlorotoluene		
	4860	2-Hexanone (MBK)		
	4540	4-Chlorotoluene		
	4910	4-Isopropyltoluene (p-Cymene)		
	4995	4-Methyl-2-pentanone (MIBK)		
	4315	Acetone		
	4320	Acetonitrile		
	4325	Acrolein (Propenal)		
	4340	Acrylonitrile		
	4375	Benzene		
	4385	Bromobenzene		

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Non-Potable Water

EPA 8260C	4390	Bromochloromethane
	4395	Bromodichloromethane
	4400	Bromoform
	4450	Carbon disulfide
	4455	Carbon tetrachloride
	4475	Chlorobenzene
	4575	Chlorodibromomethane
	4485	Chloroethane (Ethyl chloride)
	4505	Chloroform
	4645	cis-1,2-Dichloroethylene
	4680	cis-1,3-Dichloropropene
	4600	cis-1,4-Dichloro-2-butene
	4595	Dibromomethane (Methylene bromide)
	4625	Dichlorodifluoromethane (Freon-12)
	9375	Di-isopropylether (DIPE)
	4765	Ethylbenzene
	4770	Ethyl-t-butylether (ETBE) (2-Ethoxy-2-methylpropane)
	4835	Hexachlorobutadiene
	4870	Iodomethane (Methyl iodide)
	4875	Isobutyl alcohol (2-Methyl-1-propanol)
	4900	Isopropylbenzene (Cumene)
	5240	m+p-xylene
	4925	Methacrylonitrile
	4940	Methyl acetate
	4950	Methyl bromide (Bromomethane)
	4960	Methyl chloride (Chloromethane)
	5000	Methyl tert-butyl ether (MTBE)
	4965	Methylcyclohexane
	4975	Methylene chloride (Dichloromethane)
	5005	Naphthalene
	4425	n-Butyl alcohol (1-Butanol, n-Butanol)
	4435	n-Butylbenzene
	5090	n-Propylbenzene
	5250	o-Xylene
	4440	sec-Butylbenzene
	5100	Styrene
	4370	T-amylmethylether (TAME)
	4445	tert-Butylbenzene
	5115	Tetrachloroethylene (Perchloroethylene)
	5120	Tetrahydrofuran (THF)
	5140	Toluene
	4700	trans-1,2-Dichloroethylene
	4685	trans-1,3-Dichloropropylene

Non-Potable Water

EPA 8260C	4605	trans-1,4-Dichloro-2-butene		
	5170	Trichloroethene (Trichloroethylene)		
	5175	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)		
	5225	Vinyl acetate		
	5235	Vinyl chloride		
	5260	Xylene (total)		
EPA 8260C SIM			10307105	Volatile Organic Compounds by GC/MS-SIM
	5105	1,1,1,2-Tetrachloroethane		
	5110	1,1,2,2-Tetrachloroethane		
	5165	1,1,2-Trichloroethane		
	4640	1,1-Dichloroethylene		
	4585	1,2-Dibromoethane (EDB, Ethylene dibromide)		
	4635	1,2-Dichloroethane (Ethylene dichloride)		
	4620	1,4-Dichlorobenzene		
	4860	2-Hexanone (MBK)		
	4375	Benzene		
	4395	Bromodichloromethane		
	4400	Bromoform		
	4575	Chlorodibromomethane		
	4505	Chloroform		
	4645	cis-1,2-Dichloroethylene		
	4680	cis-1,3-Dichloropropene		
	4595	Dibromomethane (Methylene bromide)		
	4835	Hexachlorobutadiene		
	4895	Isopropyl alcohol (2-Propanol, Isopropanol)		
	4950	Methyl bromide (Bromomethane)		
	5005	Naphthalene		
	5115	Tetrachloroethylene (Perchloroethylene)		
	4685	trans-1,3-Dichloropropylene		
	5170	Trichloroethene (Trichloroethylene)		
	5235	Vinyl chloride		
EPA 8260C SIM EPA 8260C SIM			10307105	Volatile Organic Compounds by GC/MS-SIM
	9318	1,3-Butadiene		
EPA 8270C			10185805	Semivolatile Organic compounds by GC/MS
	6715	1,2,4,5-Tetrachlorobenzene		
	5155	1,2,4-Trichlorobenzene		
	4610	1,2-Dichlorobenzene		
	6221	1,2-Diphenylhydrazine		
	4615	1,3-Dichlorobenzene		

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EPA 8270C	4620	1,4-Dichlorobenzene
	6380	1-Methylnaphthalene
	4659	2,2-Oxybis(1-chloropropane)
	6735	2,3,4,6-Tetrachlorophenol
	6738	2,3,4-Trichlorophenol
	6740	2,3,5,6-Tetrachlorophenol
	6742	2,3,5-Trichlorophenol
	6830	2,3,6-Trichlorophenol (4C)
	9363	2,3-Dichloroaniline
	6835	2,4,5-Trichlorophenol
	6840	2,4,6-Trichlorophenol
	6000	2,4-Dichlorophenol
	6130	2,4-Dimethylphenol
	6175	2,4-Dinitrophenol
	6185	2,4-Dinitrotoluene (2,4-DNT)
	6190	2,6-Dinitrotoluene (2,6-DNT)
	5795	2-Chloronaphthalene
	5800	2-Chlorophenol
	6360	2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)
	6385	2-Methylnaphthalene
	6400	2-Methylphenol (o-Cresol)
	6460	2-Nitroaniline
	6490	2-Nitrophenol
	6412	3 & 4 Methylphenol
	5945	3,3'-Dichlorobenzidine
	6818	3,4,5-Trichlorophenol
	6465	3-Nitroaniline
	5660	4-Bromophenyl phenyl ether (BDE-3)
	5700	4-Chloro-3-methylphenol
	5745	4-Chloroaniline
	5825	4-Chlorophenyl phenylether
	6410	4-Methylphenol (p-Cresol)
	6470	4-Nitroaniline
	6500	4-Nitrophenol
	5500	Acenaphthene
	5505	Acenaphthylene
	5510	Acetophenone
	5545	Aniline
	5555	Anthracene
	5595	Benzidine
	5575	Benzo(a)anthracene
	5580	Benzo(a)pyrene
	5590	Benzo(g,h,i)perylene

Non-Potable Water

EPA 8270C	5600	Benzo(k)fluoranthene		
	5585	Benzo[b]fluoranthene		
	5587	Benzofluoranthene		
	5610	Benzoic acid		
	5630	Benzyl alcohol		
	5760	bis(2-Chloroethoxy)methane		
	5765	bis(2-Chloroethyl) ether		
	5670	Butyl benzyl phthalate		
	5680	Carbazole		
	5855	Chrysene		
	6065	Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate, DEHP)		
	5895	Dibenz(a,h) anthracene		
	5905	Dibenzofuran		
	6070	Diethyl phthalate		
	6135	Dimethyl phthalate		
	5925	Di-n-butyl phthalate		
	6200	Di-n-octyl phthalate		
	6265	Fluoranthene		
	6270	Fluorene		
	6275	Hexachlorobenzene		
	4835	Hexachlorobutadiene		
	6285	Hexachlorocyclopentadiene		
	4840	Hexachloroethane		
	6315	Indeno(1,2,3-cd) pyrene		
	6320	Isophorone		
	5005	Naphthalene		
	5875	n-Decane		
	5015	Nitrobenzene		
	6530	n-Nitrosodimethylamine		
	6545	n-Nitrosodi-n-propylamine		
	6535	n-Nitrosodiphenylamine		
	6580	n-Octadecane		
	6605	Pentachlorophenol		
	6615	Phenanthrene		
	6625	Phenol		
	6665	Pyrene		
	5095	Pyridine		
EPA 8270C SIM			10242407	Semivolatile Organic compounds by GC/MS Selective Ion Monitoring
	4735	1,4-Dioxane (1,4- Diethyleneoxide)		
	6380	1-Methylnaphthalene		
	6185	2,4-Dinitrotoluene (2,4-DNT)		
	6190	2,6-Dinitrotoluene (2,6-DNT)		

Non-Potable Water

EPA 8270C SIM	6385	2-Methylnaphthalene	
	5500	Acenaphthene	
	5505	Acenaphthylene	
	5555	Anthracene	
	5575	Benzo(a)anthracene	
	5580	Benzo(a)pyrene	
	5590	Benzo(g,h,i)perylene	
	5600	Benzo(k)fluoranthene	
	5585	Benzo[b]fluoranthene	
	5765	bis(2-Chloroethyl) ether	
	5855	Chrysene	
	5895	Dibenz(a,h) anthracene	
	6265	Fluoranthene	
	6270	Fluorene	
	6275	Hexachlorobenzene	
	4835	Hexachlorobutadiene	
	6285	Hexachlorocyclopentadiene	
	4840	Hexachloroethane	
	6315	Indeno(1,2,3-cd) pyrene	
	5005	Naphthalene	
	5015	Nitrobenzene	
	6530	n-Nitrosodimethylamine	
	6545	n-Nitrosodi-n-propylamine	
	6605	Pentachlorophenol	
	6615	Phenanthrene	
	6665	Pyrene	
EPA 8270D			10186002 Semivolatile Organic compounds by GC/MS
	6715	1,2,4,5-Tetrachlorobenzene	
	5155	1,2,4-Trichlorobenzene	
	4610	1,2-Dichlorobenzene	
	6221	1,2-Diphenylhydrazine	
	4615	1,3-Dichlorobenzene	
	4620	1,4-Dichlorobenzene	
	6380	1-Methylnaphthalene	
	4659	2,2-Oxybis(1-chloropropane)	
	6735	2,3,4,6-Tetrachlorophenol	
	6740	2,3,5,6-Tetrachlorophenol	
	6835	2,4,5-Trichlorophenol	
	6840	2,4,6-Trichlorophenol	
	6000	2,4-Dichlorophenol	
	6130	2,4-Dimethylphenol	
	6175	2,4-Dinitrophenol	
	6185	2,4-Dinitrotoluene (2,4-DNT)	

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EPA 8270D	6190	2,6-Dinitrotoluene (2,6-DNT)
	5795	2-Chloronaphthalene
	5800	2-Chlorophenol
	6360	2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)
	6385	2-Methylnaphthalene
	6400	2-Methylphenol (o-Cresol)
	6460	2-Nitroaniline
	6490	2-Nitrophenol
	6412	3 & 4 Methylphenol
	5945	3,3'-Dichlorobenzidine
	6465	3-Nitroaniline
	5660	4-Bromophenyl phenyl ether (BDE-3)
	5700	4-Chloro-3-methylphenol
	5745	4-Chloroaniline
	5825	4-Chlorophenyl phenylether
	6410	4-Methylphenol (p-Cresol)
	6470	4-Nitroaniline
	6500	4-Nitrophenol
	5500	Acenaphthene
	5505	Acenaphthylene
	5510	Acetophenone
	5545	Aniline
	5555	Anthracene
	5595	Benzidine
	5575	Benzo(a)anthracene
	5580	Benzo(a)pyrene
	5590	Benzo(g,h,i)perylene
	5600	Benzo(k)fluoranthene
	5585	Benzo[b]fluoranthene
	5610	Benzoic acid
	5630	Benzyl alcohol
	5760	bis(2-Chloroethoxy)methane
	5765	bis(2-Chloroethyl) ether
	5670	Butyl benzyl phthalate
	5680	Carbazole
	5855	Chrysene
	6065	Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate, DEHP)
	5895	Dibenz(a,h) anthracene
	5905	Dibenzofuran
	6070	Diethyl phthalate
	6135	Dimethyl phthalate
	5925	Di-n-butyl phthalate

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EPA 8270D	6200	Di-n-octyl phthalate		
	6265	Fluoranthene		
	6270	Fluorene		
	6275	Hexachlorobenzene		
	4835	Hexachlorobutadiene		
	6285	Hexachlorocyclopentadiene		
	4840	Hexachloroethane		
	6315	Indeno(1,2,3-cd) pyrene		
	6320	Isophorone		
	5005	Naphthalene		
	5875	n-Decane		
	5015	Nitrobenzene		
	6530	n-Nitrosodimethylamine		
	6545	n-Nitrosodi-n-propylamine		
	6535	n-Nitrosodiphenylamine		
	6580	n-Octadecane		
	6605	Pentachlorophenol		
	6615	Phenanthrene		
	6625	Phenol		
	6665	Pyrene		
	5095	Pyridine		
EPA 8270D SIM			10242509	Semivolatile Organic compounds by GC/MS Selective Ion Monitoring
	4735	1,4-Dioxane (1,4- Diethyleneoxide)		
	6380	1-Methylnaphthalene		
	6840	2,4,6-Trichlorophenol		
	6175	2,4-Dinitrophenol		
	6185	2,4-Dinitrotoluene (2,4-DNT)		
	6190	2,6-Dinitrotoluene (2,6-DNT)		
	6385	2-Methylnaphthalene		
	5500	Acenaphthene		
	5505	Acenaphthylene		
	5555	Anthracene		
	5575	Benzo(a)anthracene		
	5580	Benzo(a)pyrene		
	5590	Benzo(g,h,i)perylene		
	5600	Benzo(k)fluoranthene		
	5585	Benzo[b]fluoranthene		
	5765	bis(2-Chloroethyl) ether		
	5855	Chrysene		
	5895	Dibenz(a,h) anthracene		
	6265	Fluoranthene		
	6270	Fluorene		
	6275	Hexachlorobenzene		

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EPA 8270D SIM	4835	Hexachlorobutadiene		
	6285	Hexachlorocyclopentadiene		
	4840	Hexachloroethane		
	6315	Indeno(1,2,3-cd) pyrene		
	5005	Naphthalene		
	5015	Nitrobenzene		
	6530	n-Nitrosodimethylamine		
	6545	n-Nitrosodi-n-propylamine		
	6605	Pentachlorophenol		
	6615	Phenanthrene		
	6665	Pyrene		
EPA 9012A			10193405	Total and Amenable Cyanide (automated colorimetric with off-line distillation)
	1510	Amenable cyanide		
	1645	Total cyanide		
EPA 9012B			10243206	Total and Amenable Cyanide (automated colorimetric with off-line distillation)
	1510	Amenable cyanide		
	1645	Total cyanide		
EPA 9013			10193609	Cyanide Extraction Procedure for Solids and Oils
	9822	Extraction/Preparation		
EPA 9040B			10197203	pH Electrometric Measurement
	1900	pH		
EPA 9040C			10244403	pH Electrometric Measurement
	1900	pH		
EPA 9050A			10198808	Specific Conductance
	1610	Conductivity		
EPA 9056A			10199607	Determination of Inorganic Anions by Ion Chromatography
	1540	Bromide		
	1575	Chloride		
	1730	Fluoride		
	1810	Nitrate as N		
	1820	Nitrate-nitrite		
	1840	Nitrite as N		
	2000	Sulfate		
EPA 9060			10200201	Total Organic Carbon
	1710	Dissolved organic carbon (DOC)		
	2040	Total organic carbon		

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EPA 9060A			10244801	Total Organic Carbon
	1710	Dissolved organic carbon (DOC)		
	2040	Total organic carbon		
NWTPH-Dx			90018409	Oregon DEQ TPH Diesel Range
	9369	Diesel range organics (DRO)		
	9499	Motor Oil		
NWTPH-Gx			90018603	Oregon DEQ TPH Gasoline Range Organics by GC/FID-PID Purge & Trap
	9408	Gasoline range organics (GRO)		
NWTPH-HCID			90013200	Oregon DEQ Total Petroleum Hydrocarbon ID
	9369	Diesel range organics (DRO)		
	9408	Gasoline range organics (GRO)		
	9499	Motor Oil		
Puget Sound Estuary Program (PSEP): Conventional Sediment Variables			60006408	PSEP: Organotins, TOC, and Sulfide
	5913	Dibutyltin		
	1206	Monobutyltin		
	1209	Tetrabutyltin		
	2040	Total organic carbon		
	1213	Tributyltin		
SM 2130 B 20th ED			20042404	Turbidity by Nephelometric Determination
	2055	Turbidity		
SM 2130 B 21st ED			20042608	Turbidity by Nephelometric Method
	2055	Turbidity		
SM 2130 B-94 online			20042802	Turbidity by Nephelometric Method
	2055	Turbidity		
SM 2320 B 20th ED			20045209	Alkalinity by Titration
	1505	Alkalinity as CaCO3		
SM 2320 B 21st ED			20045403	Alkalinity by Titration Method
	1505	Alkalinity as CaCO3		
SM 2320 B-97 SM 2320 B-97			20045607	Alkalinity by Titration Method
	1505	Alkalinity as CaCO3		
SM 2340 B 20th ED			20046202	Hardness by calculation
	1750	Hardness		
SM 2340 B 21st ED			20046406	Hardness by calculation
	1750	Hardness		
SM 2340 B-97 1997			20046600	Hardness by calculation
	1550	Calcium hardness as CaCO3		
	1755	Total hardness as CaCO3		

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SM 2340 C 20th ED	1750	Hardness	20047205	Hardness by EDTA Titration
SM 2340 C 21st ED	1750	Hardness	20047409	Hardness by EDTA Titration Method
SM 2340 C-97 online	1755	Total hardness as CaCO3	20047603	Hardness by EDTA Titration Method
SM 2510 B 20th ED	1610	Conductivity	20048208	Conductivity by Probe
SM 2510 B 21st ED	1610	Conductivity	20048402	Conductivity by Probe
SM 2510 B-97 SM 2510 B-97	1610	Conductivity	20048606	Conductivity by Probe
SM 2520 B 20th ED	1975	Salinity	20040055	Salinity by Electrical Conductivity
SM 2540 B 21st ED	1950	Residue-total	20049201	Total Solids Dried at 103 - 105C
SM 2540 B 20th ED	1950	Residue-total	20049007	Total Solids
SM 2540 B-97 SM 2540 B-97	1950	Residue-total	20049405	Total Solids Dried at 103 - 105C
SM 2540 C 20th ED	1955	Residue-filterable (TDS)	20050004	Total Dissolved Solids
SM 2540 C 21st ED	1955	Residue-filterable (TDS)	20050208	Total Dissolved Solids Dried at 180C
SM 2540 C-97 SM 2540 C-97	1955	Residue-filterable (TDS)	20050402	Total Dissolved Solids Dried at 180C
SM 2540 D 21st ED	1960	Residue-nonfilterable (TSS)	20051007	Total Suspended Solids Dried at 103 - 105C
SM 2540 D 20th ED	1960	Residue-nonfilterable (TSS)	20050800	Total Suspended Solids
SM 2540 D-97 SM 2540 D-97	1960	Residue-nonfilterable (TSS)	20051201	Total Suspended Solids Dried at 103 - 105C
SM 2540 F 20th ED	1965	Residue-settleable	20051803	Settleable Solids
SM 2540 F 21st ED	1965	Residue-settleable	20052000	Settleable Solids

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SM 2540 F 18th ED	1965	Residue-settleable	20005009	Settleable Solids
SM 2540 F-97 online	1965	Residue-settleable	20052204	Settleable Solids
SM 3500-Cr B 20th ED	1045	Chromium VI	20065809	Chromium by Colorimetric Method
SM 3500-Cr B-2009 online	1045	Chromium VI	20066255	Chromium by Colorimetric Method
SM 4500-CN E 20th ED	1645	Total cyanide	20092404	Cyanide by Colorimetric Determination
SM 4500-CN G 20th ED	1510	Amenable cyanide	20093203	Cyanide Amenable to Chlorination after Distillation
SM 4500-CN I 20th ED	1635	Cyanide	20093601	Weak Acid Dissociable Cyanide
SM 4500-CN⁻ E 21st ED	1635	Cyanide	20096202	Cyanide by Colorimetric Method
SM 4500-CN⁻ G 21st ED	1510	Amenable cyanide	20097001	Cyanide by Cyanides Amenable to Chlorination after Distillation
SM 4500-CN⁻ I 21st ED	1635	Cyanide	20097807	Cyanide by Weak Acid Dissociable Cyanide
SM 4500-H+ B 21st ED	1900	pH	20105004	pH Value by Electrometric Method .
SM 4500-H+ B 20th ED	1900	pH	20104807	pH by Probe
SM 4500-H+ B-96 online	1900	pH	20105208	pH Value by Electrometric Method .
SM 4500-NH3 G 20th ED	1515	Ammonia as N	20111006	Ammonia by Automated Phenate
SM 4500-NH3 G 18th ED	1515	Ammonia as N	20023205	Ammonia Nitrogen by Ion Selective Electrode with Known Addition
SM 4500-P F 19th ED	1870 1910	Orthophosphate as P Phosphorus, total	20124407	Phosphorus by Automated Ascorbic Acid Reduction
SM 4500-P F 20th ED	1870	Orthophosphate as P	20124601	Phosphorus by Automated Ascorbic Acid Reduction

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SM 4500-P F 20th ED	1910	Phosphorus, total		
SM 4500-P F 21st ED			20124805	Phosphorus by Automated Ascorbic Acid Reduction Method
	1870	Orthophosphate as P		
	1910	Phosphorus, total		
SM 5210 B 20th ED			20134809	Biochemical Oxygen Demand, 5-Day (BOD5)
	1530	Biochemical oxygen demand		
SM 5210 B 21st ED			20135006	Biochemical Oxygen Demand, 5-Day (BOD5)
	1530	Biochemical oxygen demand		
SM 5210 B-97 online			20135200	Biochemical Oxygen Demand, 5-Day (BOD5)
	1530	Biochemical oxygen demand		
	1555	Carbonaceous BOD, CBOD		
SM 5220 C 21st ED			20135802	COD by Closed Reflux, Titrimetric Method
	1565	Chemical oxygen demand		
SM 5220 C 20th ED			20135608	Chemical Oxygen Demand by Closed Reflux and Titration
	1565	Chemical oxygen demand		
SM 5220 C-97 online			20136009	COD by Closed Reflux, Titrimetric Method
	1565	Chemical oxygen demand		
SM 5220 D 21st ED			20136601	COD by Closed Reflux, Colorimetric Method
	1565	Chemical oxygen demand		
SM 5220 D 20th ED			20136407	Chemical Oxygen Demand by Closed Reflux and Colorimetric Determination
	1565	Chemical oxygen demand		
SM 5220 D-97 online			20136805	COD by Closed Reflux, Colorimetric Method
	1565	Chemical oxygen demand		
SM 5310 B 20th ED			20137400	Total Organic Carbon by Combustion Infra-red Method
	1710	Dissolved organic carbon (DOC)		
	2040	Total organic carbon		
SM 5310 B 21st ED			20137604	TOC by High-Temperature Combustion Method
	1710	Dissolved organic carbon (DOC)		
	2040	Total organic carbon		
SM 5310 B-96 online			20137808	TOC by High-Temperature Combustion Method
	2040	Total organic carbon		

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SM 5310 C 20th ED			20138403	Total Organic Carbon by Persulfate-Ultraviolet Oxidation Method
	1710	Dissolved organic carbon (DOC)		
	2040	Total organic carbon		
SM 5310 C 21st ED			20138607	TOC by Persulfate-Ultraviolet or Heated-Persulfate Oxidation Method
	1710	Dissolved organic carbon (DOC)		
	2040	Total organic carbon		
WA EPH			60015001	Extractable Petroleum Hydrocarbons
	9369	Diesel range organics (DRO)		
	6211	EPH Aliphatic >C10-C12		
	6212	EPH Aliphatic >C12-C16		
	6214	EPH Aliphatic >C16-C21		
	6216	EPH Aliphatic >C21-C34		
	6219	EPH Aliphatic C8-C10		
	6224	EPH Aromatic >C10-C12		
	6226	EPH Aromatic >C12-C16		
	6228	EPH Aromatic >C16-C21		
	6231	EPH Aromatic >C21-C34		
	6236	EPH Aromatic C8-C10		
WA VPH			60015056	Volatile Petroleum Hydrocarbons (VPH) by GC/PID Purge & Trap
	4375	Benzene		
	4765	Ethylbenzene		
	9408	Gasoline range organics (GRO)		
	5240	m+p-xylene		
	5000	Methyl tert-butyl ether (MTBE)		
	4855	n-Hexane		
	5250	o-Xylene		
	5140	Toluene		
	5300	VPH Aliphatic >C10-C12		
	5301	VPH Aliphatic >C6-C8		
	5302	VPH Aliphatic >C8-C10		
	5303	VPH Aliphatic C5-C6		
	5308	VPH Aromatic >C10-C12		
	5309	VPH Aromatic >C12-C13		
	5310	VPH Aromatic >C8-C10		
	5260	Xylene (total)		

Solids

ASTM D2217-85			30025151	Grain sizing
	6118	Distribution of particle sizes		
ASTM D422-63			30030854	Partical Size Distribution (Grain sizing)
	6118	Distribution of particle sizes		

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EPA 1020A			10117007	Ignitability Setaflash Closed-cup Method
	1780	Ignitability		
EPA 1311			10118806	Toxicity Characteristic Leaching Procedure
	9822	Extraction/Preparation		
EPA 1312			10119003	Synthetic Precipitation Leaching Procedure
	9822	Extraction/Preparation		
EPA 300.0 2.1			10053200	Methods for the Determination of Inorganic Substances in Environmental Samples
	1540	Bromide		
	1575	Chloride		
	1730	Fluoride		
	1810	Nitrate as N		
	1820	Nitrate-nitrite		
	1840	Nitrite as N		
	2000	Sulfate		
EPA 3050B			10135601	Acid Digestion of Sediments, Sludges, and soils
	9822	Extraction/Preparation		
EPA 3546			10141205	Microwave Extraction
	9822	Extraction/Preparation		
EPA 3550B			10141807	Ultrasonic Extraction
	9822	Extraction/Preparation		
EPA 3580A			10143007	Waste Dilution
	9822	Extraction/Preparation		
EPA 3585			10143201	Waste Dilution for Volatile Organics
	8031	Extraction/Preparation		
EPA 3610B			10144602	Alumina Cleanup
	8031	Extraction/Preparation		
EPA 3620B			10145809	Florisil Cleanup
	9822	Extraction/Preparation		
EPA 3630C			10146802	Silica gel cleanup
	9822	Extraction/Preparation		
EPA 3660B			10148400	Sulfur cleanup
	9822	Extraction/Preparation		
EPA 3665A			10148808	Sulfuric Acid / permanganate Cleanup
	9822	Extraction/Preparation		
EPA 5030B			10153409	Purge and trap for aqueous samples
	9822	Extraction/Preparation		

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EPA 5035A			10284807	Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples
	8031	Extraction/Preparation		
EPA 6010B			10155609	ICP - AES
	1000	Aluminum		
	1005	Antimony		
	1010	Arsenic		
	1015	Barium		
	1020	Beryllium		
	1025	Boron		
	1030	Cadmium		
	1035	Calcium		
	1040	Chromium		
	1050	Cobalt		
	1055	Copper		
	1760	Hardness (calc.)		
	1070	Iron		
	1075	Lead		
	1085	Magnesium		
	1090	Manganese		
	1100	Molybdenum		
	1105	Nickel		
	1125	Potassium		
	1140	Selenium		
	1990	Silica as SiO2		
	1145	Silicon		
	1150	Silver		
	1155	Sodium		
	1160	Strontium		
	1165	Thallium		
	1175	Tin		
	1180	Titanium		
	1185	Vanadium		
	1190	Zinc		
EPA 6010C 3			10155905	Inductively Coupled Plasma - Atomic Emission Spectrometry
	1000	Aluminum		
	1005	Antimony		
	1010	Arsenic		
	1015	Barium		
	1020	Beryllium		
	1025	Boron		
	1030	Cadmium		

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EPA 6010C 3	1035	Calcium	
	1040	Chromium	
	1050	Cobalt	
	1055	Copper	
	1070	Iron	
	1075	Lead	
	1085	Magnesium	
	1090	Manganese	
	1100	Molybdenum	
	1105	Nickel	
	1125	Potassium	
	1140	Selenium	
	1990	Silica as SiO2	
	1145	Silicon	
	1150	Silver	
	1155	Sodium	
	1160	Strontium	
	1165	Thallium	
	1175	Tin	
	1180	Titanium	
	1755	Total hardness as CaCO3	
	1185	Vanadium	
	1190	Zinc	
EPA 6010D 4		10155916	Metals by ICP - AES
	1000	Aluminum	
	1005	Antimony	
	1010	Arsenic	
	1015	Barium	
	1020	Beryllium	
	1025	Boron	
	1030	Cadmium	
	1035	Calcium	
	1040	Chromium	
	1050	Cobalt	
	1055	Copper	
	1760	Hardness (calc.)	
	1070	Iron	
	1075	Lead	
	1085	Magnesium	
	1090	Manganese	
	1100	Molybdenum	
	1105	Nickel	
	1125	Potassium	

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EPA 6010D 4				
	1140	Selenium		
	1990	Silica as SiO2		
	1145	Silicon		
	1150	Silver		
	1155	Sodium		
	1160	Strontium		
	1165	Thallium		
	1175	Tin		
	1180	Titanium		
	1185	Vanadium		
	1190	Zinc		
EPA 6020			10156000	Inductively Coupled Plasma-Mass Spectrometry
	1005	Antimony		
	1010	Arsenic		
	1015	Barium		
	1020	Beryllium		
	1030	Cadmium		
	1040	Chromium		
	1050	Cobalt		
	1055	Copper		
	1075	Lead		
	1090	Manganese		
	1095	Mercury		
	1100	Molybdenum		
	3055	Natural uranium		
	1105	Nickel		
	1140	Selenium		
	1150	Silver		
	1160	Strontium		
	1165	Thallium		
	1180	Titanium		
	1185	Vanadium		
	1190	Zinc		
EPA 6020A 1			10156419	Inductively Coupled Plasma -Mass Spectrometry
	1000	Aluminum		
	1010	Arsenic		
	1015	Barium		
	1020	Beryllium		
	1030	Cadmium		
	1040	Chromium		
	1050	Cobalt		
	1055	Copper		

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EPA 6020A 1	1075	Lead		
	1090	Manganese		
	1095	Mercury		
	1100	Molybdenum		
	3055	Natural uranium		
	1105	Nickel		
	1140	Selenium		
	1150	Silver		
	1160	Strontium		
	1165	Thallium		
	1180	Titanium		
	1185	Vanadium		
	1190	Zinc		
EPA 6020B 2014			10156420	Inductively Coupled Plasma-Mass Spectrometry
	1005	Antimony		
	1010	Arsenic		
	1015	Barium		
	1020	Beryllium		
	1030	Cadmium		
	1040	Chromium		
	1050	Cobalt		
	1055	Copper		
	1070	Iron		
	1075	Lead		
	1090	Manganese		
	1095	Mercury		
	1100	Molybdenum		
	1105	Nickel		
	1140	Selenium		
	1150	Silver		
	1160	Strontium		
	1165	Thallium		
	1180	Titanium		
	3035	Uranium		
	1185	Vanadium		
	1190	Zinc		
EPA 7470A			10165807	Mercury in Liquid Waste by Cold Vapor Atomic Absorption
	1095	Mercury		
EPA 7471A			10166208	Mercury in Solid Waste by Cold Vapor Atomic Absorption
	1095	Mercury		

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Solids

EPA 8000B			10172200	Determinative Chromatographic Separations
	9822	Extraction/Preparation		
EPA 8000C			10305201	Determinative Chromatographic Separations
	8031	Extraction/Preparation		
EPA 8011			10173009	1,2-Dibromoethane and 1,2-Dibromo-3-chloropropane by Microextraction and GC/ECD
	5180	1,2,3-Trichloropropane		
	4570	1,2-Dibromo-3-chloropropane (DBCP)		
	4585	1,2-Dibromoethane (EDB, Ethylene dibromide)		
EPA 8015B			10173601	Non-halogenated organics using GC/FID
	9369	Diesel range organics (DRO)		
	9408	Gasoline range organics (GRO)		
	9499	Motor Oil		
EPA 8081A			10178606	Organochlorine Pesticides by GC/ECD
	7355	4,4'-DDD		
	7360	4,4'-DDE		
	7365	4,4'-DDT		
	7025	Aldrin		
	7110	alpha-BHC (alpha-Hexachlorocyclohexane)		
	7240	alpha-Chlordane		
	7115	beta-BHC (beta-Hexachlorocyclohexane)		
	7250	Chlordane (tech.)		
	7105	delta-BHC		
	7470	Dieldrin		
	7510	Endosulfan I		
	7515	Endosulfan II		
	7520	Endosulfan sulfate		
	7540	Endrin		
	7530	Endrin aldehyde		
	7535	Endrin ketone		
	7120	gamma-BHC (Lindane, gamma-HexachlorocyclohexanE)		
	7245	gamma-Chlordane		
	7685	Heptachlor		
	7690	Heptachlor epoxide		
	6275	Hexachlorobenzene		
	4835	Hexachlorobutadiene		
	7810	Methoxychlor		
	8250	Toxaphene (Chlorinated camphene)		

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EPA 8081B			10178800	Organochlorine Pesticides by GC/ECD
	7355	4,4'-DDD		
	7360	4,4'-DDE		
	7365	4,4'-DDT		
	7025	Aldrin		
	7110	alpha-BHC (alpha-Hexachlorocyclohexane)		
	7240	alpha-Chlordane		
	7115	beta-BHC (beta-Hexachlorocyclohexane)		
	7250	Chlordane (tech.)		
	7105	delta-BHC		
	7470	Dieldrin		
	7510	Endosulfan I		
	7515	Endosulfan II		
	7520	Endosulfan sulfate		
	7540	Endrin		
	7530	Endrin aldehyde		
	7535	Endrin ketone		
	7120	gamma-BHC (Lindane, gamma-HexachlorocyclohexanE)		
	7245	gamma-Chlordane		
	7685	Heptachlor		
	7690	Heptachlor epoxide		
	6275	Hexachlorobenzene		
	4835	Hexachlorobutadiene		
	7810	Methoxychlor		
	8250	Toxaphene (Chlorinated camphene)		
EPA 8082			10179007	Polychlorinated Biphenyls (PCBs) by GC/ECD
	8880	Aroclor-1016 (PCB-1016)		
	8885	Aroclor-1221 (PCB-1221)		
	8890	Aroclor-1232 (PCB-1232)		
	8895	Aroclor-1242 (PCB-1242)		
	8900	Aroclor-1248 (PCB-1248)		
	8905	Aroclor-1254 (PCB-1254)		
	8910	Aroclor-1260 (PCB-1260)		
	8912	Aroclor-1262 (PCB-1262)		
	8913	Aroclor-1268 (PCB-1268)		
EPA 8082A			10179201	Polychlorinated Biphenyls (PCBs) by GC/ECD
	8880	Aroclor-1016 (PCB-1016)		
	8885	Aroclor-1221 (PCB-1221)		
	8890	Aroclor-1232 (PCB-1232)		
	8895	Aroclor-1242 (PCB-1242)		

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EPA 8082A	8900	Aroclor-1248 (PCB-1248)		
	8905	Aroclor-1254 (PCB-1254)		
	8910	Aroclor-1260 (PCB-1260)		
	8912	Aroclor-1262 (PCB-1262)		
	8913	Aroclor-1268 (PCB-1268)		
EPA 8151A (GC/MS)			10183230	Chlorinated Herbicides by GC/MS Using Methylation or Pentafluorobenzylation Derivitization
	8655	2,4,5-T		
	8545	2,4-D		
	8560	2,4-DB		
	6500	4-Nitrophenol		
	8555	Dalapon		
	8595	Dicamba		
	8605	Dichloroprop (Dichlorprop)		
	8620	Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)		
	7775	MCPA		
	7780	MCPP		
	6605	Pentachlorophenol		
	8650	Silvex (2,4,5-TP)		
EPA 8260B			10184802	Volatile Organic Compounds by purge and trap GC/MS
	5105	1,1,1,2-Tetrachloroethane		
	5160	1,1,1-Trichloroethane		
	5110	1,1,2,2-Tetrachloroethane		
	5195	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)		
	5165	1,1,2-Trichloroethane		
	4630	1,1-Dichloroethane		
	4640	1,1-Dichloroethylene		
	4670	1,1-Dichloropropene		
	5150	1,2,3-Trichlorobenzene		
	5180	1,2,3-Trichloropropane		
	5182	1,2,3-Trimethylbenzene		
	5155	1,2,4-Trichlorobenzene		
	5210	1,2,4-Trimethylbenzene		
	4570	1,2-Dibromo-3-chloropropane (DBCP)		
	4585	1,2-Dibromoethane (EDB, Ethylene dibromide)		
	4610	1,2-Dichlorobenzene		
	4635	1,2-Dichloroethane (Ethylene dichloride)		
	4655	1,2-Dichloropropane		
	5215	1,3,5-Trimethylbenzene		
	4615	1,3-Dichlorobenzene		

Solids

EPA 8260B	4660	1,3-Dichloropropane
	4620	1,4-Dichlorobenzene
	4665	2,2-Dichloropropane
	4410	2-Butanone (Methyl ethyl ketone, MEK)
	4500	2-Chloroethyl vinyl ether
	4535	2-Chlorotoluene
	4860	2-Hexanone (MBK)
	4540	4-Chlorotoluene
	4910	4-Isopropyltoluene (p-Cymene)
	4995	4-Methyl-2-pentanone (MIBK)
	4315	Acetone
	4320	Acetonitrile
	4325	Acrolein (Propenal)
	4340	Acrylonitrile
	4375	Benzene
	4385	Bromobenzene
	4390	Bromochloromethane
	4395	Bromodichloromethane
	4400	Bromoform
	4450	Carbon disulfide
	4455	Carbon tetrachloride
	4475	Chlorobenzene
	4575	Chlorodibromomethane
	4485	Chloroethane (Ethyl chloride)
	4505	Chloroform
	4645	cis-1,2-Dichloroethylene
	4680	cis-1,3-Dichloropropene
	4600	cis-1,4-Dichloro-2-butene
	4595	Dibromomethane (Methylene bromide)
	4625	Dichlorodifluoromethane (Freon-12)
	9375	Di-isopropylether (DIPE)
	4765	Ethylbenzene
	4770	Ethyl-t-butylether (ETBE) (2-Ethoxy-2-methylpropane)
	4835	Hexachlorobutadiene
	4870	Iodomethane (Methyl iodide)
	4875	Isobutyl alcohol (2-Methyl-1-propanol)
	4900	Isopropylbenzene (Cumene)
	5240	m+p-xylene
	4925	Methacrylonitrile
	4940	Methyl acetate
	4950	Methyl bromide (Bromomethane)
	4960	Methyl chloride (Chloromethane)
	5000	Methyl tert-butyl ether (MTBE)

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Solids

EPA 8260B	4965	Methylcyclohexane	
	4975	Methylene chloride (Dichloromethane)	
	5005	Naphthalene	
	4425	n-Butyl alcohol (1-Butanol, n-Butanol)	
	4435	n-Butylbenzene	
	5090	n-Propylbenzene	
	5250	o-Xylene	
	4440	sec-Butylbenzene	
	5100	Styrene	
	4370	T-amylmethylether (TAME)	
	4445	tert-Butylbenzene	
	5115	Tetrachloroethylene (Perchloroethylene)	
	5120	Tetrahydrofuran (THF)	
	5140	Toluene	
	4700	trans-1,2-Dichloroethylene	
	4685	trans-1,3-Dichloropropylene	
	4605	trans-1,4-Dichloro-2-butene	
	5170	Trichloroethene (Trichloroethylene)	
	5175	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	
	5225	Vinyl acetate	
	5235	Vinyl chloride	
EPA 8260B SIM		10184904	Volatile Organic Compounds by purge and trap GC/MS-SIM
	5105	1,1,1,2-Tetrachloroethane	
	5110	1,1,2,2-Tetrachloroethane	
	5165	1,1,2-Trichloroethane	
	4640	1,1-Dichloroethylene	
	4585	1,2-Dibromoethane (EDB, Ethylene dibromide)	
	4635	1,2-Dichloroethane (Ethylene dichloride)	
	9318	1,3-Butadiene	
	4620	1,4-Dichlorobenzene	
	4860	2-Hexanone (MBK)	
	4375	Benzene	
	4395	Bromodichloromethane	
	4400	Bromoform	
	4575	Chlorodibromomethane	
	4505	Chloroform	
	4645	cis-1,2-Dichloroethylene	
	4680	cis-1,3-Dichloropropene	
	4595	Dibromomethane (Methylene bromide)	
	4835	Hexachlorobutadiene	
	4895	Isopropyl alcohol (2-Propanol, Isopropanol)	

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Solids

EPA 8260B SIM	4950	Methyl bromide (Bromomethane)	
	5005	Naphthalene	
	5115	Tetrachloroethylene (Perchloroethylene)	
	4685	trans-1,3-Dichloropropylene	
	5170	Trichloroethene (Trichloroethylene)	
	5235	Vinyl chloride	
EPA 8260C			10307003 Volatile Organics: GC/MS (capillary column)
	5105	1,1,1,2-Tetrachloroethane	
	5160	1,1,1-Trichloroethane	
	5110	1,1,2,2-Tetrachloroethane	
	5195	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	
	5165	1,1,2-Trichloroethane	
	4630	1,1-Dichloroethane	
	4640	1,1-Dichloroethylene	
	4670	1,1-Dichloropropene	
	5150	1,2,3-Trichlorobenzene	
	5180	1,2,3-Trichloropropane	
	5182	1,2,3-Trimethylbenzene	
	5155	1,2,4-Trichlorobenzene	
	5210	1,2,4-Trimethylbenzene	
	4570	1,2-Dibromo-3-chloropropane (DBCP)	
	4585	1,2-Dibromoethane (EDB, Ethylene dibromide)	
	4610	1,2-Dichlorobenzene	
	4635	1,2-Dichloroethane (Ethylene dichloride)	
	4655	1,2-Dichloropropane	
	5215	1,3,5-Trimethylbenzene	
	4615	1,3-Dichlorobenzene	
	4660	1,3-Dichloropropane	
	4620	1,4-Dichlorobenzene	
	4665	2,2-Dichloropropane	
	4410	2-Butanone (Methyl ethyl ketone, MEK)	
	4500	2-Chloroethyl vinyl ether	
	4535	2-Chlorotoluene	
	4860	2-Hexanone (MBK)	
	4540	4-Chlorotoluene	
	4910	4-Isopropyltoluene (p-Cymene)	
	4995	4-Methyl-2-pentanone (MIBK)	
	4315	Acetone	
	4320	Acetonitrile	
	4325	Acrolein (Propenal)	
	4340	Acrylonitrile	

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Solids

EPA 8260C	4375	Benzene
	4385	Bromobenzene
	4390	Bromochloromethane
	4395	Bromodichloromethane
	4400	Bromoform
	4450	Carbon disulfide
	4455	Carbon tetrachloride
	4475	Chlorobenzene
	4575	Chlorodibromomethane
	4485	Chloroethane (Ethyl chloride)
	4505	Chloroform
	4645	cis-1,2-Dichloroethylene
	4680	cis-1,3-Dichloropropene
	4600	cis-1,4-Dichloro-2-butene
	4595	Dibromomethane (Methylene bromide)
	4625	Dichlorodifluoromethane (Freon-12)
	9375	Di-isopropylether (DIPE)
	4765	Ethylbenzene
	4770	Ethyl-t-butylether (ETBE) (2-Ethoxy-2-methylpropane)
	4835	Hexachlorobutadiene
	4870	Iodomethane (Methyl iodide)
	4875	Isobutyl alcohol (2-Methyl-1-propanol)
	4900	Isopropylbenzene (Cumene)
	5240	m+p-xylene
	4925	Methacrylonitrile
	4940	Methyl acetate
	4950	Methyl bromide (Bromomethane)
	4960	Methyl chloride (Chloromethane)
	5000	Methyl tert-butyl ether (MTBE)
	4965	Methylcyclohexane
	4975	Methylene chloride (Dichloromethane)
	5005	Naphthalene
	4425	n-Butyl alcohol (1-Butanol, n-Butanol)
	4435	n-Butylbenzene
	5090	n-Propylbenzene
	5250	o-Xylene
	4440	sec-Butylbenzene
	5100	Styrene
	4370	T-amylmethylether (TAME)
	4445	tert-Butylbenzene
	5115	Tetrachloroethylene (Perchloroethylene)
	5120	Tetrahydrofuran (THF)
	5140	Toluene

Solids

EPA 8260C	4700	trans-1,2-Dichloroethylene		
	4685	trans-1,3-Dichloropropylene		
	4605	trans-1,4-Dichloro-2-butene		
	5170	Trichloroethene (Trichloroethylene)		
	5175	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)		
	5225	Vinyl acetate		
	5235	Vinyl chloride		
	5260	Xylene (total)		
EPA 8260C SIM			10307105	Volatile Organic Compounds by GC/MS-SIM
	5105	1,1,1,2-Tetrachloroethane		
	5110	1,1,2,2-Tetrachloroethane		
	5165	1,1,2-Trichloroethane		
	4640	1,1-Dichloroethylene		
	4585	1,2-Dibromoethane (EDB, Ethylene dibromide)		
	4635	1,2-Dichloroethane (Ethylene dichloride)		
	4620	1,4-Dichlorobenzene		
	4860	2-Hexanone (MBK)		
	4375	Benzene		
	4395	Bromodichloromethane		
	4400	Bromoform		
	4575	Chlorodibromomethane		
	4505	Chloroform		
	4645	cis-1,2-Dichloroethylene		
	4680	cis-1,3-Dichloropropene		
	4595	Dibromomethane (Methylene bromide)		
	4835	Hexachlorobutadiene		
	4895	Isopropyl alcohol (2-Propanol, Isopropanol)		
	4950	Methyl bromide (Bromomethane)		
	5005	Naphthalene		
	5115	Tetrachloroethylene (Perchloroethylene)		
	4685	trans-1,3-Dichloropropylene		
	5170	Trichloroethene (Trichloroethylene)		
	5235	Vinyl chloride		
EPA 8260C SIM EPA 8260C SIM			10307105	Volatile Organic Compounds by GC/MS-SIM
	9318	1,3-Butadiene		
EPA 8270C			10185805	Semivolatile Organic compounds by GC/MS
	6715	1,2,4,5-Tetrachlorobenzene		
	5155	1,2,4-Trichlorobenzene		
	4610	1,2-Dichlorobenzene		

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Solids	EPA 8270C	6221	1,2-Diphenylhydrazine
		4615	1,3-Dichlorobenzene
		4620	1,4-Dichlorobenzene
		6380	1-Methylnaphthalene
		4659	2,2-Oxybis(1-chloropropane)
		6735	2,3,4,6-Tetrachlorophenol
		6738	2,3,4-Trichlorophenol
		6740	2,3,5,6-Tetrachlorophenol
		6742	2,3,5-Trichlorophenol
		6830	2,3,6-Trichlorophenol (4C)
		9363	2,3-Dichloroaniline
		6835	2,4,5-Trichlorophenol
		6840	2,4,6-Trichlorophenol
		6000	2,4-Dichlorophenol
		6130	2,4-Dimethylphenol
		6175	2,4-Dinitrophenol
		6185	2,4-Dinitrotoluene (2,4-DNT)
		6190	2,6-Dinitrotoluene (2,6-DNT)
		5795	2-Chloronaphthalene
		5800	2-Chlorophenol
		6360	2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2 -methylphenol)
		6385	2-Methylnaphthalene
		6400	2-Methylphenol (o-Cresol)
		6460	2-Nitroaniline
		6490	2-Nitrophenol
		6412	3 & 4 Methylphenol
		5945	3,3'-Dichlorobenzidine
		6818	3,4,5-Trichlorophenol
		6465	3-Nitroaniline
		5660	4-Bromophenyl phenyl ether (BDE-3)
		5700	4-Chloro-3-methylphenol
		5745	4-Chloroaniline
		5825	4-Chlorophenyl phenylether
		6410	4-Methylphenol (p-Cresol)
		6470	4-Nitroaniline
		6500	4-Nitrophenol
		5500	Acenaphthene
		5505	Acenaphthylene
		5510	Acetophenone
		5545	Aniline
		5555	Anthracene
		5595	Benzidine
		5575	Benzo(a)anthracene

Solids

EPA 8270C	5580	Benzo(a)pyrene		
	5590	Benzo(g,h,i)perylene		
	5600	Benzo(k)fluoranthene		
	5585	Benzo[b]fluoranthene		
	5587	Benzofluoranthene		
	5610	Benzoic acid		
	5630	Benzyl alcohol		
	5760	bis(2-Chloroethoxy)methane		
	5765	bis(2-Chloroethyl) ether		
	5670	Butyl benzyl phthalate		
	5680	Carbazole		
	5855	Chrysene		
	6065	Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate, DEHP)		
	5895	Dibenz(a,h) anthracene		
	5905	Dibenzofuran		
	6070	Diethyl phthalate		
	6135	Dimethyl phthalate		
	5925	Di-n-butyl phthalate		
	6200	Di-n-octyl phthalate		
	6265	Fluoranthene		
	6270	Fluorene		
	6275	Hexachlorobenzene		
	4835	Hexachlorobutadiene		
	6285	Hexachlorocyclopentadiene		
	4840	Hexachloroethane		
	6315	Indeno(1,2,3-cd) pyrene		
	6320	Isophorone		
	5005	Naphthalene		
	5875	n-Decane		
	5015	Nitrobenzene		
	6530	n-Nitrosodimethylamine		
	6545	n-Nitrosodi-n-propylamine		
	6535	n-Nitrosodiphenylamine		
	6580	n-Octadecane		
	6605	Pentachlorophenol		
	6615	Phenanthrene		
	6625	Phenol		
	6665	Pyrene		
	5095	Pyridine		
EPA 8270C SIM			10242407	Semivolatile Organic compounds by GC/MS Selective Ion Monitoring
	4735	1,4-Dioxane (1,4- Diethyleneoxide)		
	6380	1-Methylnaphthalene		

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Solids

EPA 8270C SIM	6185	2,4-Dinitrotoluene (2,4-DNT)
	6190	2,6-Dinitrotoluene (2,6-DNT)
	6385	2-Methylnaphthalene
	5500	Acenaphthene
	5505	Acenaphthylene
	5555	Anthracene
	5575	Benzo(a)anthracene
	5580	Benzo(a)pyrene
	5590	Benzo(g,h,i)perylene
	5600	Benzo(k)fluoranthene
	5585	Benzo[b]fluoranthene
	5765	bis(2-Chloroethyl) ether
	5855	Chrysene
	5895	Dibenz(a,h) anthracene
	6265	Fluoranthene
	6270	Fluorene
	6275	Hexachlorobenzene
	4835	Hexachlorobutadiene
	6285	Hexachlorocyclopentadiene
	4840	Hexachloroethane
	6315	Indeno(1,2,3-cd) pyrene
	5005	Naphthalene
	5015	Nitrobenzene
	6530	n-Nitrosodimethylamine
	6545	n-Nitrosodi-n-propylamine
	6605	Pentachlorophenol
	6615	Phenanthrene
	6665	Pyrene
EPA 8270D	10186002	Semivolatile Organic compounds by GC/MS
	6715	1,2,4,5-Tetrachlorobenzene
	5155	1,2,4-Trichlorobenzene
	4610	1,2-Dichlorobenzene
	6221	1,2-Diphenylhydrazine
	4615	1,3-Dichlorobenzene
	4620	1,4-Dichlorobenzene
	6380	1-Methylnaphthalene
	4659	2,2-Oxybis(1-chloropropane)
	6735	2,3,4,6-Tetrachlorophenol
	6740	2,3,5,6-Tetrachlorophenol
	6835	2,4,5-Trichlorophenol
	6840	2,4,6-Trichlorophenol
	6000	2,4-Dichlorophenol
	6130	2,4-Dimethylphenol

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Environmental Laboratory Accreditation Program

ORELAP Fields of Accreditation

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TestAmerica Seattle

EPA CODE: WA00050

5755 8th Street East

Certificate: WA100007 - 012

Tacoma, WA 98424

Issue Date: 11/6/2017 Expiration Date: 11/5/2018

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Solids	EPA 8270D	6175	2,4-Dinitrophenol
		6185	2,4-Dinitrotoluene (2,4-DNT)
		6190	2,6-Dinitrotoluene (2,6-DNT)
		5795	2-Chloronaphthalene
		5800	2-Chlorophenol
		6360	2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)
		6385	2-Methylnaphthalene
		6400	2-Methylphenol (o-Cresol)
		6460	2-Nitroaniline
		6490	2-Nitrophenol
		6412	3 & 4 Methylphenol
		5945	3,3'-Dichlorobenzidine
		6465	3-Nitroaniline
		5660	4-Bromophenyl phenyl ether (BDE-3)
		5700	4-Chloro-3-methylphenol
		5745	4-Chloroaniline
		5825	4-Chlorophenyl phenylether
		6410	4-Methylphenol (p-Cresol)
		6470	4-Nitroaniline
		6500	4-Nitrophenol
		5500	Acenaphthene
		5505	Acenaphthylene
		5510	Acetophenone
		5545	Aniline
		5555	Anthracene
		5595	Benzidine
		5575	Benzo(a)anthracene
		5580	Benzo(a)pyrene
		5590	Benzo(g,h,i)perylene
		5600	Benzo(k)fluoranthene
		5585	Benzo[b]fluoranthene
		5610	Benzoic acid
		5630	Benzyl alcohol
		5760	bis(2-Chloroethoxy)methane
		5765	bis(2-Chloroethyl) ether
		5670	Butyl benzyl phthalate
		5680	Carbazole
		5855	Chrysene
		6065	Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate, DEHP)
		5895	Dibenz(a,h) anthracene
		5905	Dibenzofuran
		6070	Diethyl phthalate

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Solids

EPA 8270D	6135	Dimethyl phthalate	
	5925	Di-n-butyl phthalate	
	6200	Di-n-octyl phthalate	
	6265	Fluoranthene	
	6270	Fluorene	
	6275	Hexachlorobenzene	
	4835	Hexachlorobutadiene	
	6285	Hexachlorocyclopentadiene	
	4840	Hexachloroethane	
	6315	Indeno(1,2,3-cd) pyrene	
	6320	Isophorone	
	5005	Naphthalene	
	5875	n-Decane	
	5015	Nitrobenzene	
	6530	n-Nitrosodimethylamine	
	6545	n-Nitrosodi-n-propylamine	
	6535	n-Nitrosodiphenylamine	
	6580	n-Octadecane	
	6605	Pentachlorophenol	
	6615	Phenanthrene	
	6625	Phenol	
	6665	Pyrene	
	5095	Pyridine	
EPA 8270D SIM		10242509	Semivolatile Organic compounds by GC/MS Selective Ion Monitoring
	4735	1,4-Dioxane (1,4- Diethyleneoxide)	
	6380	1-Methylnaphthalene	
	6840	2,4,6-Trichlorophenol	
	6175	2,4-Dinitrophenol	
	6185	2,4-Dinitrotoluene (2,4-DNT)	
	6190	2,6-Dinitrotoluene (2,6-DNT)	
	6385	2-Methylnaphthalene	
	5500	Acenaphthene	
	5505	Acenaphthylene	
	5555	Anthracene	
	5575	Benzo(a)anthracene	
	5580	Benzo(a)pyrene	
	5590	Benzo(g,h,i)perylene	
	5600	Benzo(k)fluoranthene	
	5585	Benzo[b]fluoranthene	
	5765	bis(2-Chloroethyl) ether	
	5855	Chrysene	
	5895	Dibenz(a,h) anthracene	
	6265	Fluoranthene	

Solids

EPA 8270D SIM	6270	Fluorene		
	6275	Hexachlorobenzene		
	4835	Hexachlorobutadiene		
	6285	Hexachlorocyclopentadiene		
	4840	Hexachloroethane		
	6315	Indeno(1,2,3-cd) pyrene		
	5005	Naphthalene		
	5015	Nitrobenzene		
	6530	n-Nitrosodimethylamine		
	6545	n-Nitrosodi-n-propylamine		
	6605	Pentachlorophenol		
	6615	Phenanthrene		
	6665	Pyrene		
EPA 9012A			10193405	Total and Amenable Cyanide (automated colorimetric with off-line distillation)
	1510	Amenable cyanide		
	1645	Total cyanide		
EPA 9012B			10243206	Total and Amenable Cyanide (automated colorimetric with off-line distillation)
	1510	Amenable cyanide		
	1645	Total cyanide		
EPA 9013			10193609	Cyanide Extraction Procedure for Solids and Oils
	9822	Extraction/Preparation		
EPA 9045C			10198400	Soil and Waste pH
	1900	pH		
EPA 9045D			10244607	Soil and Waste pH
	1900	pH		
EPA 9056A			10199607	Determination of Inorganic Anions by Ion Chromatography
	1540	Bromide		
	1575	Chloride		
	1730	Fluoride		
	1810	Nitrate as N		
	1820	Nitrate-nitrite		
	1840	Nitrite as N		
	2000	Sulfate		
EPA 9060			10200201	Total Organic Carbon
	1710	Dissolved organic carbon (DOC)		
	2040	Total organic carbon		
EPA 9060A			10244801	Total Organic Carbon
	1710	Dissolved organic carbon (DOC)		

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Solids

EPA 9060A	2040	Total organic carbon		
NWTPH-Dx			90018409	Oregon DEQ TPH Diesel Range
	9369	Diesel range organics (DRO)		
	9499	Motor Oil		
NWTPH-Gx			90018603	Oregon DEQ TPH Gasoline Range Organics by GC/FID-PID Purge & Trap
	9408	Gasoline range organics (GRO)		
NWTPH-HCID			90013200	Oregon DEQ Total Petroleum Hydrocarbon ID
	9369	Diesel range organics (DRO)		
	9408	Gasoline range organics (GRO)		
	9499	Motor Oil		
PLUMB 1981 PLUMB 1981			60006259	Extraction/Preparation
	6118	Distribution of particle sizes		
Puget Sound Estuary Program (PSEP): Conventional Sediment Variables			60006408	PSEP: Organotins, TOC, and Sulfide
	5913	Dibutyltin		
	1206	Monobutyltin		
	1209	Tetrabutyltin		
	2040	Total organic carbon		
	1213	Tributyltin		
WA EPH			60015001	Extractable Petroleum Hydrocarbons
	9369	Diesel range organics (DRO)		
	6211	EPH Aliphatic >C10-C12		
	6212	EPH Aliphatic >C12-C16		
	6214	EPH Aliphatic >C16-C21		
	6216	EPH Aliphatic >C21-C34		
	6219	EPH Aliphatic C8-C10		
	6224	EPH Aromatic >C10-C12		
	6226	EPH Aromatic >C12-C16		
	6228	EPH Aromatic >C16-C21		
	6231	EPH Aromatic >C21-C34		
	6236	EPH Aromatic C8-C10		
WA VPH			60015056	Volatile Petroleum Hydrocarbons (VPH) by GC/PID Purge & Trap
	4375	Benzene		
	4765	Ethylbenzene		
	9408	Gasoline range organics (GRO)		
	5240	m+p-xylene		
	5000	Methyl tert-butyl ether (MTBE)		
	4855	n-Hexane		
	5250	o-Xylene		

Solids	WA VPH	5140	Toluene
		5300	VPH Aliphatic >C10-C12
		5301	VPH Aliphatic >C6-C8
		5302	VPH Aliphatic >C8-C10
		5303	VPH Aliphatic C5-C6
		5308	VPH Aromatic >C10-C12
		5309	VPH Aromatic >C12-C13
		5310	VPH Aromatic >C8-C10
		5260	Xylene (total)

Quality Assurance Manual

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Quality Assurance Manual
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Technical Manager, Volatiles – Isaac Hooper	Date
Technical Manager, Semivolatiles – Joan Protasio	Date
Technical Manager, Inorganics – Stan Palmquist	Date

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REFERENCED CORPORATE SOPs AND POLICIES

SOP / Policy Reference	Title
CA-I-P-002	Electronic Reporting and Signature Policy
CA-L-P-002	Contract Compliance Policy
CW-L-S-004	Subcontracting
CA-Q-M-002	Corporate Quality Management Plan
CA-Q-S-001	Solvent and Acid Lot Testing and Approval
CA-Q-S-002	Acceptable Manual Integration Practices
CA-Q-S-006	Detection Limits
CA-T-P-001	Qualified Products List
CW-E-M-001	Corporate Environmental Health & Safety Manual
CW-F-P-002	Company-Wide Authorization Matrix
CW-F-P-004	Procurement and Contracts Policy
CW-F-S-007	Capital Expenditure, Controlled Purchase Requests and Fixed Asset Capitalization
CW-L-P-004	Ethics Policy
CW-L-S-002	Internal Investigation of Potential Data Discrepancies and Determination for Data Recall
CW-Q-S-001	Corporate Document Control and Archiving
CW-Q-S-002	Writing a Standard Operating Procedure (SOPs)
CW-Q-S-003	Internal Auditing
CW-Q-S-004	Management Systems Review

REFERENCED LABORATORY SOPs

SOP Reference	Title
TA-QA-0528	Document Control
TA-QA-0529	Complaint Resolution
TA-QA-0530	Management of Change
TA-QA-0506	Archiving Reports and Report File Maintenance
TA-QA-0608	Employee Training Procedures
TA-QA-0500	Standard Operating Procedures
TA-QA-0617	Analyst Demonstration of Capability
TA-QA-0602	Method Detection Limit Studies, Limits of Detection, Reporting Limits and Limits of Quantitation
TA-IP-0226	Multi Incremental Subsampling of Soils and Sediments
TA-QA-0028	Subsampling of Solid Samples
TA-QA-0001	Sample Receipt & Login
TA-QA-0610	Laboratory Corrective Action Procedures
TA-QA-0635	Data Review

TA-QA-0014	Selection and Use of Laboratory Balances
TA-QA-0024	Use, Calibration and Maintenance of Laboratory Thermometers
TA-QA-0016	Volumetric Verification
TA-QA-0610	Laboratory Corrective Action Procedures
TA-QA-0619	Receipt, Storage and Verification of Standards
TA-QA-0600	Quality Control Charting and Establishing

SECTION 3. INTRODUCTION, SCOPE AND APPLICABILITY

3.1 Introduction and Compliance References

TestAmerica Seattle's Quality Assurance Manual (QAM) is a document prepared to define the overall policies, organization objectives and functional responsibilities for achieving TestAmerica's data quality goals. The laboratory maintains a local perspective in its scope of services and client relations and maintains a national perspective in terms of quality.

The QAM has been prepared to assure compliance with The NELAC Institute (TNI) Standard, dated 2009, Volume 1 Modules 2 and 4, and ISO/IEC Guide 17025:2005(E). In addition, the policies and procedures outlined in this manual are compliant with TestAmerica's Corporate Quality Management Plan (CQMP) and the various accreditation and certification programs listed in Appendix 3. The CQMP provides a summary of TestAmerica's quality and data integrity system. It contains requirements and general guidelines under which all TestAmerica facilities shall conduct their operations.

The QAM has been prepared to be consistent with the requirements of the following documents:

- ANSI/ASQC, E4-1994, "Specifications and Guidelines for Quality Management Systems for Environmental Data Collection and Environmental Technology Programs" (American National Standard, January 5, 1995, or most recent version)
- "EPA Requirements for Quality Management Programs" (QA/R-2) (EPA/240/B-01/002, May 31, 2006).
- EPA 600/4-88/039, Methods for the Determination of Organic Compounds in Drinking Water, EPA, Revised July 1991.
- EPA 600/R-95/131, Methods for the Determination of Organic Compounds in Drinking Water, Supplement III, EPA, August 1995.
- EPA 600/4-79-019, Handbook for Analytical Quality Control in Water and Wastewater Laboratories, EPA, March 1979.
- Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846), Third Edition, September 1986, Final Update I, July 1992, Final Update IIA, August 1993, Final Update II, September 1994; Final Update IIB, January 1995; Final Update III, December 1996; Final Update IV, January 2008.
- U.S. Department of Defense (DoD)/Department of Energy (DOE) Consolidated Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.0, July 2013.
- *U.S. Department of Defense (DoD)/Department of Energy (DOE) Consolidated Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1, January 2017.*
- Federal Register, 40 CFR Parts 136, 141, 172, 173, 178, 179 and 261.
- APHA, Standard Methods for the Examination of Water and Wastewater, 18th Edition, 19th, 20th, 21st, and on-line Editions.
- Marine Protection, Research, and Sanctuaries Act (MPRSA).
- Toxic Substances Control Act (TSCA).

3.2 Terms and Definitions

A Quality Assurance Program is a company-wide system designed to ensure that data produced by the laboratory conforms to the standards set by state and/or federal regulations. The program functions at the management level through company goals and management policies, and at the analytical level through Standard Operating Procedures (SOPs) and quality control. The TestAmerica program is designed to minimize systematic error, encourage constructive, documented problem solving, and provide a framework for continuous improvement within the organization.

Refer to Appendix 2 for the Glossary/Acronyms.

3.3 Scope / Fields of Testing

The laboratory analyzes a broad range of environmental and industrial samples every month. Sample matrices vary among effluent water, groundwater, hazardous waste, sludge, sediments and soils. The Quality Assurance Program contains specific procedures and methods to test samples of differing matrices for chemical and physical parameters. The Program also contains guidelines on maintaining documentation of analytical processes, reviewing results, servicing clients and tracking samples through the laboratory. The technical and service requirements of all analytical requests are thoroughly evaluated before commitments are made to accept the work. Measurements are made using published reference methods or methods developed and validated by the laboratory.

The methods covered by this manual include the most frequently requested methodologies needed to provide analytical services in the United States and its territories. The specific list of test methods used by the laboratory can be found in the Laboratory Information Management System (LIMS). The approach of this manual is to define the minimum level of quality assurance and quality control necessary to meet these requirements. All methods performed by the laboratory shall meet these criteria as appropriate. In some instances, quality assurance project plans (QAPPs), project specific data quality objectives (DQOs) or local regulations may require criteria other than those contained in this manual. In these cases, the laboratory will abide by the requested criteria following review and acceptance of the requirements by the Laboratory Director and the Quality Assurance (QA) Manager. In some cases, QAPPs and DQOs may specify less stringent requirements. The Laboratory Director and the QA Manager must determine if it is in the lab's best interest to follow the less stringent requirements.

3.4 Management of the Manual

3.4.1 Review Process

The template on which this manual is based is reviewed annually by Corporate Quality Management Personnel to assure that it remains in compliance with Section 3.1. This manual itself is reviewed annually by senior laboratory management to assure that it reflects current practices and meets the requirements of the laboratory's clients and regulators as well as the CQMP. Occasionally, the manual may need changes in order to meet new or changing regulations and operations. The QA Manager will review the changes in the normal course of business and incorporate changes into revised sections of the document. All updates will be reviewed by the senior laboratory management staff. The laboratory updates and approves such changes according to our Document Control procedures (refer to SOP No. TA-QA-0528).

SECTION 4. MANAGEMENT REQUIREMENTS

4.1 Overview

TestAmerica Seattle is a local operating unit of TestAmerica Laboratories, Inc.. The organizational structure, responsibilities and authorities of the corporate staff of TestAmerica Laboratories, Inc. are presented in the CQMP. The laboratory has day-to-day independent operational authority overseen by corporate officers (e.g., President, Chief Executive Officer, Corporate Quality, etc.). The laboratory operational and support staff work under the direction of the Laboratory Director. The organizational structure for both Corporate & TestAmerica Seattle is presented in Figure 4-1.

4.2 Roles and Responsibilities

In order for the Quality Assurance Program to function properly, all members of the staff must clearly understand and meet their individual responsibilities as they relate to the quality program. The following descriptions briefly define each role in its relationship to the Quality Assurance Program.

4.2.1 Additional Requirements for Laboratories

The responsibility for quality resides with every employee of the laboratory. All employees have access to the QAM, are trained to this manual, and are responsible for upholding the standards therein. Each person carries out his/her daily tasks in a manner consistent with the goals and in accordance with the procedures in this manual and the laboratory's SOPs. Role descriptions for Corporate personnel are defined in the CQMP. This manual is specific to the operations of TestAmerica's Seattle laboratory.

4.2.2 *President and* Chief Executive Officer (CEO)

The *President and* CEO is a member of the Board of Directors and is ultimately responsible for the quality and performance of all TestAmerica facilities. The *President and* CEO establishes the overall quality standard and data integrity program for the Analytical Business, providing the necessary leadership and resources to assure that the standard and integrity program are met.

4.2.3 *Chief Operation Officer (COO)*

The COO reports directly to the President and CEO of TestAmerica. The COO oversees the operations of all TestAmerica laboratories and the EMLab P&K business unit. The VP's of Operations report directly to COO

4.2.4 Vice President of Operations

Each VP of Operations reports directly to the *Chief Operation Officer* and is a part of the Executive Committee. Each VP of Operations is responsible for the overall administrative and operational management of their respective laboratories. The VP's responsibilities include allocation of personnel and resources, long-term planning, goal setting, and achieving the financial, business, and quality objectives of TestAmerica. The VP's ensure timely compliance with Corporate Management directives, policies, and management systems reviews. The VP's are also responsible for restricting any laboratory from performing analyses that cannot be consistently and successfully performed to meet the standards set forth in this manual.

4.2.5 Vice President of Quality *and Environmental Health and Safety* (VP-QA/*EHS*)

The Vice President (VP) of QA/*EHS* reports directly to the President and CEO. With the aid of the Executive Committee, Laboratory Directors, Quality Directors, Safety Manager, EH&S Coordinators and QA Managers, the VP-QA/*EHS* has the responsibility for the establishment, general overview and Corporate maintenance of the Quality Assurance *and EH&S Programs* within TestAmerica. Additional responsibilities include:

- Review of QA/QC *and EHS* aspects of Corporate SOPs & Policies, national projects and expansions or changes in services.
- Work with various organizations outside of TestAmerica to further the development of quality standards and represent TestAmerica at various trade meetings.
- *Preparation of a monthly report that includes quality metrics across the analytical laboratories and a summary of any quality related initiatives and issues.*
- *Preparation of a monthly report that includes EH&S metrics across the analytical laboratories and a summary of any EH&S related initiatives and issues.*
- Work with various organizations outside of TestAmerica to further the development of quality standards and represent TestAmerica at various trade meetings.
- *With the assistance of the Corporate Senior Management Teams and the EHS Directors, development and implementation of the TestAmerica Environmental, Health and Safety Program.*

4.2.6 Vice President of Client Service

The VP of Client Services leads the Client Service Organization (CSO) and is responsible for client satisfaction, driving operational excellence and improving client responsiveness. The VP provides direction to the Client Service Directors, Programs Managers and Project Managers.

4.2.7 Quality Assessment Director

The Quality Assessment Director reports to the VP-QA/EHS. The Quality Assessment Director has QA oversight of laboratories; responsible for the internal audit system, schedule and procedure; monitors laboratory internal audit findings; identifies common laboratory weaknesses; and monitors corrective action closures. Together with the Quality Compliance Director, the Quality Systems Director, and the VP-QA/EHS, the Quality Assessment Director has the responsibility for the establishment, general overview and maintenance of the Analytical Quality Assurance Program within TestAmerica.

4.2.8 Quality Compliance Director

The Quality Systems Director reports to the VP-QA/EHS. The Quality Systems Director has QA oversight of laboratories; develops quality policies, procedures and management tools; monitors and communicates regulatory and certification requirements; identifies common laboratory weaknesses; and monitors corrective action closures. Together with the Quality Assessment Director, Quality Compliance Director and the VP-QA/EHS, the Quality Systems Director has the responsibility for the establishment, general overview and maintenance of the Analytical Quality Assurance Program within TestAmerica.

4.2.9 Quality Information Manager

The Quality Information Manager is responsible for managing all company official documents (e.g., Policies, Procedures, Work Instructions), the company's accreditation database, intranet websites, external laboratory subcontracting, regulatory limits for clients on the company's TotalAccess website; internal and external client support for various company groups (e.g., Client Services, EH&S, Legal, IT, Sales) for both quality and operational functions. The Quality Information Manager reports to the VP-QA/EHS; and works alongside the Quality Assessment, Quality Compliance and Quality System Directors and EHS Managers to support both the Analytical Quality Assurance and EHS Programs within TestAmerica.

4.2.10 Technical Services Director

The Technical Services Director is responsible for establishing, implementing and communicating TestAmerica's Analytical Business's Technical Policies, SOPs, and Manuals. Other responsibilities include conducting technical assessments as required, acting as a technical resource in national contracts review, coordinating new technologies, establishing best practices, advising staff on technology advances, innovations, and applications.

4.2.11 Ethics and Compliance Officers (ECOs)

TestAmerica has designated two senior members of the Corporate staff to fulfill the role of Ethics and Compliance Officer (ECO) – Corporate Counsel & VP of Human Resources and the VP-QA/EHS. Each ECO acts as a back-up to the other ECO and both are involved when data investigations occur. Each ECO has a direct line of communication to the entire senior Corporate and lab management staff.

The ECOs ensure that the organization distributes the data integrity and ethical practices policies to all employees and ensures annual trainings and orientation of new hires to the ethics program and its policies. The ECO is responsible for establishing a mechanism to foster employee reporting of incidents of illegal, unethical, or improper practices in a safe and confidential environment.

The ECOs monitor and audit procedures to determine compliance with policies and to make recommendations for policy enhancements to the President and CEO, VPOs, Laboratory Director or other appropriate individuals within the laboratory. The ECO will assist the laboratory QA Manager in the coordination of internal auditing of ethical policy related activities and processes within the laboratory, in conjunction with the laboratories regular internal auditing function.

The ECOs will also participate in investigations of alleged violations of policies and work with the appropriate internal departments to investigate misconduct, remedy the situation, and prevent recurrence of any such activity.

4.2.12 Chief Information Officer (CIO)

The CIO is responsible for establishing, implementing and communicating TestAmerica's Information Technology (IT) Policies, SOPs and Manuals. Other responsibilities include coordinating new technologies, development of electronic communication tools such as TestAmerica's intranet and internet sites, ensuring data security and documentation of software, ensuring compliance with the NELAC standard, and assistance in establishing, updating, and maintaining Laboratory Information Management Systems (LIMS) at the various TestAmerica facilities.

4.2.13 Environmental Health and Safety Managers (Corporate)

The EHS Managers report directly to the VP-QA/EHS. The EHS Managers are responsible for the development and implementation of the TestAmerica Environmental, Health and Safety program. Responsibilities include:

- Consolidation and tracking all safety and health-related information and reports for the company, and managing compliance activities for TestAmerica locations.
- Coordination/preparation of the corporate Environmental, Health and Safety Manual Template that is used by each laboratory to prepare its own laboratory-specific Safety Manual/ CHP.
- Preparation of information and training materials for laboratory EHS Coordinators.
- Assistance in the internal and external coordination of employee exposure and medical monitoring programs to insure compliance with applicable safety and health regulations.
- Serving as Department of Transportation (D.O.T.) focal point and providing technical assistance to location management.
- Serving as Hazardous Waste Management main contact and providing technical assistance to location management.

4.2.14 Laboratory Director

TestAmerica Seattle's Laboratory Director is responsible for the overall quality, safety, financial, technical, human resource and service performance of the whole laboratory and reports to their respective GM. The Laboratory Director provides the resources necessary to implement and maintain an effective and comprehensive Quality Assurance and Data Integrity Program.

Specific responsibilities include, but are not limited to:

- Provides one or more technical managers for the appropriate fields of testing. If the Technical Manager is absent for a period of time exceeding 15 consecutive calendar days, the Laboratory Director must designate another full time staff member meeting the qualifications of the Technical Manager to temporarily perform this function. If the absence exceeds 65 consecutive calendar days, the primary accrediting authority must be notified in writing.
- Ensures that all analysts and supervisors have the appropriate education and training to properly carry out the duties assigned to them and ensures that this training has been documented.
- Ensures that personnel are free from any commercial, financial and other undue pressures that might adversely affect the quality of their work.
- Ensures TestAmerica's human resource policies are adhered to and maintained.
- Ensures that sufficient numbers of qualified personnel are employed to supervise and perform the work of the laboratory.
- Ensures that appropriate corrective actions are taken to address analyses identified as requiring such actions by internal and external performance or procedural audits. Procedures that do not meet the standards set forth in the QAM or laboratory SOPs may be temporarily suspended by the Laboratory Director.
- Reviews and approves the laboratory specific QAM, policies, SOPs prior to their implementation and ensures all approved procedures are implemented and adhered to.

- Pursues and maintains appropriate laboratory certification and contract approvals. Supports ISO 17025 requirements. Organizes bid activities for prospective new projects and clients.
- Ensures client specific reporting and quality control requirements are met.
- Captains the management team, consisting of the QA Manager, the Technical Manager(s), and the Operations Manager as direct reports.
- Annually assesses the effectiveness of the QMP and QAM within the laboratory.

4.2.15 Quality Assurance (QA) Manager or Designee

The QA Manager has responsibility and authority to ensure the continuous implementation of the quality system.

The QA Manager reports directly to the Laboratory Director and their Corporate Quality Director. This position is able to evaluate data objectively and perform assessments without outside (e.g., managerial) influence. Corporate QA may be used as a resource in dealing with regulatory requirements, certifications and other quality assurance related items. The QA Manager directs the activities of the QA officers to accomplish specific responsibilities, which include, but are not limited to:

- Compliance with ISO 17025.
- Compliance with DoD/DOE QSM.
- Serves as the focal point for QA/QC in the laboratory.
- Having functions independent from laboratory operations for which he/she has quality assurance oversight.
- Maintaining and updating the QAM.
- Monitoring and evaluating laboratory certifications; scheduling proficiency testing samples.
- Monitoring and communicating regulatory changes that may affect the laboratory to management.
- Training and advising the laboratory staff on quality assurance/quality control procedures that are pertinent to their daily activities.
- Have documented training and/or experience in QA/QC procedures and the laboratory's Quality System.
- Having a general knowledge of the analytical test methods for which data audit/review is performed (and/or having the means of getting this information when needed).
- Arranging for or conducting internal audits on quality systems and the technical operation.
- The laboratory QA Manager will maintain records of all ethics-related training, including the type and proof of attendance.
- Maintain, improve, and evaluate the corrective action database and the corrective and preventive action systems.
- Notifying laboratory management of deficiencies in the quality system and ensuring corrective action is taken. Procedures that do not meet the standards set forth in the QAM or laboratory SOPs shall be investigated following procedures outlined in Section 12.

- Objectively monitors standards of performance in quality control and quality assurance without outside (e.g., managerial) influence.
- Coordinating of document control of SOPs, MDLs, control limits, and miscellaneous forms and information.
- Review a percentage of all final data reports for internal consistency. Review of Chain of Custody (COC), correspondence with the analytical request, batch QC status, completeness of any corrective action statements, 5% of calculations, format, holding time, sensibility and completeness of the project file contents.
- Review of external audit reports and data validation requests.
- Follow-up with audits to ensure client QAPP requirements are met.
- Establishment of reporting schedule and preparation of various quality reports for the Laboratory Director, clients and/or Corporate QA.
- Development of suggestions and recommendations to improve quality systems.
- Research of current state and federal requirements and guidelines.
- Captains the QA team to enable communication and to distribute duties and responsibilities.
- Ensuring Communication & monitoring standards of performance to ensure that systems are in place to produce the level of quality as defined in this document.
- Evaluation of the thoroughness and effectiveness of training.

4.2.16 Quality Assurance Assistant

The Quality Assurance Assistant performs several roles. The QA Assistant reports to the facility QA Manager. The QA Assistant is responsible for QA documentation and involvement in the following activities:

- Assisting the QA Manager in performing the annual internal laboratory audits, compiling the evaluation, and coordinating the development of an action plan to address any deficiency identified.
- Assisting the QA Manager in maintaining the laboratory's reference data to keep it current and accurate.
- Preparing certification applications for states as directed by QA Manager.
- Reviewing and maintaining personnel training records.
- Performing document control maintenance.
- Assisting departments in generating MDL spreadsheets and calculations, reviewing MDL studies submitted to QA.
- Assisting in control limit generation.
- Ensuring maintenance of records archives.
- Maintaining historical indices for all technical records including SOPs, QC records, laboratory data, etc.
- Assisting the QA Manager in meeting the responsibilities of the QA Department as described in laboratory policies and SOPs.

4.2.17 Technical Managers or Designees

The Technical Managers report directly to the Laboratory Director. He/she is accountable for all analyses and analysts under their experienced supervision and for compliance with the ISO 17025 Standard. The scope of responsibility ranges from the new-hire process and existing technology through the ongoing training and development programs for existing analysts and new instrumentation. Specific responsibilities include, but are not limited to:

- Compliance with ISO 17025.
- Compliance with DoD/DOE ELAP.
- Exercises day-to-day supervision of laboratory operations for the appropriate field of accreditation and reporting of results. Coordinating, writing, and reviewing preparation of all test methods, i.e., SOPs, with regard to quality, integrity, regulatory and optimum and efficient production techniques, and subsequent analyst training and interpretation of the SOPs for implementation and unusual project samples. He/she insures that the SOPs are properly managed and adhered to at the bench. He/she develops standard costing of SOPs to include supplies, labor, overhead, and capacity (design vs. demonstrated versus first-run yield) utilization.
- Reviewing and approving, with input from the QA Manager, proposals from marketing, in accordance with an established procedure for the review of requests and contracts. This procedure addresses the adequate definition of methods to be used for analysis and any limitations, the laboratory's capability and resources, the client's expectations. Differences are resolved before the contract is signed and work begins. A system documenting any significant changes is maintained, as well as pertinent discussions with the client regarding their requirements or the results of the analyses during the performance of the contract. All work subcontracted by the laboratory must be approved by the client. Any deviations from the contract must be disclosed to the client. Once the work has begun, any amendments to the contract must be discussed with the client and so documented.
- Monitoring the validity of the analyses performed and data generated in the laboratory. This activity begins with reviewing and supporting all new business contracts, insuring data quality, analyzing internal and external non-conformances to identify root cause issues and implementing the resulting corrective and preventive actions, facilitating the data review process (training, development, and accountability at the bench), and providing technical and troubleshooting expertise on routine and unusual or complex problems.
- Providing training and development programs to applicable laboratory staff as new hires and, subsequently, on a scheduled basis. Training includes instruction on calculations, instrumentation management to include troubleshooting and preventive maintenance.
- Enhancing efficiency and improving quality through technical advances and improved LIMS utilization. Capital forecasting and instrument life cycle planning for second generation methods and instruments as well as asset inventory management.
- Coordinating sample management from "cradle to grave," insuring that no time is lost in locating samples.
- Scheduling all QA/QC-related requirements for compliance, e.g., MDLs, etc..

- Captains department personnel to communicate quality, technical, personnel, and instrumental issues for a consistent team approach.
- Coordinates audit responses with the QA Manager.

4.2.18 Hazardous Waste Coordinator

The Hazardous Waste Coordinator reports directly to the Laboratory Director. The duties consist of:

- Managing laboratory generated hazardous waste in accordance with appropriate regulations.
- Staying current with the hazardous waste regulations.
- Continuing training on hazardous waste issues.
- Reviewing and updating annually the Hazardous Waste Contingency Plan in the Environmental Health & Safety Manual.
- Auditing the staff with regard to compliance with the Hazardous Waste Contingency Plan.
- Contacting the hazardous waste subcontractors for review of procedures and opportunities

4.2.19 Laboratory Analysts

Laboratory analysts are responsible for conducting analysis and performing all tasks assigned to them by the department manager, group leader or supervisor. The responsibilities of the analysts are listed below:

- Perform analyses by adhering to analytical and quality control protocols prescribed by current SOPs, this QA Manual, and project-specific plans honestly, accurately, timely, safely, and in the most cost-effective manner.
- Document standard and sample preparation, instrument calibration and maintenance, data calculations, sample matrix effects, and any observed non-conformance on worklists, benchsheets, lab notebooks and/or the Non-Conformance Database.
- Report all non-conformance situations, instrument problems, matrix problems and QC failures, which might affect the reliability of the data, to their supervisor, the Technical Manager, and/or the QA Manager or member of QA staff.
- Ensures sample and data integrity by adhering to internal chain-of-custody procedures.
- Perform 100% review of the data generated prior to entering and submitting for secondary level review.
- Suggest method improvements to their supervisor, the Technical Manager, and the QA Manager. These improvements, if approved, will be incorporated. Ideas for the optimum performance of their assigned area, for example, through the proper cleaning and maintenance of the assigned instruments and equipment, are encouraged.
- Work cohesively as a team in their department to achieve the goals of accurate results, optimum turnaround time, cost effectiveness, cleanliness, complete documentation, and personal knowledge of environmental analysis.
- Work Cell: A “work cell” is considered to be all those individuals who see a sample through the complete process of preparation, extraction, and analysis. To ensure that the entire preparation, extraction, and analysis process is completed by a group of capable individuals, the laboratory shall ensure that each member of the work cell (including a new member entering an already

existing work cell) demonstrates capability in his/her area of responsibility in the sequence. Even though the work cell operates as a "team," the demonstration of capability at each individual step in the sequence, as performed by each individual analyst/team member, remains of utmost importance. A work cell may NOT be defined as a group of analysts who perform the same step in the same process (for example, extractions for Method 8270), represented by one analyst who has demonstrated capability for that step.

4.2.20 Safety Officer

The Safety Officer reports to the Laboratory Director and ensures that systems are maintained for the safe operation of the laboratory. The Safety Officer is responsible to:

- Conduct ongoing, necessary safety training and conduct new employee safety orientation.
- Assist in developing and maintaining the Chemical Hygiene/Safety Manual.
- Administer dispersal of all Material Safety Data Sheet (MSDS) information.
- Perform regular chemical hygiene and housekeeping instruction.
- Give instruction on proper labeling and practice.
- Serve as chairman of the laboratory safety committee.
- Provide and train personnel on protective equipment.
- Oversee the inspection and maintenance of general safety equipment – fire extinguishers, safety showers, eyewash fountains, etc. and ensure prompt repairs as needed.
- Supervise and schedule fire drills and emergency evacuation drills.
- Determine what initial and subsequent exposure monitoring, if necessary to determine potential employee exposure to chemicals used in the laboratory.
- When determined necessary, conduct exposure monitoring assessments.
- Determine when a complaint of possible over-exposure is "reasonable" and should be referred for medical consultation.
- Assist in the internal and external coordination of the medical consultation/monitoring program conducted by TestAmerica's medical consultants.
- Manages facility maintenance.

4.2.21 Sample Receiving Staff

The Sample Receiving Technicians report to the Sample Receiving Supervisor; the Supervisor reports to the Operations Manager. The responsibilities are outlined below:

- Ensures implementation of proper sample receipt procedures, including maintenance of chain-of-custody.
- Reports nonconformances associated with condition-upon-receipt of samples.
- Logs incoming samples into the LIMS.
- Ensures that all samples are stored in the proper environment.
- Ensure the verification of data entry from login.

- Responsible for meeting quality requirements including documenting preservation.
- Responsible for ensuring the timely and correct shipment of sample containers, including proper preservatives and instructions, to clients
- Assists Environmental Health and Safety staff with sample disposal.

4.2.22 Manager of Project Management

The Project Manager Supervisor reports to the Client Services Director and serves as the interface between the laboratory's technical departments and the laboratory's clients. The staff consists of the Project Management team. With the overall goal of total client satisfaction, the functions of this position are outlined below:

- Technical training and growth of the Project Management team.
- Technical liaison for the Project Management team.
- Human resource management of the Project Management team.
- Has signature authority for laboratory reports.
- Assesses and assures customer satisfaction.
- Provides feedback to management on changing customer needs.
- Works with the Department Managers and/or Analysts/Technicians to ensure the requirements of projects are met in a timely manner.
- Organizes bid activities for prospective new projects and clients.

4.2.23 Project Managers

The Project Managers report to the Manager of Project Management and serve as the interface between the laboratory and the clients. With the overall goal of total client satisfaction, the functions of this position are outlined below:

- Responsible to ensure that clients receive the proper sampling supplies.
- Accountable for response to client inquiries concerning sample status.
- Responsible for assistance to clients regarding the resolution of problems concerning COC.
- Ensuring that client specifications, when known, are met by communicating project and quality assurance requirements to the laboratory. Prepares a Quality Assurance Summary (QAS) or equivalent summary form as needed.
- Notifying the supervisors of incoming projects and sample delivery schedules.
- Accountable to clients for communicating sample progress in daily status meeting with agreed-upon due dates.
- Approves customer requested variances to methods and to standard laboratory protocols.
- Responsible for discussing with client any project-related problems, resolving service issues, and coordinating technical details with the laboratory staff.
- Reports client inquiries involving data quality issues or data acceptability to the facility, CSM, Laboratory Director, QA Manager, and to the appropriate staff.

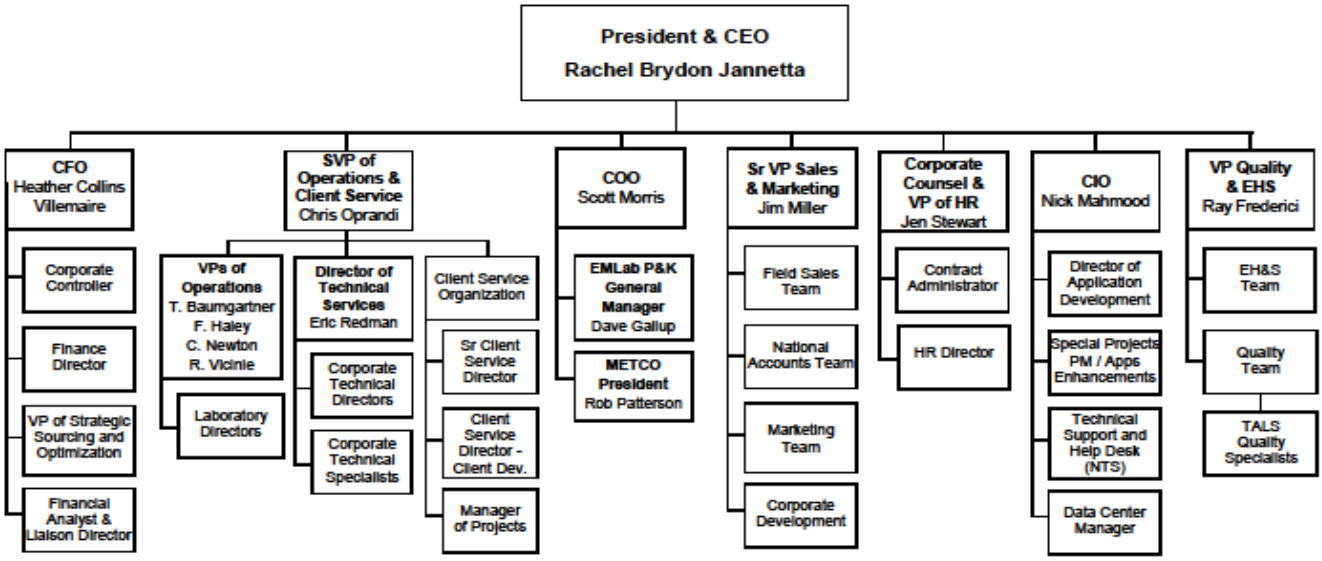
- Responsible for staff familiarization with specific quotes, sample log-in review, and final report completeness.
- Monitor the status of all data package projects in-house to ensure timely and accurate delivery of reports. Reviews project data packages for completeness and compliance to client needs and have signature authority for final reports.
- Inform clients of data package-related problems and resolve service issues.
- Coordinate requests for sample containers and other services (data packages).
- Prepares re-issue requests for project data.
- Organizes bid activities for prospective new projects and clients.
- Has signature authority for laboratory reports.

4.3 Deputies

The following table defines who assumes the responsibilities of key personnel in their absence:

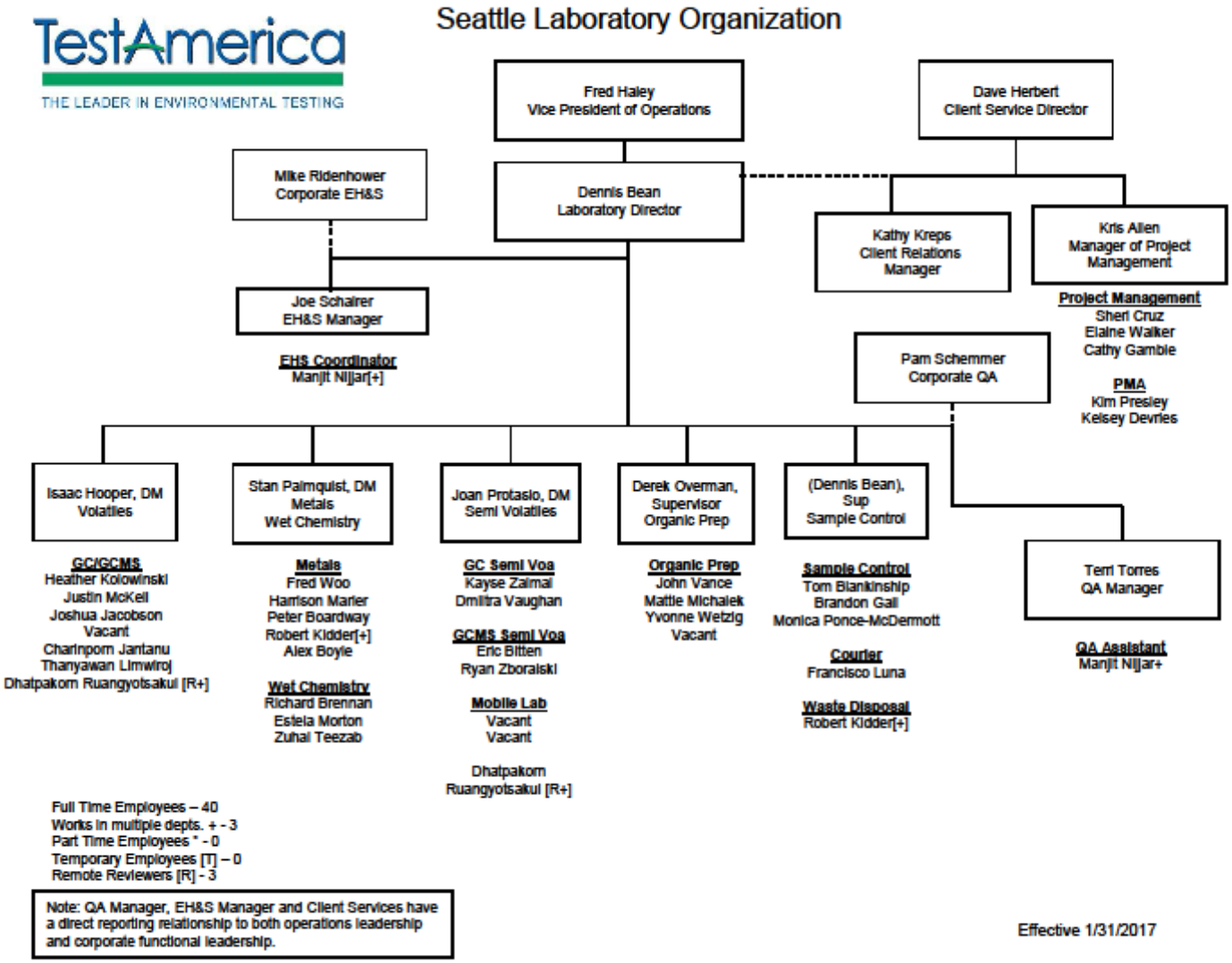
Key Personnel	Deputy
Laboratory Director	QA Manager
QA Manager	Laboratory Director
Inorganic Technical Manager	Laboratory Director
Semivolatile Technical Manager	Laboratory Director
Volatile Technical Manager	Laboratory Director
EHS Coordinator	Laboratory Director
Project Manager Supervisor	Laboratory Director

Figure 4-1. Corporate and Laboratory Organization Charts



February 27 2017

TestAmerica Seattle
Organization Chart



SECTION 5. QUALITY SYSTEM

5.1 Quality Policy Statement

It is TestAmerica's Policy to:

- Provide data of known quality to its clients by adhering to approved methodologies, regulatory requirements and the QA/QC protocols.
- Effectively manage all aspects of the laboratory and business operations by the highest ethical standards.
- Continually improve systems and provide support to quality improvement efforts in laboratory, administrative and managerial activities. TestAmerica recognizes that the implementation of a quality assurance program requires management's commitment and support as well as the involvement of the entire staff.
- Provide clients with the highest level of professionalism and the best service practices in the industry.
- To comply with the ISO/IEC 17025:2005(E) International Standard, the 2009 TNI Standard and to continually improve the effectiveness of the management system.

Every staff member at the laboratory plays an integral part in quality assurance and is held responsible and accountable for the quality of their work. It is, therefore, required that all laboratory personnel are trained and agree to comply with applicable procedures and requirements established by this document.

5.2 Ethics and Data Integrity

TestAmerica is committed to ensuring the integrity of its data and meeting the quality needs of its clients. The elements of TestAmerica's Ethics and Data Integrity Program include:

- An Ethics Policy (Corporate Policy No. CW-L-P-004) and Employee Ethics Statements.
- Ethics and Compliance Officers (ECOs).
- A Training Program.
- Self-governance through disciplinary action for violations.
- A Confidential mechanism for anonymously reporting alleged misconduct and a means for conducting internal investigations of all alleged misconduct. (Corporate SOP No. CW-L-S-002)
- Procedures and guidance for recalling data if necessary (Corporate SOP No. CW-Q-S-005).
- Effective external and internal monitoring system that includes procedures for internal audits (Section 15).
- Produce results, which are accurate and include QA/QC information that meets client pre-defined Data Quality Objectives (DQOs).
- Present services in a confidential, honest and forthright manner.

- Provide employees with guidelines and an understanding of the Ethical and Quality Standards of our Industry.
- Operate our facilities in a manner that protects the environment and the health and safety of employees and the public.
- Obey all pertinent federal, state and local laws and regulations and encourage other members of our industry to do the same.
- Educate clients as to the extent and kinds of services available.
- Assert competency only for work for which adequate personnel and equipment are available and for which adequate preparation has been made.
- Promote the status of environmental laboratories, their employees, and the value of services rendered by them.

5.3 Quality System Documentation

The laboratory's Quality System is communicated through a variety of documents.

- Quality Assurance Manual – Each laboratory has a lab-specific quality assurance manual.
- Corporate SOPs and Policies – Corporate SOPs and Policies are developed for use by all relevant laboratories. They are incorporated into the laboratory's normal SOP distribution, training and tracking system. Corporate SOPs may be general or technical.
- Work Instructions – A subset of procedural steps, tasks or forms associated with an operation of a management system (e.g., checklists, preformatted bench sheets, forms).
- Laboratory SOPs – General and Technical
- Laboratory QA/QC Policy Memorandums

5.3.1 Order of Precedence

In the event of a conflict or discrepancy between policies, the order of precedence is as follows:

- Corporate Quality Management Plan (CQMP)
- Corporate SOPs and Policies
- Laboratory QA/QC Policy Memorandum
- Laboratory Quality Assurance Manual (QAM)
- Laboratory SOPs and Policies
- Other (Work Instructions (WI), memos, flow charts, etc.)

Note: The laboratory has the responsibility and authority to operate in compliance with regulatory requirements of the jurisdiction in which the work is performed. Where the CQMP conflicts with those regulatory requirements, the regulatory requirements of the jurisdiction shall hold primacy. The laboratory's QAM shall take precedence over the CQMP in those cases.

5.4 QA/QC Objectives for the Measurement of Data

Quality Assurance (QA) and Quality Control (QC) are activities undertaken to achieve the goal of producing data that accurately characterize the sites or materials that have been sampled. Quality Assurance is generally understood to be more comprehensive than Quality Control. Quality Assurance can be defined as the integrated system of activities that ensures that a product or service meets defined standards.

Quality Control is generally understood to be limited to the analyses of samples and to be synonymous with the term “analytical quality control”. QC refers to the routine application of statistically based procedures to evaluate and control the accuracy of results from analytical measurements. The QC program includes procedures for estimating and controlling precision and bias and for determining reporting limits.

Request for Proposals (RFPs) and Quality Assurance Project Plans (QAPP) provide a mechanism for the client and the laboratory to discuss the data quality objectives in order to ensure that analytical services closely correspond to client needs. The client is responsible for developing the QAPP. In order to ensure the ability of the laboratory to meet the Data Quality Objectives (DQOs) specified in the QAPP, clients are advised to allow time for the laboratory to review the QAPP before being finalized. Additionally, the laboratory will provide support to the client for developing the sections of the QAPP that concern laboratory activities.

Historically, laboratories have described their QC objectives in terms of precision, accuracy, representativeness, comparability, completeness, selectivity and sensitivity (PARCCSS).

5.4.1 Precision

The laboratory objective for precision is to meet the performance for precision demonstrated for the methods on similar samples and to meet data quality objectives of the EPA and/or other regulatory programs. Precision is defined as the degree of reproducibility of measurements under a given set of analytical conditions (exclusive of field sampling variability). Precision is documented on the basis of replicate analysis, usually duplicate or matrix spike (MS) duplicate samples.

5.4.2 Accuracy

The laboratory objective for accuracy is to meet the performance for accuracy demonstrated for the methods on similar samples and to meet data quality objectives of the EPA and/or other regulatory programs. Accuracy is defined as the degree of bias in a measurement system. Accuracy may be documented through the use of laboratory control samples (LCS) and/or MS. A statement of accuracy is expressed as an interval of acceptance recovery about the mean recovery.

5.4.3 Representativeness

The laboratory objective for representativeness is to provide data which is representative of the sampled medium. Representativeness is defined as the degree to which data represent a characteristic of a population or set of samples and is a measurement of both analytical and field sampling precision. The representativeness of the analytical data is a function of the procedures used in procuring and processing the samples. The representativeness can be documented by the

relative percent difference between separately procured, but otherwise identical samples or sample aliquots.

The representativeness of the data from the sampling sites depends on both the sampling procedures and the analytical procedures. The laboratory may provide guidance to the client regarding proper sampling and handling methods in order to assure the integrity of the samples.

5.4.4 Comparability

The comparability objective is to provide analytical data for which the accuracy, precision, representativeness and reporting limit statistics are similar to these quality indicators generated by other laboratories for similar samples, and data generated by the laboratory over time.

The comparability objective is documented by inter-laboratory studies carried out by regulatory agencies or carried out for specific projects or contracts, by comparison of periodically generated statements of accuracy, precision and reporting limits with those of other laboratories.

5.4.5 Completeness

The completeness objective for data is 90% (or as specified by a particular project), expressed as the ratio of the valid data to the total data over the course of the project. Data will be considered valid if they are adequate for their intended use. Data usability will be defined in a QAPP, project scope or regulatory requirement. Data validation is the process for reviewing data to determine its usability and completeness. If the completeness objective is not met, actions will be taken internally and with the data user to improve performance. This may take the form of an audit to evaluate the methodology and procedures as possible sources for the difficulty or may result in a recommendation to use a different method.

5.4.6 Selectivity

Selectivity is defined as: The capability of a test method or instrument to respond to a target substance or constituent in the presence of non-target substances. Target analytes are separated from non-target constituents and subsequently identified/detected through one or more of the following, depending on the analytical method: extractions (separation), digestions (separation), interelement corrections (separation), use of matrix modifiers (separation), specific retention times (separation and identification), confirmations with different columns or detectors (separation and identification), specific wavelengths (identification), specific mass spectra (identification), specific electrodes (separation and identification), etc..

5.4.7 Sensitivity

Sensitivity refers to the amount of analyte necessary to produce a detector response that can be reliably detected (Method Detection Limit) or quantified (Reporting Limit).

5.5 Criteria for Quality Indicators

The laboratory maintains quality control limits in the Laboratory Information Management System that summarize the precision and accuracy acceptability limits for performed analyses. This summary includes an effective date, is updated each time new limits are generated and are managed by the laboratory's QA department. Unless otherwise noted, limits within these tables are laboratory generated. Some acceptability limits are derived from US EPA methods when they are required. Where US EPA method limits are not required, the laboratory has developed limits from evaluation of data from similar matrices. Criteria for development of control limits is contained in SOP TA-QA-0600 Control Charting and Establishing Method Warning and Action Limits.

5.6 Statistical Quality Control

Statistically-derived precision and accuracy limits are required by selected methods (such as SW-846) and programs, such as the Ohio Voluntary Action Plan (VAP). The laboratory routinely utilizes statistically-derived limits to evaluate method performance and determine when corrective action is appropriate. The analysts are instructed to use the current limits in the laboratory (dated and approved by the Technical Manager and QA Manager) and entered into the Laboratory Information Management System (LIMS). The Quality Assurance department maintains an archive of all limits used within the laboratory via the LIMS. If a method defines the QC limits, the method limits are used.

If a method requires the generation of historical limits, the lab develops such limits from recent data in the QC database of the LIMS following the guidelines described in Section 24. All calculations and limits are documented and dated when approved and effective. On occasion, a client requests contract-specified limits for a specific project.

Current QC limits are entered and maintained in the LIMS analyte database. As sample results and the related QC are entered into LIMS, the sample QC values are compared with the limits in LIMS to determine if they are within the acceptable range. The analyst then evaluates if the sample needs to be rerun or re-extracted/rerun or if a comment should be added to the report explaining the reason for the QC outlier.

5.6.1 QC Charts

As the QC limits are calculated, QC charts are generated showing warning and control limits for the purpose of evaluating trends. The QA Manager evaluates these to determine if adjustments need to be made or for corrective actions to methods. All findings are documented and kept on file. (Refer to SOP TA-QA-0600 Control Charting and Establishing Method Warning and Action Limits.)

5.7 Quality System Metrics

In addition to the QC parameters discussed above, the entire Quality System is evaluated on a monthly basis through the use of specific metrics (refer to Section 16). These metrics are used to drive continuous improvement in the laboratory's Quality System.

SECTION 6. DOCUMENT CONTROL

6.1 Overview

The QA Department is responsible for the control of documents used in the laboratory to ensure that approved, up-to-date documents are in circulation and out-of-date (obsolete) documents are archived or destroyed. The following documents, at a minimum, must be controlled:

- Laboratory Quality Assurance Manual
- Laboratory Standard Operating Procedures (SOP)
- Laboratory Policies
- Work Instructions and Forms
- Corporate Policies and Procedures distributed outside the intranet

Corporate Quality posts Corporate Manuals, SOPs, Policies, Work Instructions, White Papers and Training Materials on the company intranet site. These Corporate documents are only considered controlled when they are read on the intranet site. Printed copies are considered uncontrolled unless the laboratory physically distributes them as controlled documents. A detailed description of the procedure for issuing, authorizing, controlling, distributing, and archiving Corporate documents is found in Corporate SOP No. CW-Q-S-001, Corporate Document Control and Archiving. The laboratory's internal document control procedures are defined in SOPs TA-QA-0528, (Document Control) and TA-QA-0506 (Document Archiving).

The laboratory QA Department also maintains access to various references and document sources integral to the operation of the laboratory. This includes reference methods and regulations. Instrument manuals (hard or electronic copies) are also maintained by the laboratory.

The laboratory maintains control of records for raw analytical data and supporting records such as audit reports and responses, logbooks, standard logs, training files, MDL studies, Proficiency Testing (PT) studies, certifications and related correspondence, and nonconformance memos/corrective action reports. Raw analytical data consists of bound logbooks, instrument printouts, any other notes, magnetic media, electronic data and final reports.

6.2 Document Approval and Issue

The pertinent elements of a document control system for each document include a unique document title and number, pagination, the total number of pages of the item or an 'end of document' page, the effective date, revision number and the laboratory's name. The QA personnel are responsible for the maintenance of this system.

Controlled documents are authorized by the QA Department. In order to develop a new document, a technical manager submits an electronic draft to the QA Department for suggestions and approval before use. Upon approval, QA personnel add the identifying version information to the document and retains that document as the official document on file. That document is then provided to all applicable operational units (may include electronic access). Controlled documents are identified as such and records of their distribution are kept by the QA Department. Document control may be achieved by either electronic or hardcopy distribution.

The QA Department maintains a list of the official versions of controlled documents.

Quality System Policies and Procedures will be reviewed at a minimum of annually and revised as appropriate. Changes to documents occur when a procedural change warrants.

6.3 Procedures for Document Control Policy

For changes to the QA Manual, refer to SOP No. TA-QA-0528 (Document Control). Uncontrolled copies must not be used within the laboratory. Previous revisions and back-up data are stored by the QA department. Electronic copies are stored on the Public server in the QAM folder for the applicable revision.

For changes to SOPs, refer to SOP No. TA-QA-0500, *Writing a Standard Operating Procedure SOP or list your labs SOP on this topic. The SOP identified above also defines the process of changes to SOPs.*

Forms, worksheets, work instructions and information are organized by department in the QA office. There is a table of contents. Electronic versions are kept on a hard drive in the QA department; hard copies are kept in QA files. The procedure for the care of these documents is in SOP TA-QA-0528 (Document Control).

6.4 Obsolete Documents

All invalid or obsolete documents are removed, or otherwise prevented from unintended use. The laboratory has specific procedures as described above to accomplish this. In general, obsolete documents are collected from employees according to distribution lists and are marked obsolete on the cover or destroyed. At least one copy of the obsolete document is archived according to SOP No. TA-QA-0528 (Document Control).

SECTION 7. SERVICE TO THE CLIENT

7.1 Overview

The laboratory has established procedures for the review of work requests and contracts, oral or written. The procedures include evaluation of the laboratory's capability and resources to meet the contract's requirements within the requested time period. All requirements, including the methods to be used, must be adequately defined, documented and understood. For many environmental sampling and analysis programs, testing design is site or program specific and does not necessarily "fit" into a standard laboratory service or product. It is the laboratory's intent to provide both standard and customized environmental laboratory services to our clients.

A thorough review of technical and QC requirements contained in contracts is performed to ensure project success. The appropriateness of requested methods, and the lab's capability to perform them must be established. Projects, proposals and contracts are reviewed for adequately defined requirements and the laboratory's capability to meet those requirements. Alternate test methods that are capable of meeting the clients' requirements may be proposed by the lab. A review of the lab's capability to analyze non-routine analytes is also part of this review process.

All projects, proposals and contracts are reviewed for the client's requirements in terms of compound lists, test methodology requested, sensitivity (detection and reporting levels), accuracy, and precision requirements (% Recovery and RPD). The reviewer ensures that the laboratory's test methods are suitable to achieve these requirements and that the laboratory holds the appropriate certifications and approvals to perform the work. The laboratory and any potential subcontract laboratories must be certified, as required, for all proposed tests.

The laboratory must determine if it has the necessary physical, personnel and information resources to meet the contract, and if the personnel have the expertise needed to perform the testing requested. Each proposal is checked for its impact on the capacity of the laboratory's equipment and personnel. As part of the review, the proposed turnaround time will be checked for feasibility.

Electronic or hard copy deliverable requirements are evaluated against the laboratory's capacity for production of the documentation.

If the laboratory cannot provide all services but intends to subcontract such services, whether to another TestAmerica facility or to an outside firm, this will be documented and discussed with the client prior to contract approval. (Refer to Section 8 for Subcontracting Procedures.)

The laboratory informs the client of the results of the review if it indicates any potential conflict, deficiency, lack of accreditation, or inability of the lab to complete the work satisfactorily. Any discrepancy between the client's requirements and the laboratory's capability to meet those requirements is resolved in writing before acceptance of the contract. It is necessary that the contract be acceptable to both the laboratory and the client. Amendments initiated by the client and/or TestAmerica, are documented in writing.

All contracts, QAPPs, Sampling and Analysis Plans (SAPs), contract amendments, and documented communications become part of the project record.

The same contract review process used for the initial review is repeated when there are amendments to the original contract by the client, and the participating personnel are informed of the changes.

7.2 Review Sequence and Key Personnel

Appropriate personnel will review the work request at each stage of evaluation.

For routine projects and other simple tasks, a review by the Project Manager (PM) is considered adequate. The PM confirms that the laboratory has any required certifications, that it can meet the clients' data quality and reporting requirements and that the lab has the capacity to meet the clients turn around needs. It is recommended that, where there is a sales person assigned to the account, an attempt should be made to contact that sales person to inform them of the incoming samples.

For new, complex or large projects, the proposed contract is given to the Client Relationship Manager or Proposal Team, who will decide which lab will receive the work based on the scope of work and other requirements, including certification, testing methodology, and available capacity to perform the work. The contract review process is outlined in TestAmerica's Corporate SOP No. CA-L-P-002**,** Contract Compliance Policy.

This review encompasses all facets of the operation. The scope of work is distributed to the appropriate personnel, as needed based on scope of contract, to evaluate all of the requirements shown above (not necessarily in the order below):

- Contract Administrator
- VP of Operations
- Laboratory Project Manager
- Laboratory Directors and/or Corporate Technical Managers
- Laboratory Directors and/or Corporate Information Technology Managers
- Account Executives
- Laboratory and/or Corporate Quality
- Laboratory and/or Corporate Environmental Health and Safety Managers/Directors
- The Laboratory Director reviews the formal laboratory quote and makes final acceptance for their facility.

The Sales Director, Contract Administrator, Account Executive or Proposal Coordinator then submits the final proposal to the client.

In the event that one of the above personnel is not available to review the contract, his or her back-up will fulfill the review requirements.

The Contracts Department maintains copies of all signed contracts**.** The Laboratory Director also maintains copies of all signed contracts on site.

7.3 Documentation

Appropriate records are maintained for every contract or work request. All stages of the contract review process are documented and include records of any significant changes. The reviewed contracts or QAPPs, along with records identifying issues or changes (at a minimum the Additional Project Notes from the quote) will be scanned and stored on the Public server.

The contract will be distributed to and maintained by the appropriate sales/marketing personnel and the Account Executive. A copy of the contract and formal quote will be filed with the laboratory PM and the Laboratory Director.

Records are maintained of pertinent discussions with a client relating to the client's requirements or the results of the work during the period of execution of the contract. The PM keeps a phone log of conversations with the client and all actions agreed upon between the PM and the client and are officially documented with a follow-up email.

7.3.1 Project-Specific Quality Planning

Communication of contract specific technical and QC criteria is an essential activity in ensuring the success of site specific testing programs. To achieve this goal, a PM is assigned to each client. It is the PM's responsibility to ensure that project-specific technical and QC requirements are effectively evaluated and communicated to the laboratory personnel before and during the project. QA department involvement may be needed to assist in the evaluation of custom QC requirements.

PM's are the primary client contact and they ensure resources are available to meet project requirements. Although PM's do not have direct reports or staff in production, they coordinate opportunities and work with laboratory management and supervisory staff to ensure available resources are sufficient to perform work for the client's project. Project management is positioned between the client and laboratory resources.

Prior to work on a new project, the dissemination of project information and/or project opening meetings may occur to discuss schedules and unique aspects of the project. Items to be discussed may include the project technical profile, turnaround times, holding times, methods, analyte lists, reporting limits, deliverables, sample hazards, or other special requirements. The PM introduces new projects to the laboratory staff through project kick-off meetings or to the supervisory staff during production meetings. These meetings provide direction to the laboratory staff in order to maximize production and client satisfaction, while maintaining quality. In addition, project notes may be associated with each sample batch as a reminder upon sample receipt and analytical processing.

During the project, any change that may occur within an active project is agreed upon between the client/regulatory agency and the PM/laboratory. These changes (e.g., use of a non-standard method or modification of a method) and approvals must be documented prior to implementation. Documentation pertains to any document, e.g., letter, e-mail, variance, contract addendum, which has been signed by both parties.

Such changes are communicated to the laboratory during production or status meetings. These changes are also updated in the project notes and are introduced to the managers at these meetings. The laboratory staff is then introduced to the modified requirements via the PM or the individual laboratory Technical Manager. After the modification is implemented into the laboratory process, documentation of the modification is made in the case narrative of the data report(s).

The laboratory strongly encourages client visits to the laboratory and for formal/informal information sharing session with employees in order to effectively communicate ongoing client needs as well as project specific details for customized testing programs.

7.4 Special Services

The laboratory cooperates with clients and their representatives to monitor the laboratory's performance in relation to work performed for the client. It is the laboratory's goal to meet all client requirements in addition to statutory and regulatory requirements. The laboratory has procedures to ensure confidentiality to clients (Section 15 and 25).

Note: ISO/IEC 17025 states that a laboratory "shall afford clients or their representatives cooperation to clarify the client's request". This topic is discussed in Section 7.

The laboratory's standard procedures for reporting data are described in Section 25. Special services are also available and provided upon request. These services include:

- Reasonable access for our clients or their representatives to the relevant areas of the laboratory for the witnessing of tests performed for the client.
- Assist client-specified third party data validators as specified in the client's contract.

- Supplemental information pertaining to the analysis of their samples. Note: An additional charge may apply for additional data/information that was not requested prior to the time of sample analysis or previously agreed upon.

7.5 Client Communication

Project managers are the primary communication link to the clients. They shall inform their clients of any delays in project completion as well as any non-conformances in either sample receipt or sample analysis. Project management will maintain ongoing client communication throughout the entire client project.

Technical Managers are available to discuss any technical questions or concerns that the client may have.

7.6 Reporting

The laboratory works with our clients to produce any special communication reports required by the contract.

7.7 Client Surveys

The laboratory assesses both positive and negative client feedback. The results are used to improve overall laboratory quality and client service. TestAmerica's Sales and Marketing teams periodically develop lab- and client-specific surveys to assess client satisfaction.

SECTION 8. SUBCONTRACTING OF TESTS

8.1 Overview

For the purpose of this quality manual, the phrase subcontract laboratory refers to a laboratory external to the TestAmerica laboratories. The phrase "work sharing" refers to internal transfers of samples between the TestAmerica laboratories. The term outsourcing refers to the act of subcontracting tests.

When contracting with our clients, the laboratory makes commitments regarding the services to be performed and the data quality for the results to be generated. When the need arises to outsource testing for our clients because project scope, changes in laboratory capabilities, capacity or unforeseen circumstances, we must be assured that the subcontractors or work sharing laboratories understand the requirements and will meet the same commitments we have made to the client. Refer to TestAmerica's Corporate SOP's on Subcontracting Procedures (*CW-L-S-004*) *and the Work Sharing Process (CA-C-S-001).*

When outsourcing analytical services, the laboratory will assure, to the extent necessary, that the subcontract or work sharing laboratory maintains a program consistent with the requirements of this document, the requirements specified in TNI/ISO 17025 and/or the client's Quality Assurance Project Plan (QAPP). All QC guidelines specific to the client's analytical program are transmitted to the subcontractor and agreed upon before sending the samples to the subcontract facility. Additionally, work requiring accreditation will be placed with an appropriately accredited laboratory.

The laboratory performing the subcontracted work will be identified in the final report, as will non-TNI accredited work where required.

Project Managers (PMs), Managers of Project Managers, Client Relationship Managers or Account Executives (AE) for the Export Lab are responsible for obtaining client approval prior to outsourcing any samples. The laboratory will advise the client of a subcontract or work sharing arrangement in writing and when possible approval from the client shall be retained in the project folder. *Standard TestAmerica Terms & Conditions include the flexibility to subcontract samples within the TestAmerica laboratories. Therefore, additional advance notification to clients for intra-laboratory subcontracting is not necessary unless specifically required by a client contract.*

Note: In addition to the client, some regulating agencies (e.g., USDA) or contracts (e.g., DoD/DOE projects) may require notification prior to placing such work.

8.2 Qualifying and Monitoring Subcontractors

Whenever a PM, Account Executive (AE) or Client Relationship Manager becomes aware of a client requirement or laboratory need where samples must be outsourced to another laboratory, the other laboratory(s) shall be selected based on the following:

- *Subcontractors specified by the client - In these circumstances, the client assumes responsibility for the quality of the data generated from the use of a subcontractor.*
- *Subcontractors reviewed by TestAmerica – Firms which have been reviewed by the company and are known to meet standards for accreditations (e.g., State, TNI and DoD/DOE); technical specifications; legal and financial information.*

A listing of vendors is available on the TestAmerica intranet site.

All TestAmerica laboratories are pre-qualified for work sharing provided they hold the appropriate accreditations, can adhere to the project/program requirements, and the client approved sending samples to that laboratory. The client must provide acknowledgement that the samples can be sent to that facility (an e-mail is sufficient documentation or if acknowledgement is verbal, the date, time, and name of person providing acknowledgement must be documented). The originating laboratory is responsible for communicating all technical, quality, and deliverable requirements as well as other contract needs. (Corporate SOP No. CA-C-S-001, Work Sharing Process).

8.2.1 *When the potential sub-contract laboratory has not been previously approved, PM, Account Executive (AE) or Client Relationship Manager may nominate a laboratory as a subcontractor based on need. The decision to nominate a laboratory must be approved by the Client Relations Manager (CRM) or Laboratory Director. The CRM or Laboratory Director requests that the QA Manager or PM begin the process of approving the subcontract laboratory as outlined in Corporate SOP No. CW-L-S-004, Subcontracting Procedures.*

Once the appropriate accreditation and legal information is received by the laboratory, it is evaluated for acceptability (where applicable) and forwarded to the Corporate Quality Information Manager (QIM) for review. After the Corporate QIM reviews the documents for completeness, the information is forwarded to the Finance Department for formal signature and contracting with the laboratory. The approved vendor will be added to the approved subcontractor list on the intranet site and the finance group is concurrently notified for JD Edwards.

The client will assume responsibility for the quality of the data generated from the use of a subcontractor they have requested the lab to use. The qualified subcontractors on the intranet site are known to meet minimal standards. TestAmerica does not certify laboratories. The subcontractors on our approved list can only be recommended to the extent that we would use them.

8.3 Oversight and Reporting

8.3.1 *The status and performance of qualified subcontractors will be monitored by the Corporate Quality department. Any problems identified will be brought to the attention of TestAmerica's Corporate Finance, Legal and Corporate Quality personnel.*

- *Complaints shall be investigated. Documentation of the complaint, investigation and corrective action will be maintained in the subcontractor's file on the intranet site. Complaints are posted using the Vendor Performance Report.*
- *Information shall be updated on the intranet when new information is received from the subcontracted laboratories.*
- *Subcontractors in good standing will be retained on the intranet listing. CSO personnel will notify all TestAmerica laboratories, Corporate Quality and Corporate Contracts if any laboratory requires removal from the intranet site. This notification will be posted on the intranet site and e-mailed to all CSO Personnel, Laboratory Directors, QA Managers and Sales Personnel.*

Prior to initially sending samples to the subcontracted laboratory, the PM confirms their certification status to determine if it's current and scope-inclusive. The information is documented within the project records.

8.3.2 *For continued use of a subcontractor, verification of certification is placed upon the subcontractor for the defined project. Samples are subcontracted under Chain of Custody with the program defined as 'Accreditation Required' and the following statement for verification upon sample receipt:*

Note: *Since laboratory accreditations are subject to change, TestAmerica Laboratories, Inc. places the ownership of method, analyte & accreditation compliance upon our subcontract laboratories. This sample shipment is forwarded under Chain of Custody. If the laboratory does not currently maintain accreditation in the State of Origin listed above for analytes/tests/matrix being analyzed, the samples must be shipped back to the TestAmerica laboratory or other instructions will be provided. Any changes to accreditation status should be brought to TestAmerica Laboratories, Inc. attention immediately. If all requested accreditations are current to date, return the signed Chain of Custody attesting to said compliance to TestAmerica Laboratories, Inc.*

For TestAmerica laboratories, certifications can be viewed on the company's TotalAccess Database.

8.3.3 *All subcontracted samples must be accompanied by a TestAmerica Chain of Custody (COC). A copy of the original COC sent by the client must be available in TALS for all samples workshared within TestAmerica. Client COCs are only forwarded to external subcontractors when samples are shipped directly from the project site to the subcontractor lab. Under routine circumstances, client COCs are not provided to external subcontractors.*

Through communication with the subcontracted laboratory, the PM monitors the status of the subcontracted analyses, facilitates successful execution of the work, and ensures the timeliness and completeness of the analytical report.

Non-TNI accredited work must be identified in the subcontractor's report as appropriate. If TNI accreditation is not required, the report does not need to include this information.

Reports submitted from subcontractor laboratories are not altered and are included in their original form in the final project report. This clearly identifies the data as being produced by a subcontractor facility. If subcontract laboratory data is incorporated into the laboratories EDD (i.e., imported), the report must explicitly indicate which lab produced the data for which methods and samples.

Note: *The results submitted by a TestAmerica work sharing laboratory may be transferred electronically and the results reported by the TestAmerica work sharing lab are identified on the final report. The report must explicitly indicate which lab produced the data for which methods and samples. The final report must include a copy of the completed COC for all work sharing reports.*

8.4 Contingency Planning

The full qualification of a subcontractor may be waived to meet emergency needs; however, this decision & justification must be documented in the project files, and the 'Purchase Order Terms And Conditions For Subcontracted Laboratory Services' must be sent with the samples and COC.

In the event this provision is utilized, the laboratory (e.g., PM) will be required to verify and document the applicable accreditations of the subcontractor. All other quality and accreditation requirements will still be applicable, but the subcontractor need not have signed a subcontract with TestAmerica at this time

The use of any emergency subcontractor will require the PM to complete a JDE New Vendor Add Form in order to process payment to the vendor and add them to TALS. This form requires the user to define the subcontractor's category/s of testing and the reason for testing.

SECTION 9. PURCHASING SERVICES AND SUPPLIES

9.1 Overview

Evaluation and selection of suppliers and vendors is performed, in part, on the basis of the quality of their products, their ability to meet the demand for their products on a continuous and short term basis, the overall quality of their services, their past history, and competitive pricing. This is achieved through evaluation of objective evidence of quality furnished by the supplier, which can include certificates of analysis, recommendations, and proof of historical compliance with similar programs for other clients. To ensure that quality critical consumables and equipment conform to specified requirements, which may affect quality, all purchases from specific vendors are approved by a member of the supervisory or management staff. Capital expenditures are made in accordance with TestAmerica's Capital Expenditure, Controlled Purchase Requests and Fixed Asset Capitalization, SOP No. CW-F-S-007.

Contracts will be signed in accordance with TestAmerica's Company-Wide Authorization Matrix Policy, Policy No. CW-F-P-002. Request for Proposals (RFP's) will be issued where more

information is required from the potential vendors than just price. Process details are available in TestAmerica's Corporate Procurement and Contracts Policy (Policy No. CW-F-P-004). RFP's allow TestAmerica to determine if a vendor is capable of meeting requirements such as supplying all of the TestAmerica facilities, meeting required quality standards and adhering to necessary ethical and environmental standards. The RFP process also allows potential vendors to outline any additional capabilities they may offer

9.2 Glassware

Glassware used for volumetric measurements must be Class A or verified for accuracy according to laboratory procedure. Pyrex (or equivalent) glass should be used where possible. For safety purposes, thick-wall glassware should be used where available.

9.3 Reagents, Standards & Supplies

Purchasing guidelines for equipment, consumables, and reagents must meet the requirements of the specific method and testing procedures for which they are being purchased. Solvents and acids are pre-tested in accordance with TestAmerica's Corporate SOP on Solvent & Acid Lot Testing & Approval, SOP No. CA-Q-S-001. Approval information for the solvents and acids tested under SOP CA-Q-S-001 is stored on the TestAmerica Sharepoint, under Solvent Approvals. A master list of all tested materials, as well as the certificates of analysis for the materials, is stored in the same location.

9.3.1 Purchasing

Chemical reagents, solvents, glassware, and general supplies are ordered as needed to maintain sufficient quantities on hand. Materials used in the analytical process must be of a known quality. The wide variety of materials and reagents available makes it advisable to specify recommendations for the name, brand, and grade of materials to be used in any determination. This information is contained in the method SOP. The analyst completes the Material Request Sheet when requesting reagents, standards, or supplies that are not stocked in on-site consignment system that contains items approved for laboratory use.

The analyst must provide the master item number (from the master item list that has been approved by the Technical Manager), item description, package size, catalogue page number, and the quantity needed. If an item being ordered is not the exact item requested, approval must be obtained from the Technical Manager prior to placing the order. The authorized requisitioning agent places the order.

9.3.2 Receiving

It is the responsibility of the receiving clerk to receive the shipment. It is the responsibility of the analyst who ordered the materials to document the date materials where received. Once the ordered reagents or materials are received, the analyst compares the information on the label or packaging to the original order to ensure that the purchase meets the quality level specified. *This is documented through the addition of the received date and initials to the information present on the daily order log.*

The analyst verifies the lot numbers of received solvents and acids against the pre-approval lists. If a received material is listed as unapproved, or is not listed, it is sequestered and returned to the

vendor. Alternatively, the laboratory may test the material for the intended use, and if it is acceptable, document the approval on the approval list. Records of any testing performed locally are maintained on the shared "public" folder on the computer network.

Materials may not be released for use in the laboratory until they have been inspected, verified as suitable for use, and the inspection/verification has been documented.

Safety Data Sheets (SDSs) are available online through the Company's intranet website. Anyone may review these for relevant information on the safe handling and emergency precautions of on-site chemicals.

9.3.3 Specifications

Methods in use in the laboratory specify the grade of reagent that must be used in the procedure. If the quality of the reagent is not specified, analytical reagent grade will be used. It is the responsibility of the analyst to check the procedure carefully for the suitability of grade of reagent.

Chemicals must not be used past the manufacturer's expiration date and must not be used past the expiration time noted in a method SOP. If expiration dates are not provided, the laboratory may contact the manufacturer to determine an expiration date.

The laboratory assumes a five year expiration date on inorganic dry chemicals and solvents unless noted otherwise by the manufacturer or by the reference source method. Chemicals/solvents should not be used past the manufacturer's or SOPs expiration date unless 'verified' (refer to item 3 listed below).

- An expiration date **cannot** be extended if the dry chemical/solvent is discolored or appears otherwise physically degraded, the dry chemical/solvent must be discarded.
- Expiration dates can be extended if the dry chemical/solvent is found to be satisfactory based on acceptable performance of quality control samples (Continuing Calibration Verification (CCV), Blanks, Laboratory Control Sample (LCS), etc.).
- If the dry chemical/solvent is used for the preparation of standards, the expiration dates can be extended 6 months if the dry chemical/solvent is compared to an unexpired independent source in performing the method and the performance of the dry chemical/solvent is found to be satisfactory. The comparison must show that the dry chemical/solvent meets CCV limits. The comparison studies are maintained in the QA files**.**

Wherever possible, standards must be traceable to national or international standards of measurement or to national or international reference materials. Records to that effect are available to the user.

Compressed gases in use are checked for pressure and secure positioning daily. To prevent a tank from going to dryness or introducing potential impurities, the pressure should be closely watched as it decreases to approximately 15% of the original reading, at which point it should be replaced. For example, a standard sized laboratory gas cylinder containing 3,000 psig of gas should be replaced when it drops to approximately 500 psig. The quality of the gases must meet method or manufacturer specification or be of a grade that does not cause any analytical interference.

Water used in the preparation of standards or reagents must have a specific conductivity of less than 1- µmho/cm (or specific resistivity of greater than 1.0 megohm-cm) at 25°C. The *specific resistivity* is checked and recorded daily. If the water's specific *resistivity is less* than the specified limit, the Facility Manager and appropriate Technical Manager must be notified immediately in order to notify all departments, decide on cessation (based on intended use) of activities, and make arrangements for correction.

The laboratory may purchase reagent grade (or other similar quality) water for use in the laboratory. This water must be certified "clean" by the supplier for all target analytes or otherwise verified by the laboratory prior to use. This verification is documented.

Standard lots are verified before first time use if the laboratory switches manufacturers or has historically had a problem with the type of standard.

Purchased bottleware used for sampling must be certified clean and the certificates must be maintained. If uncertified sampling bottleware is purchased, all lots must be verified clean prior to use. This verification must be maintained.

Records of manufacturer's certification and traceability statements are stored as scanned images in the LIMS Reagent module. These records include date of receipt, lot number (when applicable), and expiration date (when applicable). Incorporation of the item into the record indicates that the analyst has compared the new certificate with the previous one for the same purpose and that no difference is noted, unless approved and so documented by the Technical Manager or QA Manager.

9.3.4 Storage

Reagent and chemical storage is important from the aspects of both integrity and safety. Light-sensitive reagents may be stored in brown-glass containers. Storage conditions are per the Corporate Environmental Health & Safety Manual (Corp. Doc. No. CW-E-M-001) and method SOPs or manufacturer instructions.

9.4 Purchase of Equipment / Instruments / Software

When a new piece of equipment is needed, either for additional capacity or for replacing inoperable equipment, the analyst or supervisor makes a supply request to the Technical Manager and/or the Laboratory Director. If they agree with the request, the procedures outlined in TestAmerica's Corporate Policy No. CA-T-P-001, Qualified Products List, are followed. A decision is made as to which piece of equipment can best satisfy the requirements. The appropriate written requests are completed and purchasing places the order.

Upon receipt of a new or used piece of equipment, an identification name is assigned and added to the equipment list. IT must also be notified so that they can synchronize the instrument for back-ups. Its capability is assessed to determine if it is adequate or not for the specific application. For instruments, a calibration curve is generated, followed by MDLs, Demonstration of Capabilities (DOCs), and other relevant criteria (refer to Section 19). For software, its operation must be deemed reliable and evidence of instrument verification must be retained by the QA Department. Software certificates supplied by the vendors are filed with the LIMS Administrator. The manufacturer's operation manual is retained at the bench.

9.5 Services

Service to analytical instruments (except analytical balances) is performed on an as needed basis. Routine preventative maintenance is discussed in Section 20. The need for service is determined by analysts and/or Technical Managers. The service providers that perform the services are approved by the Technical Manager.

Analytical balances are serviced and calibrated annually in accordance with SOP TA-QA-0014. The calibration and maintenance services are performed on-site, and the balances are returned to use immediately following successful calibration. When the calibration certificates are received (usually within two weeks of the service), they are reviewed, and documentation of the review is filed with the certificates. If the calibration was unsuccessful, the balance is immediately removed from service and segregated pending either further maintenance or disposal.

Calibration services for support equipment such as thermometers, weight sets, autopipettors, etc, are obtained from vendors with current and valid ISO 17025 accreditation for calibration of the specific piece of equipment. Prior to utilizing the vendor's services, the vendor's accreditation status is verified. Once the equipment has been calibrated, the calibration certificates are reviewed by the QA department, and documentation of the review is filed with the calibration certificates. The equipment is then returned to service within the laboratory

9.6 Suppliers

TestAmerica selects vendors through a competitive proposal / bid process, strategic business alliances or negotiated vendor partnerships (contracts). This process is defined in the Procurement & Contracts Policy (Policy No. CW-F-P-004). The level of control used in the selection process is dependent on the anticipated spending amount and the potential impact on TestAmerica business. Vendors that provide test and measuring equipment, solvents, standards, certified containers, instrument related service contracts or subcontract laboratory services shall be subject to more rigorous controls than vendors that provide off-the-shelf items of defined quality that meet the end use requirements. The JD Edwards purchasing system includes all suppliers/vendors that have been approved for use.

Evaluation of suppliers is accomplished by ensuring the supplier ships the product or material ordered and that the material is of the appropriate quality. This is documented by signing off on packing slips or other supply receipt documents. The purchasing documents contain the data that adequately describe the services and supplies ordered.

Any issues of vendor performance are to be reported immediately by the laboratory staff to the Corporate Purchasing Group by completing a Vendor Performance Report.

The Corporate Purchasing Group will work through the appropriate channels to gather the information required to clearly identify the problem and will contact the vendor to report the problem and to make any necessary arrangements for exchange, return authorization, credit, etc.

As deemed appropriate, the Vendor Performance Reports will be summarized and reviewed to determine corrective action necessary, or service improvements required by vendors.

The laboratory has access to a listing of all approved suppliers of critical consumables, supplies and services. This information is provided through the JD Edwards purchasing system.

9.6.1 New Vendor Procedure

TestAmerica employees who wish to request the addition of a new vendor must complete a J.D. Edwards Vendor Add Request Form.

New vendors are evaluated based upon criteria appropriate to the products or services provided as well as their ability to provide those products and services at a competitive cost. Vendors are also evaluated to determine if there are ethical reasons or potential conflicts of interest with TestAmerica employees that would make it prohibitive to do business with them as well as their financial stability. The QA Department and/or the Technology Manager are consulted with vendor and product selection that have an impact on quality.

SECTION 10. COMPLAINTS

10.1 Overview

The laboratory considers an effective client complaint handling processes to be of significant business and strategic value. Listening to and documenting client concerns captures 'client knowledge' that enables our operations to continually improve processes and client satisfaction. An effective client complaint handling process also provides assurance to the data user that the laboratory will stand behind its data, service obligations and products.

A client complaint is any expression of dissatisfaction with any aspect of our business services (e.g., communications, responsiveness, data, reports, invoicing and other functions) expressed by any party, whether received verbally or in written form. Client inquiries, complaints or noted discrepancies are documented, communicated to management, and addressed promptly and thoroughly.

The laboratory has procedures for addressing both external and internal complaints with the goal of providing satisfactory resolution to complaints in a timely and professional manner.

The nature of the complaint is identified, documented and investigated, and an appropriate action is determined and taken. In cases where a client complaint indicates that an established policy or procedure was not followed, the QA Department must evaluate whether a special audit must be conducted to assist in resolving the issue. A written confirmation or letter to the client, outlining the issue and response taken is recommended as part of the overall action taken.

The process of complaint resolution and documentation utilizes the procedures outlined in Section 12 (Corrective Actions) and laboratory SOP TA-QA-0529 (Client Complaint Resolution).

10.2 External Complaints

An employee that receives a complaint initiates the complaint resolution process by first documenting the complaint according to SOP TA-QA-0529.

Complaints fall into two categories: correctable and non-correctable. An example of a correctable complaint would be one where a report re-issue would resolve the complaint. An example of a non-correctable complaint would be one where a client complains that their data was repeatedly late.

Non-correctable complaints should be reviewed for preventive action measures to reduce the likelihood of future occurrence and mitigation of client impact.

The general steps in the complaint handling process are:

- Receiving and Documenting Complaints
- Complaint Investigation and Service Recovery
- Process Improvement

The laboratory shall inform the initiator of the complaint of the results of the investigation and the corrective action taken, if any.

10.3 Internal Complaints

Internal complaints include, but are not limited to: errors and non-conformances, training issues, internal audit findings, and deviations from methods. Corrective actions may be initiated by any staff member who observes a nonconformance and shall follow the procedures outlined in Section 12. In addition, Corporate Management, Sales and Marketing and IT may initiate a complaint by contacting the laboratory or through the corrective action system described in Section 12.

10.4 Management Review

The number and nature of client complaints is reported by the QA Manager to the laboratory and Quality Director in the QA Monthly report. Monitoring and addressing the overall level and nature of client complaints and the effectiveness of the solutions is part of the Annual Management Review (Section 16).

SECTION 11. CONTROL OF NON-CONFORMING WORK

11.1 Overview

When data discrepancies are discovered or deviations and departures from laboratory SOPs, policies and/or client requests have occurred, corrective action is taken immediately. First, the laboratory evaluates the significance of the nonconforming work. Then, a corrective action plan is initiated based on the outcome of the evaluation. If it is determined that the nonconforming work is an isolated incident, the plan could be as simple as adding a qualifier to the final results and/or making a notation in the case narrative. If it is determined that the nonconforming work is a systematic or improper practices issue, the corrective action plan could include a more in depth investigation and a possible suspension of an analytical method. In all cases, the actions taken are documented using the laboratory's corrective action system (refer to Section 12).

Due to the frequently unique nature of environmental samples, sometimes departures from documented policies and procedures are needed. When an analyst encounters such a situation, the problem is presented to the supervisor for resolution. The supervisor may elect to discuss it with the Technical Manager or have a representative contact the client to decide on a logical course of action. Once an approach is agreed upon, the analyst documents it using the laboratory's corrective action system described in Section 12. This information can then be supplied to the client in the form of a footnote or a case narrative with the report.

Project Management may encounter situations where a client may request that a special procedure be applied to a sample that is not standard lab practice. Based on a technical evaluation, the lab may accept or opt to reject the request based on technical or ethical merit. An example might be the need to report a compound that the lab does not normally report. The lab would not have validated the method for this compound following the procedures in Section 19. The client may request that the compound be reported based only on the calibration. Such a request would need to be approved by the Technical Manager and QA Manager, documented and included in the project folder. Deviations **must** also be noted on the final report with a statement that the compound is not reported in compliance with TNI (or the analytical method) requirements and the reason. Data being reported to a non-NELAC state would need to note the change made to how the method is normally run.

11.2 Responsibilities and Authorities

Under certain circumstances, the Laboratory Director, a Technical Manager, or a member of the QA team may authorize departures from documented procedures or policies. The departures may be a result of procedural changes due to the nature of the sample; a one-time procedure for a client; QC failures with insufficient sample to reanalyze, etc.. In most cases, the client will be informed of the departure prior to the reporting of the data. Any departures must be well documented using the laboratory's corrective action procedures. This information may also be documented in logbooks and/or data review checklists as appropriate**.** Any impacted data must be referenced in a case narrative and/or flagged with an appropriate data qualifier.

Any misrepresentation or possible misrepresentation of analytical data discovered by any laboratory staff member must be reported to facility Senior Management within 24-hours. The Senior Management staff is comprised of the Laboratory Director, the QA Manager, and the Technical Managers. The reporting of issues involving alleged violations of the company's Data Integrity or Manual Integration procedures must be conveyed to an Ethics and Compliance Officer (ECO), Exec. Director of Quality & EHS and the laboratory's Quality Director within 24 hours of discovery.

Whether an inaccurate result was reported due to calculation or quantitation errors, data entry errors, improper practices, or failure to follow SOPs, the data must be evaluated to determine the possible effect.

The Laboratory Director, QA Manager, ECOs, VP of Operations and the Quality Directors have the authority and responsibility to halt work, withhold final reports, or suspend an analysis for due cause as well as authorize the resumption of work.

11.3 Evaluation of Significance and Actions Taken

For each nonconforming issue reported, an evaluation of its significance and the level of management involvement needed is made. This includes reviewing its impact on the final data, whether or not it is an isolated or systematic issue, and how it relates to any special client requirements.

Corporate SOP entitled Data Recalls (CW-Q-S-005) is the procedure to be followed when it is discovered that erroneous or biased data may have been reported to clients or regulatory agencies.

Corporate SOP entitled Internal Investigations (CW-L-S-002) is the procedure to be followed for investigation and correction of situations involved alleged incidents of misconduct or violation of the company's ethics policy.

Laboratory level decisions are documented and approved using the laboratory's standard nonconformance/corrective action reporting in lieu of the data recall determination form contained in TestAmerica's Corporate SOP No. CW-Q-S-005.

11.4 Prevention of NonConforming Work

If it is determined that the nonconforming work could recur, further corrective actions must be made following the laboratory's corrective action system. On a weekly basis, the QA Department evaluates non-conformances to determine if any nonconforming work has been repeated multiple times. If so, the laboratory's corrective action process may be followed.

11.5 Method Suspension / Restriction (Stop Work Procedures)

In some cases, it may be necessary to suspend/restrict the use of a method or target compound which constitutes significant risk and/or liability to the laboratory. Suspension/restriction procedures can be initiated by any of the persons noted in Section 11.2, Paragraph 5.

Prior to suspension/restriction, confidentiality will be respected, and the problem with the required corrective and preventive action will be stated in writing and presented to the Laboratory Director and Operations Manager.

The Laboratory Director shall arrange for the appropriate personnel to meet with the QA Manager as needed. This meeting shall be held to confirm that there is a problem, that suspension/restriction of the method is required and will be concluded with a discussion of the steps necessary to bring the method/target or test fully back on line. In some cases, that may not be necessary if all appropriate personnel have already agreed there is a problem and there is agreement on the steps needed to bring the method, target or test fully back on line. The QA Manager will also initiate a corrective action report as described in Section 12 if one has not already been started. A copy of any meeting notes and agreed upon steps should be faxed or e-mailed by the laboratory to the appropriate VP of Operations and member of Corporate QA. This fax/e-mail acts as notification of the incident.

After suspension/restriction, the lab will hold all reports to clients pending review. No faxing, mailing or distributing through electronic means may occur. The report must not be posted for viewing on the internet. It is the responsibility of the Laboratory Director to hold all reporting and to notify all relevant laboratory personnel regarding the suspension/restriction (e.g., Project Management, Log-in, etc…). Clients will NOT generally be notified at this time. Analysis may proceed in some instances depending on the non-conformance issue.

Within 72 hours, the QA Manager will determine if compliance is now met and reports can be released, OR determine the plan of action to bring work into compliance, and release work. A team, with all principals involved (Laboratory Director, Technical Manager, QA Manager) can devise a start-up plan to cover all steps from client notification through compliance and release of reports. Project Management and the Directors of Client Services and Sales and Marketing must be notified if clients must be notified or if the suspension/restriction affects the laboratory's ability to accept work. The QA Manager must approve start-up or elimination of any restrictions after all corrective

action is complete. This approval is given by final signature on the completed corrective action report.

SECTION 12. CORRECTIVE ACTION

12.1 Overview

A major component of TestAmerica's Quality Assurance (QA) Program is the problem investigation and feedback mechanism designed to keep the laboratory staff informed on quality related issues and to provide insight to problem resolution. When nonconforming work or departures from policies and procedures in the quality system or technical operations are identified, the corrective action procedure provides a systematic approach to assess the issues, restore the laboratory's system integrity, and prevent reoccurrence. Corrective actions are documented using Non-Conformance Memo (NCM) and Corrective Action Reports (CAR) (refer to SOP No. TA-QA-0610 and Figure 12-1).

12.2 General

Problems within the quality system or within analytical operations may be discovered in a variety of ways, such as QC sample failures, internal or external audits, proficiency testing (PT) performance, client complaints, staff observation, etc.

The purpose of a corrective action system is to:

- Identify non-conformance events and assign responsibility(s) for investigating.
- Resolve non-conformance events and assign responsibility for any required corrective action.
- Identify systematic problems before they become serious.
- Identify and track client complaints and provide resolution.

12.2.1 **Non-Conformance Memo (NCM)** - is used to document the following types of corrective actions:

- Deviations from an established procedure or SOP
- QC outside of limits (non-matrix related)
- Isolated reporting / calculation errors
- Client complaints
- Discrepancies in materials / goods received vs. manufacturer packing slips.

12.2.2 **Corrective Action Report (CAR)** - is used to document the following types of corrective actions:

- Questionable trends that are found in the review of NCMs.
- Issues found while reviewing NCMs that warrant further investigation.
- Internal and external audit findings.
- Failed or unacceptable PT results.
- Corrective actions that cross multiple departments in the laboratory.

- Systematic reporting / calculation errors
- Client complaints
- Data recall investigations
- Identified poor process or method performance trends
- Excessive revised reports
- Health and Safety violations

This will provide background documentation to enable root cause analysis and preventive action.

12.3 Closed Loop Corrective Action Process

Any employee in the company can initiate a corrective action. There are four main components to a closed-loop corrective action process once an issue has been identified: Cause Analysis, Selection and Implementation of Corrective Actions (both short and long term), Monitoring of the Corrective Actions, and Follow-up. (refer to SOP No. TA-QA-0610 for more detail)

12.3.1 Cause Analysis

- Upon discovery of a non-conformance event, the event must be defined and documented. An NCM or CAR must be initiated, someone is assigned to investigate the issue and the event is investigated for cause. Table 12-1 provides some general guidelines on determining responsibility for assessment.
- The cause analysis step is the key to the process as a long term corrective action cannot be determined until the cause is determined.
- If the cause is not readily obvious, the Technical Manager, Laboratory Director, or QA Manager (or QA designee) is consulted.

12.3.2 Selection and Implementation of Corrective Actions

- Where corrective action is needed, the laboratory shall identify potential corrective actions. The action(s) most likely to eliminate the problem and prevent recurrence are selected and implemented. Responsibility for implementation is assigned.
- Corrective actions shall be to a degree appropriate to the magnitude of the problem identified through the cause analysis.
- Whatever corrective action is determined to be appropriate, the laboratory shall document and implement the changes. The NCM or CAR is used for this documentation.

12.3.3 Root Cause Analysis

Root Cause Analysis is a class of problem solving (investigative) methods aimed at identifying the basic or causal factor(s) that underlie variation in performance or the occurrence of a significant failure. The root cause may be buried under seemingly innocuous events, many steps preceding the perceived failure. At first glance, the immediate response is typically directed at a symptom and not the cause. Typically, root cause analysis would be best with three or more incidents to triangulate a weakness. *Corporate SOP Root Cause Analysis (No. CA-Q-S-009) describes the procedure.*

Systematically analyze and document the root causes of the more significant problems that are reported. Identify, track, and implement the corrective actions required to reduce the likelihood of

recurrence of significant incidents. Trend the root cause data from these incidents to identify root causes that, when corrected, can lead to dramatic improvements in performance by eliminating entire classes of problems.

Identify the one event associated with problem and ask why this event occurred. Brainstorm the root causes of failures; for example, by asking why events occurred or conditions existed; and then why the cause occurred 5 consecutive times until you get to the root cause. For each of these sub events or causes, ask why it occurred. Repeat the process for the other events associated with the incident.

Root cause analysis does not mean the investigation is over. Look at technique, or other systems outside the normal indicators. Often creative thinking will find root causes that ordinarily would be missed, and continue to plague the laboratory or operation.

12.3.4 Monitoring of the Corrective Actions

- *The Technical Manager and QA Manager are responsible to ensure that the corrective action taken was effective.*
- *Ineffective actions are documented and re-evaluated until acceptable resolution is achieved. Technical Managers are accountable to the Laboratory Director to ensure final acceptable resolution is achieved and documented appropriately.*
- *Each NCM and CAR is entered into a database for tracking purposes and a monthly summary of all corrective actions is printed out for review to aid in ensuring that the corrective actions have taken effect.*
- *TestAmerica laboratories began using the Incident/Corrective Action Tracker (iCAT) database developed by the company in 2015. (Previously, a local database served this purpose.) An incident is an event triggering the need for one or more corrective actions as distinct from a corrective action, a potential deficiency stemming from an incident that requires investigation and possibly fixing. The database is independent of TALS, available to all local and corporate managers, and capable of notifying and tracking multiple corrective actions per event, dates, and personnel. iCAT allows associated document upload, categorization (such as, external/internal audit, client service concerns, data quality issues, proficiency testing, etc.), and trend analysis. Refer to Figure 12-1.*
- *The QA Manager reviews monthly NCMs and CARs for trends. Highlights are included in the QA monthly report (refer to Section 16). If a significant trend develops that adversely affects quality, an audit of the area is performed and corrective action implemented.*
- *Any out-of-control situations that are not addressed acceptably at the laboratory level may be reported to the Corporate Quality Director by the QA Manager, indicating the nature of the out-of-control situation and problems encountered in solving the situation.*

12.3.5 Follow-up Audits

- Follow-up audits may be initiated by the QA Manager and shall be performed as soon as possible when the identification of a nonconformance casts doubt on the laboratory's compliance with its own policies and procedures, or on its compliance with state or federal requirements.
- These audits often follow the implementation of the corrective actions to verify effectiveness. An additional audit would only be necessary when a critical issue or risk to business is discovered.

(Also refer to Section 15.1.4, Special Audits.)

12.4 Technical Corrective Actions

In addition to providing acceptance criteria and specific protocols for technical corrective actions in the method SOPs, the laboratory has general procedures to be followed to determine when departures from the documented policies and procedures and quality control have occurred (refer to Section 11). The documentation of these procedures is through the use of an NCM.

Table 12-1 includes examples of general technical corrective actions. For specific criteria and corrective actions, refer to the analytical methods or specific method SOPs. The laboratory may also maintain Work Instructions on these items that are available upon request.

Table 12-1 provides some general guidelines for identifying the individual(s) responsible for assessing each QC type and initiating corrective action. The table also provides general guidance on how a data set should be treated if associated QC measurements are unacceptable. Specific procedures are included in Method SOPs, Work Instructions and QAM Sections 19 and 20. All corrective actions are reviewed monthly, at a minimum, by the QA Manager and highlights are included in the QA monthly report.

To the extent possible, samples shall be reported only if all quality control measures are acceptable. If the deficiency does not impair the usability of the results, data will be reported with an appropriate data qualifier and/or the deficiency will be noted in the case narrative. Where sample results may be impaired, the Project Manager is notified by an NCM and appropriate corrective action (e.g., reanalysis) is taken and documented**.**

12.5 Basic Corrections

When mistakes occur in records, each mistake shall be crossed-out, [not obliterated (e.g. no white-out), and the correct value entered alongside. All such corrections shall be initialed (or signed) and dated by the person making the correction. In the case of records stored electronically, the original “uncorrected” file must be maintained intact and a second “corrected” file is created.

This same process applies to adding additional information to a record. All additions made later than the initial must also be initialed (or signed) and dated.

When corrections are due to reasons other than obvious transcription errors, the reason for the corrections (or additions) shall also be documented.

Figure 12-1.

Example - Non Conformance Memo

NCM	TestAmerica Seattle - 145339
Project	WWTP
Job/Client	580-66230-1 ABC Inc.
Lab Section	GC/MS Semi VOA
Method	625
NCM Type	Deficiency - CCV - %D, High, Sample ND, Sample IDs Included
Affected Items	580-66230-B-1-A Client Sample-B1 CCVIS 580-239305/3
Narrative for Job 580-66230-1	The continuing calibration verification (CCV) associated with batch 580-239305 recovered above the upper control limit for Bis(2-ethylhexyl) phthalate. The samples associated with this CCV were non-detects for the affected analytes; therefore, the data have been reported. The following sample is impacted: Client Sample-B1 (580-66230-1) and (CCVIS 580-239305/3).
Internal Comments	[INTERNALCOMMENTS]

Example – Corrective Action Report

iCAT id:	Created On:	Created By:
Subject:	Client:	Project (if applicable):
Laboratory Function:	Corrective Action Type:	Finding Number:
Finding Reference:	Priority:	Assigned To:
Response Due to QA:	Planned Issue Closure Date:	Date Closed:
Follow-Up Assigned To:		Date Follow-Up Due:

Corrective Action Requested:

Investigation/Response:

Root Cause Analysis:

Corrective Action:

Table 12-1. Example – General Corrective Action Procedures

QC Activity (Individual Responsible for Initiation/Assessment)	Acceptance Criteria	Recommended Corrective Action
Initial Instrument Blank (Analyst)	- Instrument response < MDL.	- Prepare another blank. - If same response, determine cause of contamination: reagents, environment, instrument equipment failure, etc..
Initial Calibration Standards (Analyst, Technical Manager(s))	- Correlation coefficient > 0.99 or standard concentration value. - % Recovery within acceptance range. - See details in Method SOP.	- Reanalyze standards. - If still unacceptable, remake standards and recalibrate instrument.
Independent Calibration Verification (Second Source) (Analyst, Technical Manager(s))	- % Recovery within control limits.	- Remake and reanalyze standard. - If still unacceptable, then remake calibration standards or use new primary standards and recalibrate instrument.
Continuing Calibration Standards (Analyst, Data Reviewer)	% Recovery within control limits.	- Reanalyze standard. - If still unacceptable, then recalibrate and rerun affected samples.
Laboratory Control Sample (LCS) (Analyst, Data Reviewer)	- % Recovery within limits specified in LIMS.	- Batch must be re-prepared and re-analyzed. This includes any allowable marginal exceedance. When not using marginal exceedances, the following exceptions apply: 1) when the acceptance criteria for the positive control are exceeded high (i.e., high bias) and there are associated samples that are non-detects, then those non-detects may be reported with data qualifying codes; 2) when the acceptance criteria for the positive control are exceeded low (i.e., low bias), those sample results may be reported if they exceed a maximum regulatory limit/decision level with data qualifying codes. **Note:** If there is insufficient sample or the holding time cannot be met, contact client and report with flags.

QC Activity (Individual Responsible for Initiation/Assessment)	Acceptance Criteria	Recommended Corrective Action
Matrix Spike / Matrix Spike Duplicate (MS/MSD) (Analyst, Data Reviewer)	- % Recovery within limits documented in LIMS.	- If the acceptance criteria for duplicates or matrix spikes are not met because of matrix interferences, the acceptance of the analytical batch is determined by the validity of the LCS. - If the LCS is within acceptable limits the batch is acceptable. - The results of the duplicates, matrix spikes and the LCS are reported with the data set. - For matrix spike or duplicate results outside criteria, the data for that sample shall be reported with qualifiers.
Surrogates (Analyst, Data Reviewer)	- % Recovery within limits of method or within three standard deviations of the historical mean.	- Individual sample must be repeated. Place comment in LIMS. - Surrogate results outside criteria shall be reported with qualifiers.
Method Blank (MB) (Analyst, Data Reviewer)	< Reporting Limit [1]	- Reanalyze blank. - If still positive, determine source of contamination. If necessary, reprocess (i.e. digest or extract) entire sample batch. Report blank results. - Qualify the result(s) if the concentration of a targeted analyte in the MB is at or above the reporting limit AND is > 1/10 of the amount measured in the sample.
Proficiency Testing (PT) Samples (QA Manager, Technical Manager(s)	- Criteria supplied by PT Supplier.	- Any failures or warnings must be investigated for cause. Failures may result in the need to repeat a PT sample to show the problem is corrected.
Internal / External Audits (QA Manager, Technical Manager(s), Laboratory Director)	- Defined in Quality System documentation such as SOPs, QAM, etc..	- Non-conformances must be investigated through CAR system and necessary corrections must be made.

QC Activity (Individual Responsible for Initiation/Assessment)	Acceptance Criteria	Recommended Corrective Action
Reporting / Calculation Errors (Depends on issue – possible individuals include: Analysts, Data Reviewers, Project Managers, Technical Managers, QA Manager, Corporate QA, Corporate Management)	- SOP CW-L-S-002, Internal Investigation of Potential Data Discrepancies and Determination for Data Recall.	- Corrective action is determined by type of error. Follow the procedures in SOP CW-L-S-002 or Lab SOP TA-QA-0610 Laboratory Corrective Action Procedures.
Client Complaints (Project Managers, Lab Director, Sales and Marketing)	-	- Corrective action is determined by the type of complaint. For example, a complaint regarding an incorrect address on a report will result in the report being corrected and then follow-up must be performed on the reasons the address was incorrect (e.g., database needs to be updated).
QA Monthly Report (Refer to Section 16 for an example) (QA Manager, Lab Director, Technical Manager(s))	- QAM, SOPs.	- Corrective action is determined by the type of issue. For example, CARs for the month are reviewed and possible trends are investigated.
Health and Safety Violation (Safety Officer, Lab Director, Technical Manager(s))	- Environmental Health and Safety (EHS) Manual.	- Non-conformance is investigated and corrected through CAR system.

Note:

1. Except as noted below for certain compounds, the method blank should be below the detection limit or for DoD/DOE projects the method blank should be below ½ the RL. Concentrations up to five times the reporting limit will be allowed for the ubiquitous laboratory and reagent contaminants: methylene chloride, toluene, acetone, 2-butanone and phthalates **provided** they appear in similar levels in the reagent blank and samples. This allowance presumes that the detection limit is significantly below any regulatory limit to which the data are to be compared and that blank subtraction will not occur. For benzene and ethylene dibromide (EDB) and other analytes for which regulatory limits are extremely close to the detection limit, the method blank must be below the method detection limit.

SECTION 13. PREVENTIVE ACTION / IMPROVEMENT

13.1 Overview

The laboratory's preventive action programs improve or eliminate potential causes of nonconforming product and/or nonconformance to the quality system. This preventive action process is a proactive and continuous process of improvement activities that can be initiated through feedback from clients, employees, business providers, and affiliates. The QA Department has the overall responsibility to ensure that the preventive action process is in place, and that relevant information on actions is submitted for management review.

Dedicating resources to an effective preventive action system emphasizes the laboratory's commitment to its Quality Program. It is beneficial to identify and address negative trends before they develop into complaints, problems and corrective actions. Additionally, the laboratory continually strives to improve customer service and client satisfaction through continuous improvements to laboratory systems.

Opportunities for improvement may be discovered through any of the following:

- *review of the monthly QA Metrics Report,*
- *trending NCMs,*
- *review of control charts and QC results,*
- *trending proficiency testing (PT) results,*
- *performance of management system reviews,*
- *trending client complaints,*
- *review of processing operations, or*
- *staff observations.*

The monthly Management Systems Metrics Report shows performance indicators in all areas of the laboratory and quality system. These areas include revised reports, corrective actions, audit findings, internal auditing and data authenticity audits, client complaints, PT samples, holding time violations, SOPs, ethics training, etc. The metrics report is reviewed monthly be the laboratory management, Corporate QA and TestAmerica's Executive Committee. These metrics are used ~~to~~ in evaluating the management and quality system performance on an ongoing basis and provide a tool for identifying areas for improvement.

Items identified as continuous improvement opportunities to the management system may be issued as goals from the annual management systems review, recommendations from internal audits, white papers, Lesson Learned, Technical Services audit report, Technical Best Practices, or as Corporate or management initiatives.

The laboratory's corrective action process is integral to implementation of preventive actions. A critical piece of the corrective action process is the implementation of actions to prevent further occurrence of a non-compliance event. Historical review of corrective action and non-conformances provides a valuable mechanism for identifying preventive action opportunities.

13.1.1 The following elements are part of a preventive action/process improvement system:

- Identification of an opportunity for preventive action or process improvement.

- Process for the preventive action or improvement.
- Define the measurements of the effectiveness of the process once undertaken.
- Execution of the preventive action or improvement.
- Evaluation of the plan using the defined measurements.
- Verification of the effectiveness of the preventive action or improvement.
- Close-Out by documenting any permanent changes to the Quality System as a result of the Preventive Action or Process Improvement. Documentation of Preventive Action/Process Improvement is incorporated into the monthly QA reports, corrective action process and management review.

13.1.2 Any Preventive Actions/Process Improvement undertaken or attempted shall be taken into account during the annual Management Systems Review (Section 16). A highly detailed report is not required; however, a summary of successes and failures within the preventive action program is sufficient to provide management with a measurement for evaluation.

13.2 Management of Change

The Management of Change process is designed to manage significant events and changes that occur within the laboratory. Through these procedures, the potential risks inherent with a new event or change are identified and evaluated. The risks are minimized or eliminated through pre-planning and the development of preventive measures. The types of changes covered under this system include: Facility Changes, Major Accreditation Changes, Addition or Deletion to Division's Capabilities or Instrumentation, Key Personnel Changes, Laboratory Information Management System (LIMS) changes. This process is discussed in further detail in SOP TA-QA-0530, Management of Change.

SECTION 14. CONTROL OF RECORDS

The laboratory maintains a records management system appropriate to its needs and that complies with applicable standards or regulations as required. The system produces unequivocal, accurate records that document all laboratory activities. The laboratory retains all original observations, calculations and derived data, calibration records and a copy of the analytical report for a minimum of five years after it has been issued. *Exceptions for programs with longer retention requirements are discussed in Section 14.1.2.*

14.1 Overview

The laboratory has established procedures for identification, collection, indexing, access, filing, storage, maintenance and disposal of quality and technical records. A record index is listed in Table 14-1. *More detailed information on retention of specific records is provided in CW-L-P-001, Records Retention Policy and CW-L-WI-001, TestAmerica Records Retention/Storage Schedule.* Quality records are maintained by the QA department in a database, which is backed up as part of the regular laboratory backup. Records are of two types; either electronic or hard copy paper formats depending on whether the record is computer or hand generated (some records may be in both formats, in this instance the electronic copy will be considered to be the vital record). Technical records are maintained by the Technical Managers.

Table 14-1. Record Index[1]

	Record Types [1]:	**Retention Time:**
Technical Records	- Raw Data - Logbooks[2] - Standards - Certificates - Analytical Records - MDLs/IDLs/DOCs - Lab Reports	5 Years from analytical report issue*
Official Documents	- Quality Assurance Manual (QAM) - Work Instructions - Policies - SOPs - Policy Memorandums - Manuals - *Published Methods*	*Indefinitely*
QA Records	*- Certifications* *- Method and Software Validation / Verification Data*	*Indefinitely*
QA Records	- Internal & External Audits/Responses - Corrective/Preventive Actions - Management Reviews - Data Investigation	5 Years from archival* **Data Investigation:** 5 years or the life of the affected raw data storage whichever is greater (beyond 5 years if ongoing project or pending investigation)
Project Records	- Sample Receipt & COC Documents - Contracts and Amendments - Correspondence - QAPP - SAP - Telephone Logbooks - Lab Reports	5 Years from analytical report issue*
Administrative Records	*Financial and Business Operations*	*Refer to CW-L-WI-001*
	EH&S Manual, Permits	*Indefinitely*
	Disposal Records	Indefinitely
	Employee Handbook	Indefinitely
	Personnel files, Employee Signature & Initials, Administrative Training Records (e.g., Ethics)	Refer to HR Manual
	Administrative Policies	*Indefinitely*
	Technical Training Records	*7 years*
	Legal Records	*Indefinitely*
	HR Records	*Refer to CW-L-WI-001*
	IT Records	*Refer to CW-L-WI-001*
	Corporate Governance Records	*Refer to CW-L-WI-001*
	Sales & Marketing	*5 years*
	Real Estate	*Indefinitely*

[1] Record Types encompass hardcopy and electronic records.
[2] Examples of Logbook types: Maintenance, Instrument Run, Preparation (standard and samples), Standard and Reagent Receipt, Archiving, Balance Calibration, Temperature (hardcopy or electronic records).
* Exceptions listed in Table 14-2.

14.1.1 All records are stored and retained in such a way that they are secure and readily retrievable at the laboratory or the Iron Mountain data storage facility that provide a suitable environment to prevent damage or deterioration and to prevent loss. All records shall be protected against fire, theft, loss, environmental deterioration, and vermin. In the case of electronic records, electronic or magnetic sources, storage media are protected from deterioration caused by magnetic fields and/or electronic deterioration.

Access to the data is limited to laboratory and company employees and shall be documented with an access log**.** Records archived off-site are stored in a secure location where a record is maintained of any entry into the storage facility. Whether on-site or off-site storage is used, logs are maintained in each storage box to note removal and return of records. Retention of records are maintained on-site at the laboratory for at least 6 months after their generation and moved offsite for the remainder of the required storage time. Records are maintained for a minimum of five years unless otherwise specified by a client or regulatory requirement.

For raw data and project records, record retention shall be calculated from the date the project report is issued. For other records, such as Controlled Documents, QA, or Administrative Records, the retention time is calculated from the date the record is formally retired. Records related to the programs listed in Table 14-2 have lengthier retention requirements and are subject to the requirements in Section 14.1.3.

14.1.2 <u>Programs with Longer Retention Requirements</u>

Some regulatory programs have longer record retention requirements than the standard record retention time. These are detailed in Table 14-2 with their retention requirements. In these cases, the longer retention requirement is enacted. If special instructions exist such that client data cannot be destroyed prior to notification of the client, the container or box containing that data is marked as to who to contact for authorization prior to destroying the data.

Table 14-2. Example: Special Record Retention Requirements

Program	[1]Retention Requirement
Drinking Water – All States	*10 years (lab reports and raw data)* 10 years - Radiochemistry (project records)
Drinking Water Lead and Copper Rule	12 years (project records)
Alaska	10 years
Navy Facilities Engineering Service Center (NFESC)	10 years
TSCA - 40 CFR Part 792	10 years after publication of final test rule or negotiated test agreement

[1]Note: Extended retention requirements must be noted with the archive documents or addressed in facility-specific records retention procedures.

14.1.3 The laboratory has procedures to protect and back-up records stored electronically and to prevent unauthorized access to or amendment of these records. All analytical data is maintained as hard copy or in a secure readable electronic format. For analytical reports that are maintained as copies in PDF format, refer to Section 19.14.1 for more information. Additional information can also

be reference in SOP TA-QA-0506 Archiving Data and Reports.

14.1.4 The record keeping system allows for historical reconstruction of all laboratory activities that produced the analytical data, as well as rapid recovery of historical data. The history of the sample from when the laboratory took possession of the samples must be readily understood through the documentation. This shall include inter-laboratory transfers of samples and/or extracts.

- The records include the identity of personnel involved in sampling, sample receipt, preparation, or testing. All analytical work contains the initials (at least) of the personnel involved. The laboratory's copy of the COC is stored with the invoice and the work order sheet generated by the LIMS. The chain of custody would indicate the name of the sampler. If any sampling notes are provided with a work order, they are kept with this package.

- All information relating to the laboratory facilities equipment, analytical test methods, and related laboratory activities, such as sample receipt, sample preparation, or data verification are documented.

- The record keeping system facilitates the retrieval of all working files and archived records for inspection and verification purposes (e.g., set format for naming electronic files, set format for what is included with a given analytical data set as per SOP TA-QA-0506 Archiving Reports and Report File Maintenance). Instrument data is stored sequentially by instrument. A given day's analyses are maintained in the order of the analysis. Run logs are maintained for each instrument or method; a copy of each day's run log or instrument sequence is stored with the data to aid in re-constructing an analytical sequence. Where an analysis is performed without an instrument, bound logbooks or bench sheets are used to record and file data. Standard and reagent information is recorded in logbooks or entered into the LIMS for each method as required.

- Changes to hardcopy records shall follow the procedures outlined in Section 12 and 19. Changes to electronic records in LIMS or instrument data are recorded in audit trails.

- The reason for a signature or initials on a document is clearly indicated in the records such as "sampled by," "prepared by," "reviewed by", or "analyzed by".

- All generated data except those that are generated by automated data collection systems, are recorded directly, promptly and legibly in permanent dark ink.

- Hard copy data may be scanned into PDF format for record storage as long as the scanning process can be verified in order to ensure that no data is lost and the data files and storage media must be tested to verify the laboratory's ability to retrieve the information prior to the destruction of the hard copy that was scanned. The procedure for this verification can be found in SOP TA-QA-0506 Archiving Reports and Report File Maintenance.

- Also refer to Section 19.14.1 'Computer and Electronic Data Related Requirements'**.**

14.2 <u>Technical and Analytical Records</u>

14.2.1 The laboratory retains records of original observations, derived data and sufficient information to establish an audit trail, calibration records, staff records and a copy of each analytical

report issued, for a minimum of five years unless otherwise specified by a client or regulatory requirement. The records for each analysis shall contain sufficient information to enable the analysis to be repeated under conditions as close as possible to the original. The records shall include the identity of laboratory personnel responsible for the performance of each analysis and reviewing results.

14.2.2 Observations, data and calculations are recorded real-time and are identifiable to the specific task.

14.2.3 Changes to hardcopy records shall follow the procedures outlined in Section 12 and 19. Changes to electronic records in LIMS or instrument data are recorded in audit trails.

The essential information to be associated with analysis, such as strip charts, tabular printouts, computer data files, analytical notebooks, and run logs, include:

- laboratory sample ID code**;**
- Date of analysis; Time of Analysis is also required if the holding time is seventy-two (72) hours or less, or when time critical steps are included in the analysis (e.g., drying times, incubations, etc.); instrumental analyses have the date and time of analysis recorded as part of their general operations. Where a time critical step exists in an analysis, location for such a time is included as part of the documentation in a specific logbook or on a benchsheet or in the LIMS.
- Instrumentation identification and instrument operating conditions/parameters. Operating conditions/parameters are typically recorded in instrument maintenance logs where available.
- analysis type**;**
- all manual calculations and manual integrations**;**
- analyst's or operator's initials/signature**;**
- sample preparation including cleanup, separation protocols, incubation periods or subculture, ID codes, volumes, weights, instrument printouts, meter readings, calculations, reagents**;**
- test results**;**
- standard and reagent origin, receipt, preparation, and use**;**
- calibration criteria, frequency and acceptance criteria**;**
- data and statistical calculations, review, confirmation, interpretation, assessment and reporting conventions**;**
- quality control protocols and assessment**;**
- electronic data security, software documentation and verification, software and hardware audits, backups, and records of any changes to automated data entries; and
- Method performance criteria including expected quality control requirements. These are indicated both in the LIMS and on specific analytical report formats**.**

14.2.4 *All logbooks used during receipt, preparation, storage, analysis, and reporting of samples or monitoring of support equipment shall undergo a documented supervisory or peer review on a monthly basis.*

14.3 Laboratory Support Activities

In addition to documenting all the above-mentioned activities, the following are retained QA records and project records (previous discussions in this section relate where and how these data are stored):

- all original raw data, whether hard copy or electronic, for calibrations, samples and quality control measures, including analysts' work sheets and data output records (chromatograms, strip charts, and other instrument response readout records)**;**
- a written description or reference to the specific test method used which includes a description of the specific computational steps used to translate parametric observations into a reportable analytical value**;**
- copies of final reports**;**
- archived SOPs**;**
- correspondence relating to laboratory activities for a specific project**;**
- all corrective action reports, audits and audit responses**;**
- proficiency test results and raw data; and
- results of data review, verification, and crosschecking procedures.

14.3.1 Sample Handling Records

Records of all procedures to which a sample is subjected while in the possession of the laboratory are maintained. These include but are not limited to records pertaining to:

- sample preservation including appropriateness of sample container and compliance with holding time requirement;
- sample identification, receipt, acceptance or rejection and login;
- sample storage and tracking including shipping receipts, sample transmittal / COC forms; and
- procedures for the receipt and retention of samples, including all provisions necessary to protect the integrity of samples.

14.4 Administrative Records

The laboratory also maintains the administrative records in either electronic or hard copy form. Refer to Table 14-1.

14.5 Records Management, Storage and Disposal

All records (including those pertaining to test equipment), certificates and reports are safely stored, held secure and in confidence to the client. Certification related records are available upon request.

All information necessary for the historical reconstruction of data is maintained by the laboratory. Records that are stored only on electronic media must be supported by the hardware and software necessary for their retrieval.

Records that are stored or generated by computers or personal computers have hard copy, write-protected backup copies, or an electronic audit trail controlling access**.**

The laboratory has a record management system (a.k.a., document control) for control of laboratory notebooks, instrument logbooks, standards logbooks, and records for data reduction, validation, storage and reporting. Laboratory notebooks are issued on a per analysis basis, and are numbered sequentially. All data are recorded sequentially within a series of sequential notebooks. Bench sheets are filed sequentially. Standards are maintained in the LIMS – no logbooks are used to record that data**.** Records are considered archived when noted as such in the records management system (a.k.a., document control.)

14.5.1 Transfer of Ownership

In the event that the laboratory transfers ownership or goes out of business, the laboratory shall ensure that the records are maintained or transferred according to client's instructions. Upon ownership transfer, record retention requirements shall be addressed in the ownership transfer agreement and the responsibility for maintaining archives is clearly established. In addition, in cases of bankruptcy, appropriate regulatory and state legal requirements concerning laboratory records must be followed. In the event of the closure of the laboratory, all records will revert to the control of the corporate headquarters. Should the entire company cease to exist, as much notice as possible will be given to clients and the accrediting bodies who have worked with the laboratory during the previous 5 years of such action.

14.5.2 Records Disposal

Records are removed from the archive and destroyed after 5 years unless otherwise specified by a client or regulatory requirement. On a project specific or program basis, clients may need to be notified prior to record destruction. Records are destroyed in a manner that ensures their confidentiality such as shredding, mutilation or incineration. (Refer to Tables 14-1 and 14-2).

Electronic copies of records must be destroyed by erasure or physically damaging off-line storage media so no records can be read.

If a third party records management company is hired to dispose of records, a "Certificate of Destruction" is required.

SECTION 15. AUDITS

15.1 Internal Audits

Internal audits are performed to verify that laboratory operations comply with the requirements of the lab's quality system and with the external quality programs under which the laboratory operates. Audits are planned and organized by the QA staff. Personnel conducting the audits should be independent of the area being evaluated. Auditors will have sufficient authority, access to work areas, and organizational freedom necessary to observe all activities affecting quality and to report the assessments to laboratory management and**,** when requested**,** to corporate management.

Audits are conducted and documented as described in the TestAmerica Corporate SOP on performing Internal Auditing, SOP No. CW-Q-S-003. The types and frequency of routine internal

audits are described in Table 15-1. Special or ad hoc assessments may be conducted as needed under the direction of the QA staff.

Table 15-1. Types of Internal Audits and Frequency

Description	Performed by	Frequency
Quality Systems Audits	QA Department, QA approved designee, or Corporate QA	All areas of the laboratory annually
Method Audits QA Technical Audits	Joint responsibility: QA Manager or designee Technical Manager or Designee (Refer to CW-Q-S-003)	Technical Audits Frequency: 50% of methods annually
SOP Method Compliance	Joint responsibility: a) QA Manager or designee b) Technical Manager or Designee (Refer to CW-Q-S-003)	SOP Compliance Review Frequency: Every 2 years 100% of SOPs annually for methods and administrative SOPs related to DoD/DOE programs
Special	QA Department or Designee	Surveillance or spot checks performed as needed, e.g., to confirm corrective actions from other audits.
Performance Testing	Analysts with QA oversight	Two successful per year for each TNI-field of testing or as dictated by regulatory requirements

15.1.1 Annual Quality Systems Audit

An annual quality systems audit is required to ensure compliance to analytical methods and SOPs, TestAmerica's Data Integrity and Ethics Policies, TNI quality systems, client and state requirements, and the effectiveness of the internal controls of the analytical process, including but not limited to data review, quality controls, preventive action and corrective action. The completeness of earlier corrective actions is assessed for effectiveness & sustainability. The audit is divided into sections for each operating or support area of the lab, and each section is comprehensive for a given area. The area audits may be performed on a rotating schedule throughout the year to ensure adequate coverage of all areas. This schedule may change as situations in the laboratory warrant.

15.1.2 QA Technical Audits

QA technical audits assess data authenticity and analyst integrity. These audits are based on client projects, associated sample delivery groups, and the methods performed. Reported results are compared to raw data to verify the authenticity of results. The validity of calibrations and QC results are compared to data qualifiers, footnotes, and case narratives. Documentation is assessed by examining run logs and records of manual integrations. Manual calculations are checked. Where possible, electronic audit miner programs (e.g., Chrom AuditMiner) are used to identify unusual manipulations of the data deserving closer scrutiny. QA technical audits will include all methods within a two-year period. Al*l analysts should be reviewed over the course of a two year period through at least one QA Technical Audit*

15.1.3 SOP Method Compliance

Compliance of all SOPs with the source methods and compliance of the operational groups with the SOPs will be assessed by the Technical Manager or qualified designee at least every two years, annually for methods and administrative SOPs related to DoD/DOE programs. It is also recommended that the work of each newly hired analyst is assessed within 3 months of working independently, (e.g., completion of method IDOC). In addition, as analysts add methods to their capabilities, (new IDOC) reviews of the analyst work products will be performed within 3 months of completing the documented training.

15.1.4 Special Audits

Special audits are conducted on an as needed basis, generally as a follow up to specific issues such as client complaints, corrective actions, PT results, data audits, system audits, validation comments, regulatory audits or suspected ethical improprieties. Special audits are focused on a specific issue, and report format, distribution, and timeframes are designed to address the nature of the issue.

15.1.5 Performance Testing

The laboratory participates semi-annually in performance audits conducted through the analysis of PT samples provided by a third party. The laboratory generally participates in the following types of PT studies: UST, Drinking Water, Non Potable Water, and Solid Hazardous Waste.

It is TestAmerica's policy that PT samples be treated as typical samples in the production process. Furthermore, where PT samples present special or unique problems, in the regular production process they may need to be treated differently, as would any special or unique request submitted by any client. The QA Manager must be consulted and in agreement with any decisions made to treat a PT sample differently due to some special circumstance.

Written responses to unacceptable PT results are required. In some cases it may be necessary for blind QC samples to be submitted to the laboratory to show a return to control.

15.2 External Audits

External audits are performed when certifying agencies or clients conduct on-site inspections or submit performance testing samples for analysis. It is TestAmerica's policy to cooperate fully with regulatory authorities and clients. The laboratory makes every effort to provide the auditors with access to personnel, documentation, and assistance. Laboratory supervisors are responsible for providing corrective actions to the QA Manager who coordinates the response for any deficiencies discovered during an external audit. Audit responses are due in the time allotted by the client or agency performing the audit. When requested, a copy of the audit report and the labs corrective action plan will be forwarded to Corporate Quality.

The laboratory cooperates with clients and their representatives to monitor the laboratory's performance in relation to work performed for the client. The client may only view data and systems related directly to the client's work. All efforts are made to keep other client information confidential.

15.2.1 Confidential Business Information (CBI) Considerations

During on-site audits, auditors may come into possession of information claimed as business

confidential. A business confidentiality claim is defined as "a claim or allegation that business information is entitled to confidential treatment for reasons of business confidentiality or a request for a determination that such information is entitled to such treatment." When information is claimed as business confidential, the laboratory must place on (or attach to) the information at the time it is submitted to the auditor, a cover sheet, stamped or typed legend or other suitable form of notice, employing language such as "trade secret", "proprietary" or "company confidential". Confidential portions of documents otherwise non-confidential must be clearly identified. CBI may be purged of references to client identity by the responsible laboratory official at the time of removal from the laboratory. However, sample identifiers may not be obscured from the information. Additional information regarding CBI can be found in within the 2009 TNI standards.

15.3 Audit Findings

Audit findings are documented using the corrective action process and database. The laboratory's corrective action responses for both types of audits may include action plans that could not be completed within a predefined timeframe. In these instances, a completion date must be set and agreed to by operations management and the QA Manager.

Developing and implementing corrective actions to findings is the responsibility of the Technical Manager where the finding originated. Findings that are not corrected by specified due dates are reported monthly to management in the QA monthly report. When requested, a copy of the audit report and the labs corrective action plan will be forwarded to Corporate Quality.

If any audit finding casts doubt on the effectiveness of the operations or on the correctness or validity of the laboratory's test results, the laboratory shall take timely corrective action, and shall notify clients in writing if the investigations show that the laboratory results have been affected. Once corrective action is implemented, a follow-up audit is scheduled to ensure that the problem has been corrected.

Clients must be notified promptly in writing, of any event such as the identification of defective measuring or test equipment that casts doubt on the validity of results given in any test report or amendment to a test report. The investigation must begin within 24-hours of discovery of the problem and all efforts are made to notify the client within two weeks after the completion of the investigation.

SECTION 16. MANAGEMENT REVIEWS

16.1 Quality Assurance Report

A comprehensive QA Report shall be prepared each month by the laboratory's QA Department and forwarded to the Laboratory Director, Technical Managers, their Quality Director as well as the VP of Operations. All aspects of the QA system are reviewed to evaluate the suitability of policies and procedures. During the course of the year, the Laboratory Director, VP of Operations or Corporate QA may request that additional information be added to the report.

On a monthly basis, Corporate QA compiles information from all the monthly laboratory reports. The Corporate Quality Directors prepare a report that includes a compilation of all metrics and notable information and concerns regarding the QA programs within the laboratories. The report also

includes a listing of new regulations that may potentially impact the laboratories. This report is presented to the Senior Management Team and VPs of Operations.

16.2 Annual Management Review

The senior lab management team (Laboratory Director, Technical Managers, QA Manager) conducts a review annually of its quality systems and LIMS to ensure its continuing suitability and effectiveness in meeting client and regulatory requirements and to introduce any necessary changes or improvements. It will also provide a platform for defining goals, objectives and action items that feed into the laboratory planning system. Corporate Operations and Corporate QA personnel is be included in this meeting at the discretion of the Laboratory Director. The LIMS review consists of examining any audits, complaints or concerns that have been raised through the year that are related to the LIMS. The laboratory will summarize any critical findings that can not be solved by the lab and report them to Corporate IT.

This management systems review (Corporate SOP No. CW-Q-S-004 & Work Instruction No. CA-Q-WI-020) uses information generated during the preceding year to assess the “big picture” by ensuring that routine actions taken and reviewed on a monthly basis are not components of larger systematic concerns. The monthly review should keep the quality systems current and effective, therefore, the annual review is a formal senior management process to review specific existing documentation. Significant issues from the following documentation are compiled or summarized by the QA Manager prior to the review meeting:

- Matters arising from the previous annual review.
- Prior Monthly QA Reports issues.
- Laboratory QA Metrics.
- Review of report reissue requests.
- Review of client feedback and complaints.
- Issues arising from any prior management or staff meetings.
- Minutes from prior senior lab management meetings. Issues that may be raised from these meetings include:
    - Adequacy of staff, equipment and facility resources.
    - Adequacy of policies and procedures.
    - Future plans for resources and testing capability and capacity.
- The annual internal double blind PT program sample performance (if performed),
- Compliance to the Ethics Policy and Data Integrity Plan. Including any evidence/incidents of inappropriate actions or vulnerabilities related to data Integrity.
- *For labs analyzing radioactive samples, also include the following:*
    - *Radiation health and safey*
    - *Radioactive hazardous waste management*
    - *Radioactive materials management*

A report is generated by the QA Manager and management. The report is distributed to the appropriate VP of Operation and the Quality Director. The report includes, but is not limited to:

- The date of the review and the names and titles of participants.
- A reference to the existing data quality related documents and topics that were reviewed.
- Quality system or operational changes or improvements that will be made as a result of the review [e.g., an implementation schedule including assigned responsibilities for the changes (Action Table)].

Changes to the quality systems requiring update to the laboratory QA Manual shall be included in the next revision of the QA Manual.

16.3 Potential Integrity Related Managerial Reviews

Potential integrity issues (data or business related) must be handled and reviewed in a confidential manner until such time as a follow-up evaluation, full investigation, or other appropriate actions have been completed and issues clarified. TestAmerica's Corporate Data Investigations SOP shall be followed (SOP No. CW-L-S-002). All investigations that result in finding of inappropriate activity are documented and include any disciplinary actions involved, corrective actions taken, and all appropriate notifications of clients.

TestAmerica's *President and* CEO, Executive VP of Operations, VP of Client & Technical Services, VPs of Operations and Quality Directors receive a monthly report from the *VP-QA/EHS* summarizing any current data integrity or data recall investigations. The VPs of Operations are also made aware of progress on these issues for their specific labs.

SECTION 17. PERSONNEL

17.1 Overview

The laboratory's management believes that its highly qualified and professional staff is the single most important aspect in assuring a high level of data quality and service. The staff consists of professionals and support personnel as outlined in the organization chart in Figure 4-1.

All personnel must demonstrate competence in the areas where they have responsibility. Any staff that is undergoing training shall have appropriate supervision until they have demonstrated their ability to perform their job function on their own. Staff shall be qualified for their tasks based on appropriate education, training, experience and/or demonstrated skills as required.

The laboratory employs sufficient personnel with the necessary education, training, technical knowledge and experience for their assigned responsibilities.

All personnel are responsible for complying with all QA/QC requirements that pertain to the laboratory and their area of responsibility. Each staff member must have a combination of experience and education to adequately demonstrate a specific knowledge of their particular area of responsibility. Technical staff must also have a general knowledge of lab operations, test methods, QA/QC procedures and records management.

Laboratory management is responsible for formulating goals for lab staff with respect to education, training and skills and ensuring that the laboratory has a policy and procedures for identifying training needs and providing training of personnel. The training shall be relevant to the present and anticipated responsibilities of the lab staff.

The laboratory only uses personnel that are employed by or under contract to, the laboratory. Contracted personnel, when used, must meet competency standards of the laboratory and work in accordance to the laboratory's quality system.

17.2 Education and Experience Requirements for Technical Personnel

The laboratory makes every effort to hire analytical staffs that possess a college degree (AA, BA, BS) in an applied science with some chemistry in the curriculum. Exceptions can be made based upon the individual's experience and ability to learn. Selection of qualified candidates for laboratory employment begins with documentation of minimum education, training, and experience prerequisites needed to perform the prescribed task. Minimum education and training requirements for TestAmerica employees are outlined in job descriptions and are generally summarized for analytical staff in the table below.

The laboratory maintains job descriptions for all personnel who manage, perform or verify work affecting the quality of the environmental testing the laboratory performs. Job Descriptions are located on the TestAmerica intranet site's Human Resources web-page (Also see Section 4 for position descriptions/responsibilities).

Experience and specialized training are occasionally accepted in lieu of a college degree (basic lab skills such as using a balance, colony counting, aseptic or quantitation techniques, etc., are also considered).

As a general rule for analytical staff:

Specialty	Education	Experience
Extractions, Digestions, some electrode methods (pH, DO, Redox, etc.), or Titrimetric and Gravimetric Analyses	H.S. Diploma	On the job training (OJT)
GFAA, CVAA, FLAA, Single component or short list Chromatography (e.g., Fuels, BTEX-GC, IC	A college degree in an applied science or 2 years of college and at least 1 year of college chemistry	Or 2 years prior analytical experience is required
ICP, ICPMS, Long List or complex chromatography (e.g., Pesticides, PCB, Herbicides, HPLC, etc.), GCMS	A college degree in an applied science or 2 years of college chemistry	or 5 years of prior analytical experience
Spectra Interpretation	A college degree in an applied science or 2 years of college chemistry	And 2 years relevant experience Or 5 years of prior analytical experience

Specialty	Education	Experience
Technical Managers – **General**	Bachelors Degree in an applied science or engineering with 24 semester hours in chemistry An advanced (MS, PhD.) degree may substitute for one year of experience	And 2 years experience in environmental analysis of representative analytes for which they will oversee
Technical Managers – **Wet Chem** only (no advanced instrumentation)	Associates degree in an applied science or engineering or 2 years of college with 16 semester hours in chemistry	And 2 years relevant experience

When an analyst does not meet these requirements, they can perform a task under the direct supervision of a qualified analyst, peer reviewer or Technical Manager, and are considered an analyst in training. The person supervising an analyst in training is accountable for the quality of the analytical data and must review and approve data and associated corrective actions.

17.3 Training

The laboratory is committed to furthering the professional and technical development of employees at all levels.

Orientation to the laboratory's policies and procedures, in-house method training, and employee attendance at outside training courses and conferences all contribute toward employee proficiency. Below are examples of various areas of required employee training:

Required Training	Time Frame	Employee Type
Environmental Health & Safety	Prior to lab work	All
Ethics – New Hires	1 week of hire	All
Ethics – Comprehensive	90 days of hire	All
Data Integrity	30 days of hire	Technical and PMs
Quality Assurance	90 days of hire	All
Ethics – Comprehensive Refresher	Annually	All
Initial Demonstration of Capability (DOC)	Prior to unsupervised method performance	Technical

The laboratory maintains records of relevant authorization/competence, education, professional qualifications, training, skills and experience of technical personnel (including contracted personnel) as well as the date that approval/authorization was given. These records are kept on file at the laboratory. Also refer to "Demonstration of Capability" in Section 19.

The training of technical staff is kept up to date by:

- Each employee must have documentation in their training file that they have read, understood and agreed to follow the most recent version of the laboratory QA Manual and SOPs in their area of responsibility. This documentation is updated as SOPs are updated.
- Documentation from any training courses or workshops on specific equipment, analytical techniques or other relevant topics are maintained in their training file.
- Documentation of proficiency (refer to Section 19).
- An Ethics Agreement signed by each staff member (renewed each year) and evidence of annual ethics training.
- A Confidentiality Agreement signed by each staff member signed at the time of employment.
- Human Resources maintains documentation and attestation forms on employment status & records; benefit programs; timekeeping/payroll; and employee conduct (e.g., ethics violations). This information is maintained in the employee's secured personnel file.

Evidence of successful training could include such items as:

- Adequate documentation of training within operational areas, including one-on-one technical training for individual technologies, and particularly for people cross-trained.
- Analysts knowledge to refer to QA Manual for quality issues.
- Analysts following SOPs, i.e., practice matches SOPs.
- Analysts regularly communicate to supervisors and QA if SOPs need revision, rather than waiting for auditors to find problems.

Further details of the laboratory's training program are described in the Employee Training SOP (TA-QA-0608).

17.4 Data Integrity and Ethics Training Program

Establishing and maintaining a high ethical standard is an important element of a Quality System. Ethics and data integrity training is integral to the success of TestAmerica and is provided for each employee at TestAmerica. It is a formal part of the initial employee orientation within 1 week of hire followed by technical data integrity training within 30 days, comprehensive training within 90 days, and an annual refresher for all employees. Senior management at each facility performs the ethics training for their staff.

In order to ensure that all personnel understand the importance TestAmerica places on maintaining high ethical standards at all times; TestAmerica has established a Corporate Ethics Policy (Policy No. CW-L-P-004) and an Ethics Statement. All initial and annual training is documented by signature on the signed Ethics Statement demonstrating that the employee has participated in the training and understands their obligations related to ethical behavior and data integrity.

Violations of this Ethics Policy will not be tolerated. Employees who violate this policy will be subject to disciplinary actions up to and including termination. Criminal violations may also be referred to the Government for prosecution. In addition, such actions could jeopardize TestAmerica's ability to

do work on Government contracts, and for that reason, TestAmerica has a Zero Tolerance approach to such violations.

Employees are trained as to the legal and environmental repercussions that result from data misrepresentation. Key topics covered in the presentation include:

- Organizational mission and its relationship to the critical need for honesty and full disclosure in all analytical reporting.
- Ethics Policy
- How and when to report ethical/data integrity issues. Confidential reporting.
- Record keeping.
- Discussion regarding data integrity procedures.
- Specific examples of breaches of ethical behavior (e.g. peak shaving, altering data or computer clocks, improper macros, etc., accepting/offering kickbacks, illegal accounting practices, unfair competition/collusion)
- Internal monitoring. Investigations and data recalls.
- Consequences for infractions including potential for immediate termination, debarment, or criminal prosecution.
- Importance of proper written narration / data qualification by the analyst and project manager with respect to those cases where the data may still be usable but are in one sense or another partially deficient.

Additionally, a data integrity hotline (1-800-736-9407) is maintained by TestAmerica and administered by the Corporate Quality Department.

SECTION 18. ACCOMMODATIONS AND ENVIRONMENTAL CONDITIONS

18.1 Overview

The fixed laboratory is a 20,000 ft^2 secure laboratory facility with controlled access and designed to accommodate an efficient workflow and to provide a safe and comfortable work environment for employees. All visitors sign in and are escorted by laboratory personnel. Access is controlled by various measures.

The mobile trailers (Units #1 and #2) are 29' 5th wheel trailers designed to accommodate an efficient workflow and to provide a safe and comfortable work environment for employees. The mobile van (Unit #3) is a 23 ft van designed to accommodate an efficient workflow and to provide a safe and comfortable work environment for employees.

The fixed and mobile laboratories are equipped with structural safety features. Each employee is familiar with the location, use, and capabilities of general and specialized safety features associated with their workplace. The laboratory provides and requires the use of protective equipment including safety glasses, protective clothing, gloves, etc., OSHA and other regulatory agency guidelines regarding required amounts of bench and fume hood space, lighting, ventilation (temperature and humidity controlled at fixed laboratory), access, and safety equipment are met or exceeded.

Traffic flow through sample preparation and analysis areas is minimized to reduce the likelihood of contamination. Adequate floor space and bench top area is provided to allow unencumbered sample preparation and analysis space. Sufficient space is also provided for storage of reagents and media, glassware, and portable equipment. Ample space is also provided for refrigerated sample storage before analysis and archival storage of samples after analysis. The fixed laboratory HVAC and deionized water systems are designed to minimize potential trace contaminants.

The fixed laboratory is separated into specific areas for sample receiving, sample preparation, volatile organic sample analysis, non-volatile organic sample analysis, inorganic sample analysis and administrative functions.

18.2 Environment

Laboratory accommodation, test areas, energy sources, lighting are adequate to facilitate proper performance of tests. The fixed facility is equipped with heating, ventilation, and air conditioning (HVAC) systems appropriate to the needs of environmental testing performed at this laboratory.

The environment in which these activities are undertaken does not invalidate the results or adversely affect the required accuracy of any measurements.

The laboratory provides for the effective monitoring, control and recording of environmental conditions that may affect the results of environmental tests as required by the relevant specifications, methods, and procedures. Such environmental conditions include temperature levels in the laboratory.

When any of the method or regulatory required environmental conditions change to a point where they may adversely affect test results, analytical testing will be discontinued until the environmental conditions are returned to the required levels.

Environmental conditions of the facility housing the computer network and LIMS are regulated to protect against raw data loss.

18.3 Work Areas

There is effective separation between neighboring areas when the activities therein are incompatible with each other. Examples include:

- Volatile organic chemical handling areas, including sample preparation and waste disposal, and volatile organic chemical analysis areas.

Access to and use of all areas affecting the quality of analytical testing is defined and controlled by secure access to the laboratory building as described below in the Building Security section.

Adequate measures are taken to ensure good housekeeping in the laboratory and to ensure that any contamination does not adversely affect data quality. These measures include regular cleaning to control dirt and dust within the laboratory. Work areas are available to ensure an unencumbered work area. Work areas include:

- Access and entryways to the laboratory.

- Sample receipt areas.
- Sample storage areas.
- Chemical and waste storage areas.
- Data handling and storage areas.
- Sample processing areas.
- Sample analysis areas.

18.4 Floor Plan

The fixed laboratory floor plan can be found in Appendix 1.

18.5 Building Security

Building/Mobile Lab keys are distributed to employees as necessary.

Visitors to the laboratory sign in and out in a visitor's logbook. A visitor is defined as any person who visits the laboratory who is not an employee of the laboratory. In addition to signing into the laboratory, the Environmental, Health and Safety Manual contains requirements for visitors and vendors. There are specific safety forms that must be reviewed and signed. Visitors (with the exception of company employees) are escorted by laboratory personnel at all times, or the location of the visitor is noted in the visitor's logbook.

SECTION 19. TEST METHODS AND METHOD VALIDATION

19.1 Overview

The laboratory uses methods that are appropriate to meet our clients' requirements and that are within the scope of the laboratory's capabilities. These include sampling, handling, transport, storage and preparation of samples, and, where appropriate, an estimation of the measurement of uncertainty as well as statistical techniques for analysis of environmental data.

Instructions are available in the laboratory for the operation of equipment as well as for the handling and preparation of samples. All instructions, Standard Operating Procedures (SOPs), reference methods and manuals relevant to the working of the laboratory are readily available to all staff. Deviations from published methods are documented (with justification) in the laboratory's approved SOPs. SOPs are submitted to clients for review at their request. Significant deviations from published methods require client approval and regulatory approval where applicable.

19.2 Standard Operating Procedures (SOPS)

The laboratory maintains SOPs that accurately reflect all phases of the laboratory such as assessing data integrity, corrective actions, handling customer complaints as well as all analytical methods and sampling procedures. The method SOPs are derived from the most recently promulgated/approved, published methods and are specifically adapted to the laboratory facility. Modifications or clarifications to published methods are clearly noted in the SOPs. All SOPs are controlled in the laboratory.

- All SOPs contain a revision number, effective date, and appropriate approval signatures. Controlled copies are available to all staff.
- Procedures for writing an SOP are incorporated by reference to *TestAmerica's Corporate SOP entitled 'Writing a Standard Operating Procedure', No. CW-Q-S-002* and the laboratory's SOP TA-QA-0500 Standard Operating Procedures.
- SOPs are reviewed at a minimum of every 2 years (annually for DoD/DOE SOPs), and where necessary, revised to ensure continuing suitability and compliance with applicable requirements.

19.3 Laboratory Methods Manual

For each test method, the laboratory shall have available the published referenced method as well as the laboratory developed SOP.

Note: If more stringent standards or requirements are included in a mandated test method or regulation than those specified in this manual, the laboratory shall demonstrate that such requirements are met. If it is not clear which requirements are more stringent, the standard from the method or regulation is to be followed. Any exceptions or deviations from the referenced methods or regulations are noted in the specific analytical SOP.

The laboratory maintains an SOP Index for both technical and non-technical SOPs. Technical SOPs are maintained to describe a specific test method. Non-technical SOPs are maintained to describe functions and processes not related to a specific test method.

19.4 Selection of Methods

Since numerous methods and analytical techniques are available, continued communication between the client and laboratory is imperative to assure the correct methods are utilized. Once client methodology requirements are established, this and other pertinent information is summarized by the Project Manager. These mechanisms ensure that the proper analytical methods are applied when the samples arrive for log-in. For non-routine analytical services (e.g., special matrices, non-routine compound lists), the method of choice is selected based on client needs and available technology. The methods selected should be capable of measuring the specific parameter of interest, in the concentration range of interest, and with the required precision and accuracy.

19.4.1 Sources of Methods

Routine analytical services are performed using standard EPA-approved methodology. In some cases, modification of standard approved methods may be necessary to provide accurate analyses of particularly complex matrices. When the use of specific methods for sample analysis is mandated through project or regulatory requirements, only those methods shall be used.

When clients do not specify the method to be used or methods are not required, the methods used will be clearly validated and documented in an SOP and available to clients and/or the end user of the data.

The analytical methods used by the laboratory are those currently accepted and approved by the U. S. EPA and the state or territory from which the samples were collected. Reference methods include:

- Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act; Analysis and Sampling Procedures; 40CFR Part 136 as amended by Method Update Rule; May 18, 2012
- Methods for Chemical Analysis of Water and Wastes, EPA 600 (4-79-020), 1983.
- Methods for the Determination of Inorganic Substances in Environmental Samples, EPA-600/R-93/100, August 1993.
- Methods for the Determination of Metals in Environmental Samples, EPA/600/4-91/010, June 1991. Supplement I: EPA-600/R-94/111, May 1994.
- NIOSH Manual of Analytical Methods, 4th ed., August 1994.
- Standard Methods for the Examination of Water and Wastewater, 18th/19th /20th/ on-line edition; Eaton, A.D. Clesceri, L.S. Greenberg, A.E. Eds; American Water Works Association, Water Pollution Control Federation, American Public Health Association: Washington, D.C.
- Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846), Third Edition, September 1986, Final Update I, July 1992, Final Update IIA, August 1993, Final Update II, September 1994; Final Update IIB, January 1995; Final Update III, December 1996; Final Update IV, January 2008.
- Annual Book of ASTM Standards, American Society for Testing & Materials (ASTM), Philadelphia, PA.
- National Status and Trends Program, National Oceanographic and Atmospheric Administration, Volume I-IV, 1985-1994.
- Code of Federal Regulations (CFR) 40, Parts 136, 141, 172, 173, 178, 179 and 261
- Plumb, Jr., R.H. 1981, Procedures for Handling and Chemical Analysis of Sediment and Water Samples, Technical Report EPA/C E-81-1. US Army Engineering Waterways Experiment Station, Vicksburg, MS.
- Recommended Protocols for Measuring Conventional Sediment Variables in Puget Sound, April 2003.
- Recommended Guidelines for Measuring Organic Compounds in Puget Sound Waters, Sediment and Tissue Samples, April 1997.
- Recommended Guidelines for Measuring Metals in Puget Sound Waters, Sediment and Tissue Samples, April 1997.

The laboratory reviews updated versions to all the aforementioned references for adaptation based upon capabilities, instrumentation, etc., and implements them as appropriate. As such, the laboratory strives to perform only the latest versions of each approved method as regulations allow or require.

Other reference procedures for non-routine analyses may include methods established by specific states (e.g., Underground Storage Tank methods), ASTM or equipment manufacturers. Sample type, source, and the governing regulatory agency requiring the analysis will determine the method utilized.

The laboratory shall inform the client when a method proposed by the client may be inappropriate or out of date. After the client has been informed, and they wish to proceed contrary to the laboratory's recommendation, it will be documented.

19.4.2 Demonstration of Capability

Before the laboratory may institute a new method and begin reporting results, the laboratory shall confirm that it can properly operate the method. In general, this demonstration does not test the performance of the method in real world samples, but in an applicable and available clean matrix

sample. If the method is for the testing of analytes that are not conducive to spiking, demonstration of capability may be performed on quality control samples.

A demonstration of capability (Analyst DOC, Lab SOP # TA-QA-0617) is performed whenever there is a change in instrument type (e.g., new instrumentation), method or personnel (e.g., analyst hasn't performed the test within the last 12 months).

Note: *The laboratory shall have a DOC for all analytes included in the methods that the laboratory performs, and proficiency DOCs for each analyst shall include all analytes that the laboratory routinely performs. Addition of non-routine analytes does not require new DOCs for all analysts if those analysts are already qualified for routine analytes tested using identical chemistry and instrument conditions.*

The initial demonstration of capability must be thoroughly documented and approved by the Technical Manager and QA Manager prior to independently analyzing client samples. All associated documentation must be retained in accordance with the laboratories archiving procedures.

The laboratory must have an approved SOP, demonstrate satisfactory performance, and conduct an MDL study (when applicable). There may be other requirements as stated within the published method or regulations (i.e., retention time window study).

Note: In some instances, a situation may arise where a client requests that an unusual analyte be reported using a method where this analyte is not normally reported. If the analyte is being reported for regulatory purposes, the method must meet all procedures outlined within this QA Manual (SOP, MDL, and Demonstration of Capability). If the client states that the information is not for regulatory purposes, the result may be reported as long as the following criteria are met:

- The instrument is calibrated for the analyte to be reported using the criteria for the method and ICV/CCV criteria are met (unless an ICV/CCV is not required by the method or criteria are per project DQOs).
- The laboratory's nominal or default reporting limit (RL) is equal to the quantitation limit (QL), must be at or above the lowest non-zero standard in the calibration curve and must be reliably determined. Project RLs are client specified reporting levels which may be higher than the QL. Results reported below the QL must be qualified as estimated values. Also see Section 19.6.1.3, Relationship of Limit of Detection (LOD) to Quantitation Limit (QL).
- The client request is documented and the lab informs the client of its procedure for working with unusual compounds. The final report must be footnoted: Reporting Limit based on the low standard of the calibration curve.

19.4.3 <u>Initial Demonstration of Capability (IDOC) Procedures</u>

19.4.3.1 The spiking standard used must be prepared independently from those used in instrument calibration.

19.4.3.2 The analyte(s) shall be diluted in a volume of clean matrix sufficient to prepare four aliquots at the concentration specified by a method or the laboratory SOP.

19.4.3.3 At least four aliquots shall be prepared (including any applicable clean-up procedures) and analyzed according to the test method (either concurrently or over a period of days).

19.4.3.4 Using all of the results, calculate the mean recovery in the appropriate reporting units and the standard deviations for each parameter of interest.

19.4.3.5 When it is not possible to determine the mean and standard deviations, such as for presence, absence and logarithmic values, the laboratory will assess performance against criteria described in the Method SOP.

19.4.3.6 Compare the information obtained above to the corresponding acceptance criteria for precision and accuracy in the test method (if applicable) or in laboratory generated acceptance criteria (LCS or interim criteria) if there is no mandatory criteria established. If any one of the parameters do not meet the acceptance criteria, the performance is unacceptable for that parameter.

19.4.3.7 When one or more of the tested parameters fail at least one of the acceptance criteria, the analyst must proceed according to either option listed below:

- Locate and correct the source of the problem and repeat the test for all parameters of interest beginning with 19.4.3.3 above.
- Beginning with 19.4.3.3 above, repeat the test for all parameters that failed to meet criteria. Repeated failure, however, will confirm a general problem with the measurement system. If this occurs, locate and correct the source of the problem and repeat the test for all compounds of interest beginning with 19.4.3.1 above.

Note: Results of successive LCS analyses can be used to fulfill the DOC requirement.

A certification statement (refer to Figure 19-1 as an example) shall be used to document the completion of each initial demonstration of capability. A copy of the certification is archived in the analyst's training folder.

Methods on line prior to the effective date of this Section shall be updated to the procedures outlined above as new analysts perform their demonstration of capability. A copy of the new record will replace that which was used for documentation in the past. At a minimum, the precision and accuracy of four mid-level laboratory control samples must have been compared to the laboratory's quality control acceptance limits.

19.5 Laboratory Developed Methods and Non-Standard Methods

Any new method developed by the laboratory must be fully defined in an SOP and validated by qualified personnel with adequate resources to perform the method. Method specifications and the relation to client requirements must be clearly conveyed to the client if the method is a non-standard method (not a published or routinely accepted method). The client must also be in agreement to the use of the non-standard method.

19.6 Validation of Methods

Validation is the confirmation by examination and the provision of objective evidence that the particular requirements for a specific intended use are fulfilled.

All non-standard methods, laboratory designed/developed methods, standard methods used outside of their scope, and major modifications to published methods must be validated to confirm they are fit for their intended use. The validation will be as extensive as necessary to meet the needs of the given application. The results are documented with the validation procedure used and contain a statement as to the fitness for use.

19.6.1 Method Validation and Verification Activities for All New Methods

While method validation can take various courses, the following activities can be required as part of method validation. Method validation records are designated QC records and are archived accordingly.

19.6.1.1 Determination of Method Selectivity – Method selectivity is the demonstrated ability to discriminate the analyte(s) of interest from other compounds in the specific matrix or matrices from other analytes or interference. In some cases to achieve the required selectivity for an analyte, a confirmation analysis is required as part of the method.

19.6.1.2 Determination of Method Sensitivity – Sensitivity can be both estimated and demonstrated. Whether a study is required to estimate sensitivity depends on the level of method development required when applying a particular measurement system to a specific set of samples. Where estimations and/or demonstrations of sensitivity are required by regulation or client agreement, such as the procedure in 40 CFR Part 136 Appendix B, under the Clean Water Act, these shall be followed.

19.6.1.3 Relationship of Limit of Detection (LOD) to the Quantitation Limit (QL) – An important characteristic of expression of sensitivity is the difference in the LOD and the QL. The LOD is the minimum level at which the presence of an analyte can be reliably concluded. The QL is the minimum concentration of analyte that can be quantitatively determined with acceptable precision and bias. For most instrumental measurement systems, there is a region where semi-quantitative data is generated around the LOD (both above and below the estimated MDL or LOD) and below the QL. In this region, detection of an analyte may be confirmed but quantification of the analyte is unreliable within the accuracy and precision guidelines of the measurement system. When an analyte is detected below the QL, and the presence of the analyte is confirmed by meeting the qualitative identification criteria for the analyte, the analyte can be reliably reported, but the amount of the analyte can only be estimated. If data is to be reported in this region, it must be done so with a qualification that denotes the semi-quantitative nature of the result.

19.6.1.4 Determination of Interferences – A determination that the method is free from interferences in a blank matrix is performed.

19.6.1.5 Determination of Range – Where appropriate to the method, the quantitation range is determined by comparison of the response of an analyte in a curve to established or targeted criteria. Generally the upper quantitation limit is defined by highest acceptable calibration concentration. The lower quantitation limit or QL cannot be lower than the lowest non-zero calibration level, and can be constrained by required levels of bias and precision.

19.6.1.6 Determination of Accuracy and Precision – Accuracy and precision studies are generally performed using replicate analyses, with a resulting percent recovery and measure of reproducibility (standard deviation, relative standard deviation) calculated and measured against a set of target criteria.

19.6.1.7 Documentation of Method – The method is formally documented in an SOP. If the method is a minor modification of a standard laboratory method that is already documented in an SOP, an SOP Attachment describing the specific differences in the new method is acceptable in place of a separate SOP.

19.6.1.8 Continued Demonstration of Method Performance – Continued demonstration of Method Performance is addressed in the SOP. Continued demonstration of method performance is generally accomplished by batch specific QC samples such as LCS, method blanks or PT samples.

19.7 Method Detection Limits (MDL) / Limits of Detection (LOD)

Method detection limits (MDL) are initially determined in accordance with 40 CFR Part 136, Appendix B or alternatively by other technically acceptable practices that have been accepted by regulators. MDL is also sometimes referred to as Limit of Detection (LOD). The MDL theoretically represents the concentration level for each analyte within a method at which the analyst is 99% confident that the true value *can be differentiated from blanks*. The MDL is determined for each analyte initially during the method validation process and updated as required in the analytical methods, whenever there is a significant change in the procedure or equipment, or based on project specific requirements. Generally, the analyst prepares at least seven replicates of solution spiked at one to five times the estimated method detection limit (most often at the lowest standard in the calibration curve) into the applicable matrix with all the analytes of interest. Each of these aliquots is extracted (including any applicable clean-up procedures) and analyzed in the same manner as the samples. Where possible, the seven replicates should be analyzed over 2-4 days to provide a more realistic MDL. To allow for some flexibility, this low level standard may be analyzed every batch or every week or some other frequency rather than doing the study all at once. In addition, a larger number of data points may be used if the appropriate t-value multiplier is used.

Refer to the Corporate SOP No. CA-Q-S-006 or the laboratory's SOP No. TA-QA-0602 for details on the laboratory's MDL process.

19.8 Instrument Detection Limits (IDL)

The IDL is sometimes used to assess the reasonableness of the MDLs or in some cases required by the analytical method or program requirements. IDLs are most used in metals analyses, but may be useful in demonstration of instrument performance in other areas.

IDLs are calculated to determine an instrument's sensitivity independent of any preparation method. IDLs are calculated either using 7 replicate spike analyses, like MDL but without sample preparation, or by the analysis of 10 instrument blanks and calculating 3 x the absolute value of the standard deviation.

If IDL is > than the MDL, it may be used as the reported MDL.

19.9 Verification of Detection and Reporting Limits

For non-DoD/DOE methods, once an MDL is established, it must be verified, on each instrument, by analyzing a quality control sample (prepared as a sample) at no more than 3 times the calculated MDL for single analyte analyses (e.g. most wet chemistry methods, Atomic Absorption, etc.) and no

more than 4 times the calculated MDL for multiple analyte methods (e.g. GC, GCMS, ICP, etc.). The analytes must be qualitatively identified. This verification does not apply to methods that are not readily spiked (e.g. pH, turbidity, etc.) or where the lab does not report to the MDL. If the MDL does not verify, then the lab will not report to the MDL, or redevelop their MDL or use the level where qualitative identification is established. MDLs must be verified at least annually.

For DoD/DOE methods, once the MDL is determined, it must be verified on each instrument used for the given method. TestAmerica defines the DoD/DOE QSM Detection Limit (DL) as being equal to the MDL. TestAmerica also defines the DoD/DOE QSM Limit of Detection (LOD) as being equal to the lowest concentration standard that successfully verifies the MDL, also referred to as the MDLV standard. MDL and MDLV standards are extracted/digested and analyzed through the entire analytical process. The MDL and MDLV determinations do not apply to methods that are not readily spiked (e.g. pH, turbidity, etc.) or where the lab does not report to the MDL. If the MDLV standard is not successful, then the laboratory will redevelop their MDL or perform and pass two consecutive MDLVs at a higher concentration and set the LOD at the higher concentration. Initial and quarterly verification is required for all methods listed in the laboratory's DoD/DOE ELAP Scope of Accreditation. Refer to the laboratory SOP TA-QA-0602, Method Detection Limit Studies, Limits of Detection, Reporting Limits and Limits of Quantitation, for further details.

For non-DoD/DOE methods, when the laboratory establishes a quantitation limit, it must be initially verified by the analysis of a low level standard or QC sample at 1-2 times the reporting limit and annually thereafter. The annual requirement is waived for methods that have an annually verified MDL. The laboratory will comply with any regulatory requirements.

For DoD/DOE methods, the laboratory quantitation limit is equivalent to the DoD/DOE Limit of Quantitation (LOQ), which is at a concentration equal to or greater than the lowest non-zero calibration standard. The DoD/DOE QSM requires the laboratory to perform an initial characterization of the bias and precision at the LOQ and quarterly LOQ verifications thereafter. If the quarterly verification results are not consistent with three-standard deviation confidence limits established initially, then the bias and precision will be reevaluated and clients contacted for any on-going projects. For DoD/DOE projects, TestAmerica makes a distinction between the Reporting Limit (RL) and the LOQ. The RL is a level at or above the LOQ that is used for specific project reporting purposes, as agreed to between the laboratory and the client. The RL cannot be lower than the LOQ concentration, but may be higher.

19.10 Retention Time Windows

Most organic analyses and some inorganic analyses use chromatography techniques for qualitative and quantitative determinations. For every chromatography analysis or as specific in the reference method, each analyte will have a specific time of elution from the column to the detector. This is known as the analytes retention time. The variance in the expected time of elution is defined as the retention time window. As the key to analyte identification in chromatography, retention time windows must be established on every column for every analyte used for that method. These records are kept with the files associated with an instrument for later quantitation of the analytes. Complete details are available in the laboratory SOPs.

19.11 Evaluation of Selectivity

The laboratory evaluates selectivity by following the checks within the applicable analytical methods, which include mass spectral tuning, second column confirmation, ICP interelement interference checks, chromatography retention time windows, sample blanks, spectrochemical, atomic absorption profiles, co-precipitation evaluations and specific electrode response factors.

19.12 Estimation of Uncertainty of Measurement

19.12.1 Uncertainty is "a parameter associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the measurand" (as defined by the International Vocabulary of Basic and General Terms in Metrology, ISO Geneva, 1993, ISBN 92-67-10175-1). Knowledge of the uncertainty of a measurement provides additional confidence in a result's validity. Its value accounts for all the factors which could possibly affect the result, such as adequacy of analyte definition, sampling, matrix effects and interferences, climatic conditions, variances in weights, volumes, and standards, analytical procedure, and random variation. Some national accreditation organizations require the use of an "expanded uncertainty": the range within which the value of the measurand is believed to lie within at least a 95% confidence level with the coverage factor k=2.

19.12.2 Uncertainty is not error. Error is a single value, the difference between the true result and the measured result. On environmental samples, the true result is never known. The measurement is the sum of the unknown true value and the unknown error. Unknown error is a combination of systematic error, or bias, and random error. Bias varies predictably, constantly, and independently from the number of measurements. Random error is unpredictable, assumed to be Gaussian in distribution, and reducible by increasing the number of measurements.

19.12.3 The minimum uncertainty associated with results generated by the laboratory can be determined by using the Laboratory Control Sample (LCS) accuracy range for a given analyte. The LCS limits are used to assess the performance of the measurement system since they take into consideration all of the laboratory variables associated with a given test over time (except for variability associated with the sampling and the variability due to matrix effects). The percent recovery of the LCS is compared either to the method-required LCS accuracy limits or to the statistical, historical, in-house LCS accuracy limits.

19.12.4 To calculate the uncertainty for the specific result reported, multiply the result by the decimal of the lower end of the LCS range percent value for the lower end of the uncertainty range, and multiply the result by the decimal of the upper end of the LCS range percent value for the upper end of the uncertainty range. These calculated values represent uncertainties at approximately the 99% confidence level with a coverage factor of k = 3. As an example, for a reported result of 1.0 mg/l with an LCS recovery range of 50 to 150%, the estimated uncertainty in the result would be 1.0 +/- 0.5 mg/l.

19.12.5 In the case where a well recognized test method specifies limits to the values of major sources of uncertainty of measurement (e.g., 524.2, 525, etc.) and specifies the form of presentation of calculated results, no further discussion of uncertainty is required.

19.13 Sample Reanalysis Guidelines

Because there is a certain level of uncertainty with any analytical measurement, a sample re-preparation (where appropriate) and subsequent analysis (hereafter referred to as 'reanalysis') may result in either a higher or lower value from an initial sample analysis. There are also variables that may be present (e.g., sample homogeneity, analyte precipitation over time, etc.) that may affect the results of a reanalysis. Based on the above comments, the laboratory will reanalyze samples at a client's request with the following caveats. Client specific Contractual Terms & Conditions for reanalysis protocols may supersede the following items.

- Homogenous samples: If a reanalysis agrees with the original result to within the RPD limits for MS/MSD or Duplicate analyses, or within $\pm$ 1 reporting limit for samples $\leq$ 5x the reporting limit, the original analysis will be reported. At the client's request, both results may be reported on the same report but not on two separate reports.

- If the reanalysis does not agree (as defined above) with the original result, then the laboratory will investigate the discrepancy and reanalyze the sample a third time for confirmation if sufficient sample is available.

- Any potential charges related to reanalysis are discussed in the contract terms and conditions or discussed at the time of the request. The client will typically be charged for reanalysis unless it is determined that the lab was in error.

- Due to the potential for increased variability, reanalysis may not be applicable to Non-homogenous, Encore, and Sodium Bisulfate preserved samples. See the Area Technical Manager or Laboratory Director if unsure.

19.14 Control of Data

The laboratory has policies and procedures in place to ensure the authenticity, integrity, and accuracy of the analytical data generated by the laboratory.

19.14.1 Computer and Electronic Data Related Requirements

The three basic objectives of our computer security procedures and policies are shown below. More detail is outlined in SOP TA-IT-0523 Data Integrity and Security. The laboratory is currently running the TALS system which is a custom in-house developed LIMS system that has been highly customized to meet the needs of the laboratory. It is referred to as LIMS for the remainder of this section. The LIMS utilizes Sequel Server which is an industry standard relational database platform. It is referred to as Database for the remainder of this section.

19.14.1.1 Maintain the Database Integrity – Assurance that data is reliable and accurate through data verification (review) procedures, password-protecting access, anti-virus protection, data change requirements, as well as an internal LIMS permissions procedure.

- LIMS Database Integrity is achieved through data input validation, internal user controls, and data change requirements.

- Spreadsheets and other software developed in-house must be verified with documentation through hand calculations prior to use. Cells containing calculations must be lock-protected and controlled.
- Instrument hardware and software adjustments are safeguarded through maintenance logs, audit trails and controlled access.

19.14.1.2 **Ensure Information Availability** – Protection against loss of information or service is ensured through scheduled back-ups, stable file server network architecture, secure storage of media, line filter, Uninterruptible Power Supply (UPS), and maintaining older versions of software as revisions are implemented.

19.14.1.3 **Maintain Confidentiality** – Ensure data confidentiality through physical access controls such as password protection or website access approval when electronically transmitting data.

19.14.2 Data Reduction

The complexity of the data reduction depends on the analytical method and the number of discrete operations involved (e.g., extractions, dilutions, instrument readings and concentrations). The analyst calculates the final results from the raw data or uses appropriate computer programs to assist in the calculation of final reportable values.

For manual data entry, e.g., Wet Chemistry, the data is reduced by the analyst and then verified by the Department Manager or alternate analyst prior to updating the data in LIMS. The spreadsheets, or any other type of applicable documents, are signed by both the analyst and alternate reviewer to confirm the accuracy of the manual entry(s).

Manual integration of peaks will be documented and reviewed and the raw data will be flagged in accordance with the TestAmerica Corporate SOP No. CA-Q-S-002, Acceptable Manual Integration Practices.

Analytical results are reduced to appropriate concentration units specified by the analytical method, taking into account factors such as dilution, sample weight or volume, etc. Blank correction will be applied only when required by the method or per manufacturer's indication; otherwise, it should not be performed. Calculations are independently verified by appropriate laboratory staff. Calculations and data reduction steps for various methods are summarized in the respective analytical SOPs or program requirements.

19.14.2.1 All raw data must be retained in the worklist folder, computer file (if appropriate), and/or run log. All criteria pertinent to the method must be recorded. The documentation is recorded at the time observations or calculations are made and must be signed or initialed/dated (month/day/year). It must be easily identifiable who performed which tasks if multiple people were involved.

19.14.2.2 In general, concentration results are reported in milligrams per liter (mg/L) or micrograms per liter (µg/l) for liquids and milligrams per kilogram (mg/Kg) or micrograms per kilogram (µg/Kg) for solids. For values greater than 10,000 mg/L, results can be reported in percent, i.e., 10,000 mg/l = 1%. Units are defined in each lab SOP.

19.14.2.3 In reporting, the analyst or the instrument output records the raw data result using values of known certainty plus one uncertain digit. If final calculations are performed external to LIMS, the

results should be entered in LIMS with at least three significant figures. In general, results are reported to 2 significant figures on the final report.

19.14.2.4 For those methods that do not have an instrument printout or an instrumental output compatible with the LIMS System, the raw results and dilution factors are entered directly into LIMS by the analyst, and the software calculates the final result for the analytical report. LIMS has a defined significant figure criterion for each analyte.

19.14.2.5 The laboratory strives to import data directly from instruments or calculation spreadsheets to ensure that the reported data are free from transcription and calculation errors. For those analyses with an instrumental output compatible with the LIMS, the raw results and dilution factors are transferred into LIMS electronically after reviewing the quantitation report, and removing unrequested or poor spectrally-matched compounds. The analyst prints a copy of what has been entered to check for errors. This printout and the instrument's printout of calibrations, concentrations, retention times, chromatograms, and mass spectra, if applicable, are retained with the data file. The data file is stored in a monthly folder on the instrument computer; periodically, this file is transferred to the server and, eventually, to a tape file.

19.14.3 Logbook / Worksheet Use Guidelines

Logbooks and worksheets are filled out 'real time' and have enough information on them to trace the events of the applicable analysis/task. (e.g. calibrations, standards, analyst, sample ID, date, time on short holding time tests, temperatures when applicable, calculations are traceable, etc.)

- Corrections are made following the procedures outlined in Section 12.
- Logbooks are controlled by the QA department. A record is maintained of all logbooks in the lab.
- Unused portions of pages must be "Z"'d out, signed and dated.
- Worksheets are created with the approval of the Technical Manager and QA Manager at the facility. The QA Manager controls all worksheets following the procedures in Section 6.

19.14.4 Review / Verification Procedures

Review procedures are outlined in several SOPs (e.g. SOP TA-QA-0001, Sample Receipt and Log-in, SOP TA-QA-0511, Project Management and SOP TA-QA-0635, Data Review)
to ensure that reported data are free from calculation and transcription errors and that QC parameters have been reviewed and evaluated before data is reported. The laboratory also utilizes corporate SOP CA-Q-S-002 Acceptable Manual Integration Practices to ensure the authenticity of the data. The general review concepts are discussed below, more specific information can be found in the SOPs.

19.14.4.1 Log-In Review - The data review process starts at the sample receipt stage. Sample control personnel review chain-of-custody forms and project instructions from the project management group. This is the basis of the sample information and analytical instructions entered into the LIMS. The log-in instructions are reviewed by the personnel entering the information, and a second level review is conducted by the project management staff.

19.14.4.2 First Level Data Review - The next level of data review occurs with the analysts. As data are generated, analysts review their work to ensure that the results meet project and SOP requirements. First level reviews include inspection of all raw data (e.g., instrument output for

continuous analyzers, chromatograms, spectra, and manual integrations), evaluation of calibration/calibration verification data in the day's analytical run, evaluation of QC data, and reliability of sample results. The analyst transfers data into LIMS, data qualifiers are added as needed. All first level reviews are documented.

19.14.4.3 Second Level Data Review – All analytical data are subject to review by a second qualified analyst or supervisor. Second level reviews include inspection of all raw data (e.g., instrument output, chromatograms, and spectra) including 100% of data associated with any changes made by the primary analyst, such as manual integrations or reassignment of peaks to different analytes, or elimination of false negative analytes. The second review also includes evaluation of initial calibration/calibration verification data in the day's analytical run, evaluation of QC data, reliability of sample results, qualifiers and NCM narratives. Manual calculations are checked in second level review. All second level reviews are documented.

Issues that deem further review include the following:

- QC data are outside the specified control limits for accuracy and precision
- Reviewed sample data does not match with reported results
- Unusual detection limit changes are observed
- Samples having unusually high results
- Samples exceeding a known regulatory limit
- Raw data indicating some type of contamination or poor technique
- Inconsistent peak integration
- Transcription errors
- Results outside of calibration range

19.14.4.4 Unacceptable analytical results may require reanalysis of the samples. Any problems are brought to the attention of the Laboratory Director, Project Manager, Quality Director/Manager, Technical Manager, or Supervisor for further investigation. Corrective action is initiated whenever necessary.

19.14.4.5 The results are then entered or directly transferred into the computer database and a hard copy (or .pdf) is printed for the client.

19.14.4.6 As a final review prior to the release of the report, the Project Manager reviews the results for appropriateness and completeness. This review and approval ensures that client requirements have been met and that the final report has been properly completed. The process includes, but is not limited to, *verifying that the COC is followed, cover letters / narratives are present, flags are appropriate, and project specific requirements are met. The Project Manager may also evaluate the validity of results for different test methods given expected chemical relationships.*

19.14.4.7 Any project that requires a data package is subject to a tertiary data review for transcription errors and acceptable quality control requirements. The Project Manager then signs the final report. The accounting personnel also check the report for any clerical or invoicing errors. When complete, the report is sent out to the client.

19.14.4.8 A visual summary of the flow of samples and information through the laboratory, as well as data review and validation, is presented in Figure 19-2.

19.14.5 Manual Integrations

Computerized data systems provide the analyst with the ability to re-integrate raw instrument data in order to optimize the interpretation of the data. Though manual integration of data is an invaluable tool for resolving variations in instrument performance and some sample matrix problems, when used improperly, this technique would make unacceptable data appear to meet quality control acceptance limits. Improper re-integrations lead to legally indefensible data, a poor reputation, or possible laboratory decertification. Because guidelines for re-integration of data are not provided in the methods and most methods were written prior to widespread implementation of computerized data systems, the laboratory trains all analytical staff on proper manual integration techniques using TestAmerica' s Corporate SOP (CA-Q-S-002).

19.14.5.1 The analyst must adjust baseline or the area of a peak in some situations, for example when two compounds are not adequately resolved or when a peak shoulder needs to be separated from the peak of interest. The analyst must use professional judgment and common sense to determine when manual integrating is required. Analysts are encouraged to ask for assistance from a senior analyst or manager when in doubt.

19.14.5.2 Analysts shall not increase or decrease peak areas for the sole purpose of achieving acceptable QC recoveries that would have otherwise been unacceptable. The intentional recording or reporting of incorrect information (or the intentional omission of correct information) is against company principles and policy and is grounds for immediate termination.

19.14.5.3 Client samples, performance evaluation samples, and quality control samples are all treated equally when determining whether or not a peak area or baseline should be manually adjusted.

19.14.5.4 All manual integrations receive a second level review. Manual integrations must be indicated on an expanded scale "after" chromatograms such that the integration performed can be easily evaluated during data review. Expanded scale "before" chromatograms are also required for all manual integrations on QC parameters (calibrations, calibration verifications, laboratory control samples, internal standards, surrogates, etc.) unless the laboratory has another documented corporate approved procedure in place that can demonstrate an active process for detection and deterrence of improper integration practices.

Figure 19-1. Example - Demonstration of Capability Documentation

Analyst Demonstration of Capability

TestAmerica Seattle

Preparation Method(s):
Analytical Method(s):
Matrix:
Method Description:

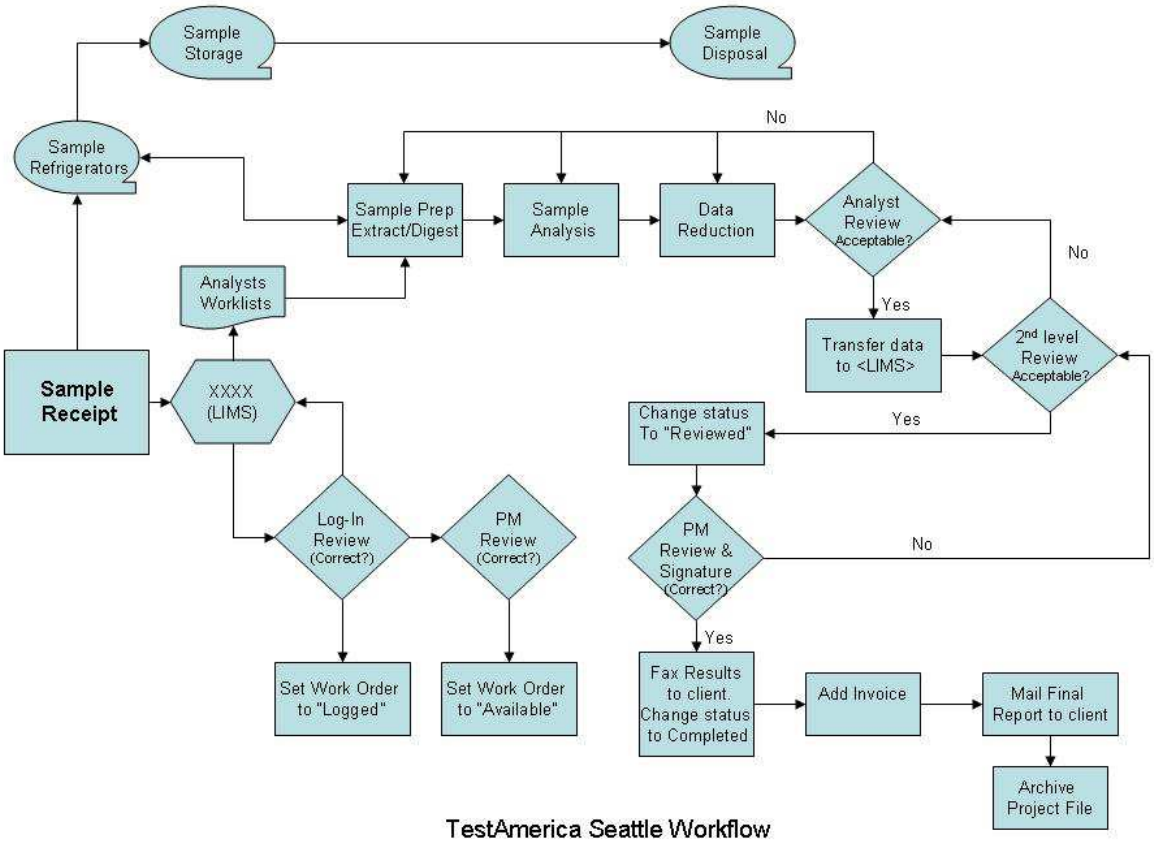
Preparation SOP No:

We, the undersigned, CERTIFY that:

1. The analyst identified above, using the cited test method with the specifications in the cited SOP, which is in use at this facility for the analyses of samples under the laboratory's Quality Assurance Plan, has completed the Demonstration of Capability (DOC).
2. The test method(s) was performed by the analyst identified on this certificate.
3. A copy of test method(s) and laboratory SOPs are available for all personnel on-site.
4. The data associated with the demonstration of capability are true, accurate, complete, and self-explanatory.
5. All raw data necessary to reconstruct and validate these analyses have been retained at the facility. The associated information is organized and available for review.

Department Manager	Signature	Date
Quality Assurance Officer	Signature	Date

Figure 19-2. Example: Work Flow



SECTION 20. EQUIPMENT and CALIBRATIONS

20.1 Overview

The laboratory purchases the most technically advanced analytical instrumentation for sample analyses. Instrumentation is purchased on the basis of accuracy, dependability, efficiency and sensitivity. Each laboratory is furnished with all items of sampling, preparation, analytical testing and measurement equipment necessary to correctly perform the tests for which the laboratory has capabilities. Each piece of equipment is capable of achieving the required accuracy and complies with specifications relevant to the method being performed. Before being placed into use, the equipment (including sampling equipment) is calibrated and checked to establish that it meets its intended specification. The calibration routines for analytical instruments establish the range of quantitation. Calibration procedures are specified in laboratory SOPs. A list of laboratory instrumentation is presented in Table 20-1. A list of software is provided in Table 20-2.

The safe handling and transport of laboratory equipment for mobile lab operations is covered in TestAmerica Seattle's SOP TA-MOB-0003.

Equipment is only operated by authorized and trained personnel. Manufacturer instructions for equipment use are readily accessible to all appropriate laboratory personnel.

20.2 Preventive Maintenance

The laboratory follows a well-defined maintenance program to ensure proper equipment operation and to prevent the failure of laboratory equipment or instrumentation during use. This program of preventive maintenance helps to avoid delays due to instrument failure.

Routine preventive maintenance procedures and frequency, such as cleaning and replacements, should be performed according to the procedures outlined in the manufacturer's manual. Qualified personnel must also perform maintenance when there is evidence of degradation of peak resolution, a shift in the calibration curve, loss of sensitivity, or failure to continually meet one of the quality control criteria.

Table 20-3 lists examples of scheduled routine maintenance. It is the responsibility of each Technical Manager to ensure that instrument maintenance logs are kept for all equipment in his/her department. Preventative maintenance procedures are also outlined in analytical SOPs or instrument manuals. (Note: for some equipment, the log used to monitor performance is also the maintenance log. Multiple pieces of equipment may share the same log as long as it is clear as to which instrument is associated with an entry.)

Instrument maintenance logs are controlled and are used to document instrument problems, instrument repair and maintenance activities. Maintenance logs shall be kept for all major pieces of equipment. Instrument maintenance logs may also be used to specify instrument parameters.

- Documentation must include all major maintenance activities such as contracted preventive maintenance and service and in-house activities such as the replacement of electrical components, lamps, tubing, valves, columns, detectors, cleaning and adjustments.
- Each entry in the instrument log includes the Analyst's initials, the date, a detailed description of the problem (or maintenance needed/scheduled), a detailed explanation of the solution or

maintenance performed, and a verification that the equipment is functioning properly (state what was used to determine a return to control. e.g. CCV run on 'date' was acceptable, or instrument recalibrated on 'date' with acceptable verification, etc.) must also be documented in the instrument records.

- When maintenance or repair is performed by an outside agency, service receipts detailing the service performed can be affixed into the logbooks adjacent to pages describing the maintenance performed. This stapled in page must be signed across the page entered and the logbook so that it is clear that a page is missing if only half a signature is found in the logbook.

If an instrument requires repair (subjected to overloading or mishandling, gives suspect results, or otherwise has shown to be defective or outside of specified limits) it shall be taken out of operation and tagged as out-of-service or otherwise isolated until such a time as the repairs have been made and the instrument can be demonstrated as operational by calibration and/or verification or other test to demonstrate acceptable performance. The laboratory shall examine the effect of this defect on previous analyses.

In the event of equipment malfunction that cannot be resolved, service shall be obtained from the instrument vendor manufacturer, or qualified service technician, if such a service can be tendered. If on-site service is unavailable, arrangements shall be made to have the instrument shipped back to the manufacturer for repair. Back up instruments, which have been approved, for the analysis shall perform the analysis normally carried out by the malfunctioning instrument. If the back up is not available and the analysis cannot be carried out within the needed timeframe, the samples shall be subcontracted.

If an instrument is sent out for service or transferred to another facility, it must be recalibrated and verified (including new initial MDL study) prior to return to lab operations.

20.3 Support Equipment

This section applies to all devices that may not be the actual test instrument, but are necessary to support laboratory operations. These include but are not limited to: balances, ovens, refrigerators, freezers, incubators, water baths, temperature measuring devices, thermal/pressure sample preparation devices and volumetric dispensing devices if quantitative results are dependent on their accuracy, as in standard preparation and dispensing or dilution into a specified volume. All raw data records associated with the support equipment are retained to document instrument performance.

20.3.1 Weights and Balances

The accuracy of the balances used in the laboratory is checked every working day, before use. All balances are placed on stable counter tops.

Each balance is checked prior to initial serviceable use with at least two certified ASTM type 1 weights spanning its range of use (weights that have been calibrated to ASTM type 1 weights may also be used for daily verification). ASTM type 1 weights used only for calibration of other weights (and no other purpose) are inspected for corrosion, damage or nicks at least annually and if no damage is observed, they are calibrated at least every 5 years by an outside calibration laboratory. Any weights (including ASTM Type 1) used for daily balance checks or other purposes are recalibrated/recertified annually to NIST standards (this may be done internally if laboratory maintains "calibration only" ASTM type 1 weights).

All balances are serviced annually by a qualified service representative, who supplies the laboratory with a certificate that identifies traceability of the calibration to the NIST standards.

All of this information is recorded in logs, and the recalibration/recertification certificates are kept on file in the QA office. Refer to SOP TA-QA-0014 Selecting and Using Balances for details.

20.3.2 pH, Conductivity, and Turbidity Meters

The pH meters used in the laboratory are accurate to ± 0.1 pH units, and have a scale readability of at least 0.05 pH units. The meters automatically compensate for the temperature, and are calibrated with at least two working range buffer solutions before each use.

Conductivity meters are also calibrated before each use with a known standard to demonstrate the meters do not exceed an error of 1% or one umhos/cm.

Turbidity meters are also calibrated before each use. All of this information is documented in logs.

Consult pH and Conductivity, and Turbidity SOPs for further information.

20.3.3 Thermometers

All thermometers are calibrated on an annual basis with a NIST-traceable thermometer**.**

- *If the temperature measuring device is used over a range of 10℃ or less, then a single point verification within the range of use is acceptable;*
- *If the temperature measuring device is used over a range of greater than 10℃, then the verification must bracket the range of use.*

The mercury NIST thermometer is recalibrated every five years *and the digital NIST thermometer is recalibrated every year* (unless thermometer has been exposed to temperature extremes or apparent separation of internal liquid) by an approved outside service and the provided certificate of traceability is kept on file. The NIST thermometer(s) have increments of 1 degree (0.5 degree or less increments are required for drinking water microbiological laboratories), and have ranges applicable to method and certification requirements. The NIST traceable thermometer is used for no other purpose than to calibrate other thermometers.

All of this information is documented in logbooks. Monitoring method-specific temperatures, including incubators, heating blocks, water baths, and ovens, is documented in method-specific logbooks. More information on this subject can be found in the SOP TA-QA-0024 Use, Calibration, and Maintenance of Laboratory Thermometers.

20.3.4 Refrigerators/Freezer Units, Waterbaths, Ovens and Incubators

The temperatures of all refrigerator units and freezers used for sample and standard storage are monitored each working day. *Sample storage is monitored 7 days a week for DoD/DOE labs.*

Ovens, water baths and incubators are monitored on days of use.

All of this equipment has a unique identification number, and is assigned a unique thermometer for monitoring.

Sample storage refrigerator temperatures are kept between > 0ºC and ≤ 6 ºC.

Specific temperature settings/ranges for other refrigerators, ovens, water baths, and incubators can be found in method specific SOPs.

All of this information is documented in Daily Temperature Logbooks and method-specific logbooks.

20.3.5 Autopipettors, Dilutors, and Syringes

Mechanical volumetric dispensing devices including burettes (except Class A Glassware *and Glass microliter syringes*) are given unique identification numbers and the delivery volumes are verified gravimetrically, at a minimum, on a *daily* basis.

For those dispensers that are not used for analytical measurements, a label is applied to the device stating that it is not calibrated. Any device not regularly verified can not be used for any quantitative measurements. Refer to SOP TA-QA-0016 Volumetric Verification.

Micro-syringes are purchased from Hamilton Company. Each syringe is traceable to NIST. The laboratory keeps on file an “Accuracy and Precision Statement of Conformance” from Hamilton attesting established accuracy.

20.4 Instrument Calibrations

Calibration of analytical instrumentation is essential to the production of quality data. Strict calibration procedures are followed for each method. These procedures are designed to determine and document the method detection limits, the working range of the analytical instrumentation and any fluctuations that may occur from day to day.

Sufficient raw data records are retained to allow an outside party to reconstruct all facets of the initial calibration. Records contain, but are not limited to, the following: calibration date, method, instrument, analyst(s) initials or signatures, analysis date, analytes, concentration, response, type of calibration (Avg RF, curve, or other calculations that may be used to reduce instrument responses to concentration.)

Sample results must be quantitated from the initial calibration and may not be quantitated from any continuing instrument calibration verification unless otherwise required by regulation, method or program.

If the initial calibration results are outside of the acceptance criteria, corrective action is performed and any affected samples are reanalyzed if possible. If the reanalysis is not possible, any data associated with an unacceptable initial calibration will be reported with appropriate data qualifiers (refer to Section 12).

Note: Instruments are calibrated initially and as needed after that and at least annually.

20.4.1 Calibration Standards

Calibration standards are prepared using the procedures indicated in the Reagents and Standards section of the determinative method SOP. If a reference method does not specify the number of calibration standards, a minimum of 3 calibration points will be used.

Standards for instrument calibration are obtained from a variety of sources. All standards are traceable to national or international standards of measurement, or to national or international standard reference materials.

The lowest concentration calibration standard that is analyzed during an initial calibration must be at or below the stated reporting limit for the method based on the final volume of extract (or sample).

The other concentrations define the working range of the instrument/method or correspond to the expected range of concentrations found in actual samples that are also within the working range of the instrument/method. Results of samples not bracketed by initial instrument calibration standards (within calibration range to at least the same number of significant figures used to report the data) must be reported as having less certainty, e.g., defined qualifiers or flags (additional information may be included in the case narrative). The exception to these rules is ICP *and ICPMS methods which define the working range with periodic linear dynamic range studies, rather than through the range of concentrations of daily calibration standards.*

All initial calibrations are verified with a standard obtained from a second source and traceable to a national standard, when available (or vendor certified different lot if a second source is not available). This verification occurs immediately after the calibration curve has been analyzed, and before the analysis of any samples.

20.4.1.1 Calibration Verification

The calibration relationship established during the initial calibration must be verified initially and at least daily as specified in the laboratory method SOPs in accordance with the referenced analytical methods and in the 2009 TNI Standard. The process of calibration verification applies to both external standard and internal standard calibration techniques, as well as to linear and non-linear calibration models. Initial calibration verification is with a standard source secondary (second source standard) to the calibration standards, but continuing calibration verifications may use the same source standards as the calibration curve.

Note: The process of calibration verification referred to here is fundamentally different from the approach called "calibration" in some methods. As described in those methods, the calibration factors or response factors calculated during calibration are used to update the calibration factors or response factors used for sample quantitation. This approach, while employed in other EPA programs, amounts to a daily single-point calibration.

All target analytes and surrogates, including those reported as non-detects, must be included in periodic calibration verifications for purposes of retention time confirmation and to demonstrate that calibration verification criteria are being met, i.e., RPD, per 2009 TNI Std. EL-V1M4 Sec. 1.7.2.

All samples must be bracketed by periodic analyses of standards that meet the QC acceptance criteria (e.g., calibration and retention time). The frequency is found in the determinative methods or SOPs.

Generally, the initial calibrations must be verified at the beginning of each 12-hour analytical shift during which samples are analyzed. (Some methods may specify more or less frequent verifications). The 12-hour analytical shift begins with the injection of the calibration verification standard (or the MS tuning standard in MS methods). The shift ends after the completion of the analysis of the last sample, QC, or standard that can be injected within 12 hours of the beginning of the shift.

A continuing instrument calibration verification (CCV) must be repeated at the beginning and, for methods that have quantitation by external calibration models, at the end of each analytical batch. Some methods have more frequent CCV requirements see specific SOPs. Most Inorganic methods require the CCV to be analyzed after ever 10 samples or injections, including matrix or batch QC samples.

Note: If an internal standard calibration is being used then bracketing *calibration verification standards* are not required, only daily verifications are needed. The results from these verification standards must meet the calibration verification criteria and the retention time criteria (if applicable).

If the results of a CCV are outside the established acceptance criteria and analysis of a second consecutive (and immediate) CCV fails to produce results within acceptance criteria, corrective action shall be performed. Once corrective actions have been completed & documented, the laboratory shall demonstrate acceptable instrument / method performance by analyzing two consecutive CCVs, or a new initial instrument calibration shall be performed.

Sample analyses and reporting of data may not occur or continue until the analytical system is calibrated or calibration verified. However, data associated with an unacceptable calibration verification may be fully useable under the following special conditions: **and reported based upon discussion and approval of the client:**

a). when the acceptance criteria for the CCV are exceeded high (i.e., high bias) and the associated samples within the batch are non-detects, then those non-detects may be reported with a footnote or case narrative explaining the high bias. Otherwise the samples affected by the unacceptable CCV shall be re-analyzed after a new calibration curve has been established, evaluated and accepted; or

b). when the acceptance criteria for the CCV are exceeded low (i.e., low bias), those sample results may be reported if they exceed a maximum regulatory limit/decision level. Otherwise the samples affected by the unacceptable CCV shall be re-analyzed after a new calibration curve has been established, evaluated and accepted.

Samples reported by the 2 conditions identified above will be appropriately flagged.

20.4.1.2 Verification of Linear and Non-Linear Calibrations

Calibration verification for calibrations involves the calculation of the percent drift or the percent difference of the instrument response between the initial calibration and each subsequent analysis of the verification standard. (These calculations are available in the laboratory method SOPs.

Verification standards are evaluated based on the % Difference from the average CF or RF of the initial calibration or based on % Drift or % Recovery if a linear or quadratic curve is used.

Regardless of whether a linear or non-linear calibration model is used, if initial verification criterion is not met, then no sample analyses may take place until the calibration has been verified or a new initial calibration is performed that meets the specifications listed in the method SOPs. If the calibration cannot be verified after the analysis of a single verification standard, then adjust the instrument operating conditions and/or perform instrument maintenance, and analyze another aliquot of the verification standard. If the calibration cannot be verified with the second standard, then a new initial calibration is performed.

- When the acceptance criteria for the calibration verification are exceeded high, i.e., high bias, and there are associated samples that are non-detects, then those non-detects may be reported. Otherwise, the samples affected by the unacceptable calibration verification shall be reanalyzed after a new calibration curve has been established, evaluated and accepted.

- When the acceptance criteria for the calibration verification are exceeded low, i.e., low bias, those sample results may be reported if they exceed a maximum regulatory limit/decision level. Otherwise, the samples affected by the unacceptable verification shall be reanalyzed after a new calibration curve has been established, evaluated and accepted. Alternatively, a reporting limit standard may be analyzed to demonstrate that the laboratory can still support non-detects at their reporting limit.

20.5 Tentatively Identified Compounds (TICs) – GC/MS Analysis

For samples containing components not associated with the calibration standards, a library search may be made for the purpose of tentative identification. The necessity to perform this type of identification will be determined by the purpose of the analyses being conducted. Data system library search routines should not use normalization routines that would misrepresent the library or unknown spectra when compared to each other.

Note: If the TIC compound is not part of the client target analyte list but is calibrated by the laboratory and is both qualitatively and/or quantitatively identifiable, it should not be reported as a TIC. If the compound is reported on the same form as true TICs, it should be qualified and/or narrated that the reported compound is qualitatively and quantitatively (if verification in control) reported compared to a known standard that is in control (where applicable).

For example, the RCRA permit or waste delisting requirements may require the reporting of non-target analytes. Only after visual comparison of sample spectra with the nearest library searches may the analyst assign a tentative identification.

20.6 GC/MS Tuning

Prior to any GCMS analytical sequence, including calibration, the instrument parameters for the tune and subsequent sample analyses within that sequence must be set.

Prior to tuning/auto-tuning the mass spec, the parameters may be adjusted within the specifications set by the manufacturer or the analytical method. These generally don't need any adjustment but it may be required based on the current instrument performance. If the tune verification does not pass

it may be necessary to clean the source or perform additional maintenance. Any maintenance is documented in the maintenance log.

Table 20-1. Example: Instrumentation List

GC	GC/MS	Ion Trap GC/MS/MS	ICP	ICPMS	CVAA	AutoAnalyzer	IC	TOC
13	15	2	1	2	2	2	2	2

Table 20-2. Example: Software List

Lab Section	Software Title and Version
All (Data Processing and Reporting)	LIMS - TALS (TestAmerica) Ver 1.0.1.330 or higher
ECD, Fuels 8270 and VOA (Data Processing)	CHROM (TestAmerica) Ver 1.2 or higher
Data Acquistion	
ECD	Environmental Chemstation G1701DA Version D.00.01.27
	Envronmental Chemstation MSD Chemstation D.02.00.275
FUELS	Environmental Chemstation G1701DA Version D.00.01.27
	EnviroQuant ChemStation G1701BA Version B.01.00.
8270	Environmental ChemStation MSD ChemStation D.01.00 Build 75 26-Aug-2003.
	Environmental Chemstation G1701DA Version D.00.01.27 08-Nov-2002
	Environmental ChemStation MSD ChemStation E.01.00.237
	EnviroQuant ChemStation G1702BA Version B.01.00.
	Varian Saturn Software Data System
	Finnigan Magnum
	Finnigan GCQ
VOA	Environmental ChemStation MSD ChemStation D.01.00.275.
	EnviroQuant Chemstation G1701BA Version B.01.00.
	Environmental ChemStation MSD ChemStation E.02.00.493.
	Environmental ChemStation MSD ChemStation D.02.00.275.
	Environmental ChemStation MSD ChemStation D.03.00.552.
	Environmental ChemStation G1701DA Version D.00.01.27.
	EnviroQuant ChemStation G1701AA Version A.03.00.
	Environmental ChemStation G1701CA Version C.00.00 21-Dec-1999
Metals	ELAN Version 3.0 Hotfix 3 (Build 3, 0, 6, 48d)
	Agilent G1834B ICP-MS ChemStation B.03.03
	Perkin Elmer WinLab32 for ICP Version 4.0.0.0305
	Thermo iTeVA – Analyst Version 2.2.0.51
	Perkin Elmer WinLab32 for ICP Version 4.0.0.0305
	WinHg Runner 1.4 CT Rev 0.286
Wet Chem	
Lachat QuikChem	Omnion Program version 3.0.220.04
Astoria Pacific	EnviroQuant Chemstation G1701BA Version B.01.00
Dionex DX-500	Dionex Peaknet Run PeakNet 5.11
Dionex ICS 2000	Chromeleon Client Version 6.60 Build1428
Mitsubishi TOX-100	TOX-100 Versions 2.17 Mitsubishi Chemical Corp
OI Analytical	OI Analytical WinTOC for Solids 3.0
Teledyne Tekmar	TOCTalk Ver 4.2.105.
LECO C632	*LECO C632 Carbon Determination Ver 1.60*

Table 20-3. Example: Schedule of Routine Maintenance

Instrument	Procedure	Frequency
Leeman Mercury Analyzer	Check tubing for wear Fill rinse tank with 10% HCl Change drying tube Fill reductant bottle with 10% Stannous Chloride	Daily Daily As required Daily
ICP	Check pump tubing Check liquid argon supply Check fluid level in waste container Check filters Clean or replace filters Check torch Check sample spray chamber for debris Clean and align nebulizer Check entrance slit for debris Change printer ribbon Replace pump tubing	Daily Daily Daily Weekly As required Daily Monthly Monthly Monthly As required As required
ICP MS	Change pump tubing Clean torch Check / clean nebulizer Clean cones Check air filters Check multiplier voltages & do cross calibration Replace sample uptake tubing Check rotary pump oil Check oil mist filters Check chiller water level	Weekly Weekly Weekly Daily Weekly Weekly Monthly Monthly Monthly Monthly
Ion chromatograph	Check seals for leakage Replace seals/valves/lamps Replace suppressor Replace column Clean source/analyzer	Daily As required As required As required As required
UV-Vis Spectrophotometer	Clean ambient flow cell Precision check/alignment of flow cell Wavelength verification check	As required As required Semi-annually
TOC Analyzer	Check gas flow Check fluid level (IC reservoirs) Replace “O” rings Check needle Replace scrubbers (halogen and CO_2) Replace catalyst	Daily Daily As required Daily Yearly As required
Auto Analyzers	Clean sampler Check all tubing Clean inside of colorimeter Clean pump well and pump rollers Clean wash fluid receptacle Oil rollers/chains/side rails Clean optics and cells	Daily Daily Daily Quarterly Weekly Weekly Quarterly

Instrument	Procedure	Frequency
Hewlett Packard GC/MS	Ion gauge tube degassing Pump oil-level check Pump oil changing Analyzer bake-out Analyzer cleaning Resolution adjustment COMPUTER SYSTEM AND PRINTER: Air filter cleaning Change data system air filter Printer head carriage lubrication Paper sprocket cleaning Drive belt lubrication	As required Monthly Annually As required As required As required As required As required As required As required As required
Gas Chromatograph	Compare standard response to previous day or since last initial calibration Check carrier gas flow rate in column Check temp. of detector, inlet, column oven Septum replacement Check system for gas leaks with SNOOP Check for loose/frayed wires and insulation ½"Bake injector/column Change/remove sections of guard column Replace connectors/liners Change/replace column(s)	Daily Daily via use of known compound retention Daily As required W/cylinder change as required Monthly As Required As Required As Required As Required
Electron Capture Detector (ECD)	Detector wipe test (Ni-63) Detector cleaning	Semi-annually As required
Flame Ionization Detector (FID)	Detector cleaning	As required
Balances	Class "S" traceable weight check Clean pan and check if level Field service	Daily, when used Daily At least Annually
Conductivity Meter	0.01M KCl calibration Conductivity cell cleaning	Daily As required
Turbidimeter	Check light bulb	Daily, when used
Deionized/Distilled Water	Conductivity Point Sources Daily conductivity check Check deionizer light Monitor for VOA's System cleaning Replace cartridge & large mixed bed resins	SOP TA-QA-0162 Daily Daily As required As required
Drying Ovens	Temperature monitoring Temperature adjustments	Daily As required
Refrigerators/ Freezers	Temperature monitoring Temperature adjustment Defrosting/cleaning	Daily As required As required
Vacuum Pumps/ Air Compressor	Drained Belts checked Lubricated	Weekly Monthly Semi-annually
pH/Specific Ion Meter	Calibration/check slope Clean electrode	Daily As required

Instrument	Procedure	Frequency
BOD Incubator	Temperature monitoring Coil and incubator cleaning	Daily Monthly
Centrifuge	Check brushes and bearings	Every 6 months or as needed
Water baths	Temperature monitoring Water replaced	Daily Monthly or as needed
Zero Headspace Extractors	Verify rotation speed Check for leakage Vendor repair	As required Annually As required
TCLP Extractors	Verify rotation speed	Quarterly

SECTION 21. MEASUREMENT TRACEABILITY

21.1 Overview

Traceability of measurements shall be assured using a system of documentation, calibration, and analysis of reference standards. Laboratory equipment that are peripheral to analysis and whose calibration is not necessarily documented in a test method analysis or by analysis of a reference standard shall be subject to ongoing certifications of accuracy. At a minimum, these must include procedures for checking specifications of ancillary equipment: balances, thermometers, temperature, Deionized (DI) and Reverse Osmosis (RO) water systems, automatic pipettes and other volumetric measuring devices. (Refer to Section 20.3). With the exception of Class A Glassware, quarterly accuracy checks are performed for all mechanical volumetric devices. Microsyringes are verified at least semi-annually or disposed of after 6 months of use. Wherever possible, subsidiary or peripheral equipment is checked against standard equipment or standards that are traceable to national or international standards. Class A Glassware and glass microliter syringes should be routinely inspected for chips, acid etching or deformity (e.g., bent needle). If the Class A glassware or syringe is suspect, the accuracy of the glassware will be assessed prior to use.

21.2 NIST-Traceable Weights and Thermometers

Reference standards of measurement shall be used for calibration only and for no other purpose, unless it can be shown that their performance as reference standards would not be invalidated.

For NIST-traceable weights and thermometers, the laboratory requires that all calibrations be conducted by a calibration laboratory accredited by A2LA, NVLAP (National Voluntary Laboratory Accreditation Program), or another accreditation organization that is a signatory to a MRA (Mutual Recognition Arrangement) of one or more of the following cooperations – ILAC (International Laboratory Accreditation Cooperation) or APLAC (Asia –Pacific Laboratory Accreditation Cooperation). A calibration certificate and scope of accreditation is kept on file at the laboratory.

21.3 Reference Standards / Materials

Reference standards/materials, where commercially available, are traceable to certified reference materials. Commercially prepared reference standards, to the extent available, are purchased from vendors that are accredited to ISO Guide 34 and ISO/IEC Guide 17025. All reference standards from commercial vendors shall be accompanied with a certificate that includes at least the following information:

- Manufacturer
- Analytes or parameters calibrated
- Identification or lot number
- Calibration method
- Concentration with associated uncertainties
- Purity

If a standard cannot be purchased from a vendor that supplies a Certificate of Analysis, the purity of the standard is documented by analysis. The receipt of all reference standards must be documented. Reference standards are labeled with a unique Standard Identification Number and

expiration date. All documentation received with the reference standard is retained as a QC record and references the Standard Identification Number.

All reference, primary and working standards/materials, whether commercially purchased or laboratory prepared, must be checked regularly to ensure that the variability of the standard or material from the 'true' value does not exceed method requirements. The accuracy of calibration standards is checked by comparison with a standard from a second source. In cases where a second standard manufacturer is not available, a vendor certified different lot is acceptable for use as a second source. The appropriate Quality Control (QC) criteria for specific standards are defined in laboratory SOPs. In most cases, the analysis of an Initial Calibration Verification (ICV) or LCS (where there is no sample preparation) is used as the second source confirmation. These checks are generally performed as an integral part of the analysis method (e.g. calibration checks, laboratory control samples).

All standards and materials must be stored and handled according to method or manufacturer's requirements in order to prevent contamination or deterioration. Refer to the Corporate Environmental Health & Safety Manual or laboratory SOPs. For safety requirements, please refer to method SOPs and the laboratory Environmental Health and Safety Manual.

Standards and reference materials shall not be used after their expiration dates unless their reliability is verified by the laboratory and their use is approved by the Quality Assurance Manager. The laboratory has documented contingency procedures for re-verifying expired standards.

21.4 Documentation and Labeling of Standards, Reagents, and Reference Materials

Reagents must be at a minimum the purity required in the test method. The date of reagent receipt and the expiration date are documented. The lots for most of the common solvents and acids are tested for acceptability prior to company wide purchase. [Refer to TestAmerica's Corporate SOP (CA-Q-S-001), Solvent and Acid Lot Testing and Approval.]

All manufacturer or vendor supplied Certificate of Analysis or Purity must be retained, stored appropriately, and readily available for use and inspection. These records are maintained in the LIMS. Records must be kept of the date of receipt and date of expiration of standards, reagents and reference materials. In addition, records of preparation of laboratory standards, reagents, and reference materials must be retained, stored appropriately, and be readily available for use and inspection. These records are maintained in the LIMS. For detailed information on documentation and labeling, please refer to SOP TA-QA-0619, Preparation, Storage, and Verification of Standards.

Commercial materials purchased for preparation of calibration solutions, spike solutions, etc.., are usually accompanied with an assay certificate or the purity is noted on the label. If the assay purity is 96% or better, the weight provided by the vendor may be used without correction. If the assay purity is less than 96% a correction will be made to concentrations applied to solutions prepared from the stock commercial material.

21.4.1 All standards, reagents, and reference materials must be labeled in an unambiguous manner. Standards are logged into the laboratory's LIMS system, and are assigned a unique identification number. The following information is typically recorded in the electronic database within the LIMS.

- Standard ID
- Description of Standard
- Department
- Preparer's name
- Final volume and number of vials prepared
- Solvent type and lot number
- Preparation Date
- Expiration Date
- Standard source type (stock or daughter)
- Standard type (spike, surrogate, other)
- Parent standard ID (if applicable)
- Parent Standard Analyte Concentration (if applicable)
- Parent Standard Amount used (if applicable)
- Component Analytes
- Final concentration of each analyte
- Comment box (text field)

Records are maintained electronically for standard and reference material preparation. These records show the traceability to purchased stocks or neat compounds. These records also include method of preparation, date of preparation, expiration date and preparer's name or initials. Preparation procedures are provided in the Method SOPs.

21.4.2 All standards, reagents, and reference materials must be clearly labeled with a minimum of the following information:

- Expiration Date (include prep date for reagents)
- Standard ID (from LIMS)
- Special Health/Safety warnings if applicable

Records must also be maintained of the date of receipt for commercially purchased items or date of preparation for laboratory prepared items. Special Health/Safety warnings must also be available to the analyst. This information is maintained in the LIMS and MSD Sheets**.**

21.4.3 In addition, the following information may be helpful:

- Date opened (for multi-use containers, if applicable)
- Description of standard (if different from manufacturer's label or if standard was prepared in the laboratory)
- Recommended Storage Conditions
- Concentration (if applicable)
- Initials of analyst preparing standard or opening container

All containers of prepared reagents must include an expiration date and an ID number to trace back to preparation.

Procedures for preparation of reagents can be found in the Method SOPs.

Standard ID numbers must be traceable through associated logbooks, worksheets and raw data.

All reagents and standards must be stored in accordance to the following priority: 1) with the manufacturer's recommendations; 2) with requirements in the specific analytical methods as specified in laboratory SOP TA-QA-0619, Preparation, Storage, and Verification of Standards.

SECTION 22. SAMPLING

22.1 Overview

The laboratory does not provide sampling services. The laboratory's responsibility in the sample collection process lies in supplying the sampler with the necessary coolers, reagent water, sample containers, preservatives, sample labels, custody seals, COC forms, ice, and packing materials required to properly preserve, pack, and ship samples to the laboratory

22.2 Sampling Containers

The laboratory offers clean sampling containers for use by clients. These containers are obtained from reputable container manufacturers and meet EPA specifications as required. Certificates of cleanliness for bottles and preservatives are provided by the supplier and are maintained at the laboratory. Alternatively, the certificates may be maintained by the supplier and available to the laboratory on-line.

22.2.1 Preservatives

Upon request, preservatives are provided to the client in pre-cleaned sampling containers. In some cases containers may be purchased pre-preserved from the container supplier. Whether prepared by the laboratory or bought pre-preserved, the grades of the preservatives are at a minimum:

- Hydrochloric Acid – Reagent ACS (Certified VOA Free) or equivalent
- Methanol – Purge and Trap grade
- Nitric Acid – Instra-Analyzed or equivalent
- Sodium Bisulfate – ACS Grade or equivalent
- Sodium Hydroxide – Instra-Analyzed or equivalent
- Sulfuric Acid – Instra-Analyzed or equivalent
- Sodium Thiosulfate – ACS Grade or equivalent

22.3 Definition of Holding Time

The date and time of sampling documented on the COC form establishes the day and time zero. As a general rule, when the maximum allowable holding time is expressed in "days" (e.g., 14 days, 28 days), the holding time is based on calendar day measured. Holding times expressed in "hours" (e.g., 6 hours, 24 hours, etc.) are measured from date and time zero. Holding times for analysis

include any necessary reanalysis. However, there are some programs that determine holding time compliance based on the date and specific time of analysis compared to the time of sampling regardless of how long the holding time is.

22.4 Sampling Containers, Preservation Requirements, Holding Times

The preservation and holding time criteria specified in the laboratory SOPs are derived from the source documents for the methods. If method required holding times or preservation requirements are not met, the reports will be qualified using a flag, footnote or case narrative. As soon as possible or "ASAP" is an EPA designation for tests for which rapid analysis is advised, but for which neither EPA nor the laboratory have a basis for a holding time.

22.5 Sample Aliquots / Subsampling

Taking a representative sub-sample from a container is necessary to ensure that the analytical results are representative of the sample collected in the field. The size of the sample container, the quantity of sample fitted within the container, and the homogeneity of the sample need consideration when sub-sampling for sample preparation. It is the laboratory's responsibility to take a representative subsample or aliquot of the sample provided for analysis.

Analysts should handle each sample as if it is potentially dangerous. At a minimum, safety glasses, gloves, and lab coats must be worn when preparing aliquots for analysis.

Guidelines on taking sample aliquots & subsampling are located in SOP TA-QA-0028, Subsampling of Solid Samples.

SECTION 23. HANDLING OF SAMPLES

Sample management procedures at the laboratory ensure that sample integrity and custody are maintained and documented from sampling/receipt through disposal.

23.1 Chain of Custody (COC)

The COC form is the written documented history of any sample and is initiated when bottles are sent to the field, or at the time of sampling. This form is completed by the sampling personnel and accompanies the samples to the laboratory where it is received and stored under the laboratory's custody. The purpose of the COC form is to provide a legal written record of the handling of samples from the time of collection until they are received at the laboratory. It also serves as the primary written request for analyses from the client to the laboratory. The COC form acts as a purchase order for analytical services when no other contractual agreement is in effect. An example of a COC form may be found in Figure 23-1.

23.1.1 Field Documentation

The information the sampler needs to provide at the time of sampling on the container label is:

- Sample identification
- Date and time
- Preservative

During the sampling process, the COC form is completed and must be legible (see Figure 23-1). This form includes information such as:

- Client name, address, phone number and fax number (if available)
- Project name and/or number
- The sample identification
- Date, time and location of sampling
- Sample collectors name
- The matrix description
- The container description
- The total number of each type of container
- Preservatives used
- Analysis requested
- Requested turnaround time (TAT)
- Any special instructions
- Purchase Order number or billing information (e.g. quote number) if available
- The date and time that each person received or relinquished the sample(s), including their signed name.

When the sampling personnel deliver the samples directly to TestAmerica personnel, the samples are stored in a cooler with ice, as applicable, and remain solely in the possession of the client's field technician until the samples are delivered to the laboratory personnel. The sample collector must assure that each container is in his/her physical possession or in his/her view at all times, or stored in such a place and manner to preclude tampering. The field technician relinquishes the samples in writing on the COC form to the sample control personnel at the laboratory or to a TestAmerica courier. When sampling personnel deliver the samples through a common carrier (Fed-Ex, UPS), the CoC relinquished date/time is completed by the field personnel and samples are released to the carrier. Samples are only considered to be received by the lab when personnel at the fixed laboratory facility have physical contact with the samples.

Note: Independent couriers are not required to sign the COC form. The COC is usually kept in the sealed sample cooler. The receipt from the courier is stored in log-in by date; it lists all receipts each date.

23.2 Sample Receipt

Samples are received at the laboratory by designated sample receiving personnel and a unique laboratory project identification number is assigned. Each sample container shall be assigned a unique sample identification number that is cross-referenced to the client identification number such that traceability of test samples is unambiguous and documented. Each sample container is affixed with a durable sample identification label. Sample acceptance, receipt, tracking and storage procedures are summarized in the following sections.

23.2.1 Laboratory Receipt

When samples arrive at the laboratory, sample receiving personnel inspect the coolers and samples. The integrity of each sample must be determined by comparing sample labels or tags with the COC and by visual checks of the container for possible damage. Any non-conformance, irregularity, or compromised sample receipt must be documented on an NCM or the login Checklist in LIMS and brought to the immediate attention of the client. The COC, shipping documents, documentation of any non-conformance, irregularity, or compromised sample receipt, record of client contact, and resulting instructions become part of the project record.

23.2.1.1 Unique Sample Identification

All samples that are processed through the laboratory receive a unique sample identification to ensure that there can be no confusion regarding the identity of such samples at anytime. This system includes identification for all samples, subsamples and subsequent extracts and/or digestates.

The laboratory assigns a unique identification (e.g., Sample ID) code to each sample container received at the laboratory. This Primary ID is made up of the following information (consisting of 4 components):

Example: 580 - 9608 - A - 1

Location ID | Login ID | Container Occurrence | Sample Number

In the example above, the Location ID code identifies the lab (580 = TestAmerica Seattle). The Login ID 9608 (unique to a particular client/job occurrence) . The container code indicates it is the first container ("A") of Sample #1.

If the primary container goes through a prep step that creates a "new" container, then the new container is considered secondary and gets another ID. An example of this being a client sample in a 1-Liter amber bottle is sent through a Liquid/Liquid Extraction and an extraction vial is created from this step. The vial would be a SECONDARY container. The secondary ID has 5 components.

Example: 580 - 9608 - A - 1 - **A** ← **Secondary Container Occurrence**

Example: 580-9608-A-1-A, would indicate the PRIMARY container listed above that went through a step that created the 1st occurrence of a Secondary container.

With this system, a client sample can literally be tracked throughout the laboratory in every step from receipt to disposal.

23.3 Sample Acceptance Policy

The laboratory has a written sample acceptance policy (Figure 23-2) that clearly outlines the circumstances under which samples shall be accepted or rejected. These include:

- a COC filled out completely;
- samples must be properly labeled;
- proper sample containers with adequate volume for the analysis (Sampling Guide) and necessary QC;
- samples must be preserved according to the requirements of the requested analytical method (Sampling Guide);
- sample holding times must be adhered to (Sampling Guide);
- the project manager will be notified if any sample is received in damaged condition.

Data from samples which do not meet these criteria are flagged and the nature of the variation from policy is defined.

23.3.1 After inspecting the samples, the sample receiving personnel sign and date the COC form, make any necessary notes of the samples' conditions and store them in appropriate refrigerators or storage locations.

23.3.2 Any deviations from these checks that question the suitability of the sample for analysis, or incomplete documentation as to the tests required will be resolved by consultation with the client. If the sample acceptance policy criteria are not met, the laboratory shall either:

- Retain all correspondence and/or records of communications with the client regarding the disposition of rejected samples, or

- Fully document any decision to proceed with sample analysis that does not meet sample acceptance criteria.

Once sample acceptance is verified, the samples are logged into the LIMS according SOP TA-QA-0001 (Sample Receiving and Login).

23.4 Sample Storage

In order to avoid deterioration, contamination or damage to a sample during storage and handling, from the time of receipt until all analyses are complete, samples are stored in refrigerators, freezers or protected locations suitable for the sample matrix. Aqueous samples for metals testing are typically stored at ambient temperature**.** In addition, samples to be analyzed for volatile organic parameters are stored in separate refrigerators designated for volatile organic parameters only. Samples are never to be stored with reagents, standards or materials that may create contamination.

To ensure the integrity of the samples during storage, refrigerator blanks are maintained in the volatile sample refrigerators and analyzed every two weeks. The refrigerator blanks are logged into the LIMS and treated as normal samples with the data stored and archived in the LIMS.

Analysts and technicians retrieve the sample container allocated to their analysis from the designated storage location and place them on carts, analyze the sample, and return the remaining sample or empty container to the storage location from which it originally came. All unused portions of samples, including empty sample containers, are returned to designated storage location. All

samples are kept in the designated storage locations for a *minimum of two from receipt*, which meets or exceeds most sample holding times. After two weeks the samples *may be* moved to dry room temperature, sample archive area where they are stored for a *minimum of four weeks from invoicing* before they are disposed of. This *minimum of six* week holding period allows samples to be checked if a discrepancy or question arises. Special arrangements may be made to store samples for longer periods of time. This extended holding period allows additional metal analyses to be performed on the archived sample and assists clients in dealing with legal matters or regulatory issues**.**

Access to the laboratory is controlled such that sample storage need not be locked at all times unless a project specifically demands it. Samples are accessible to laboratory personnel only. Visitors to the laboratory are prohibited from entering the refrigerator and laboratory areas unless accompanied by an employee of TestAmerica.

23.5 Hazardous Samples and Foreign Soils

To minimize exposure to personnel and to avoid potential accidents, hazardous and foreign soil samples are stored in isolated areas designated for hazardous waste or foreign soil samples only. All hazardous samples are either returned to the client or disposed of appropriately through a hazardous waste disposal firm that lab-packs all hazardous samples and removes them from the laboratory. Foreign soil samples are sent out for incineration by a USDA-approved waste disposal facility.

23.6 Sample Shipping

In the event that the laboratory needs to ship samples, the samples are placed in a cooler with enough ice to ensure the samples remain just above freezing and at or below 6.0°C during transit. The samples are carefully surrounded by packing material to avoid breakage (yet maintain appropriate temperature). A trip blank is enclosed for those samples requiring water/solid volatile organic analyses (see Note). The chain-of-custody form is signed by the sample control technician and attached to the shipping paperwork. Samples are generally shipped overnight express or hand-delivered by a TestAmerica courier to maintain sample integrity. All personnel involved with shipping and receiving samples must be trained to maintain the proper chain-of-custody documentation and to keep the samples intact and on ice. The Environmental, Health and Safety Manual contains additional shipping requirements.

Note: If a client does not request trip blank analysis on the COC or other paperwork, the laboratory will not analyze the trip blanks that were supplied. However, in the interest of good client service, the laboratory will advise the client at the time of sample receipt that it was noted that they did not request analysis of the trip blank; and that the laboratory is providing the notification to verify that they are not inadvertently omitting a key part of regulatory compliance testing.

23.7 Sample Disposal

Samples should be retained for a minimum of 30 days after the project *invoice* is sent, however, provisions may be made for earlier disposal of samples once the holding time is exceeded. Some samples are required to be held for longer periods based on regulatory or client requirements (e.g., 60 days after project *invoice* is sent). The laboratory must follow the longer sample retention requirements where required by regulation or client agreement. Several possibilities for sample

disposal exist: the sample may be consumed completely during analysis, the sample may be returned to the customer or location of sampling for disposal, or the sample may be disposed of in accordance with the laboratory's waste disposal procedures (SOP: TA-EHS-0036). All procedures in the laboratory Environmental, Health and Safety Manual are followed during disposal. Samples are normally maintained in the laboratory no longer than ninety days from receipt unless otherwise requested. Unused portions of samples found or suspected to be hazardous according to state or federal guidelines may be returned to the client upon completion of the analytical work.

If a sample is part of a known litigation, the affected legal authority, sample data user, and/or submitter of the sample must participate in the decision about the sample's disposal. All documentation and correspondence concerning the disposal decision process must be kept on file. Pertinent information includes the date of disposal, nature of disposal (such as sample depletion, hazardous waste facility disposal or return to client), names of individuals who conducted the arrangements and physically completed the task. The laboratory will remove or deface sample labels prior to disposal unless this is accomplished through the disposal method (e.g., samples are incinerated). A Waste Disposal Record should be completed.

Figure 23-1. Example: Chain of Custody (COC)

Seattle
5755 8th Street East
Tacoma, WA 98424
253-922-2310

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Client Contact	Project Manager:	Site Contact:	Date:	COC No:
Your Company Name here	Tel/Fax:	Lab Contact:	Carrier:	_____ of _____ COCs
Address	Analysis Turnaround Time			Job No.
City/State/Zip	Calendar (C) or Work Days (W) _____			
(xxx) xxx-xxxx Phone	TAT if different from Below _____			
(xxx) xxx-xxxx FAX	☐ 2 weeks			SDG No.
Project Name:	☐ 1 week			
Site:	☐ 2 days			
P O #	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type	Matrix	# of Cont.	Filtered Sample																	Sample Specific Notes:

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other _____

Possible Hazard Identification
☐ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* *Poison B* ☐ *Unknown* ☐

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For _____ Months*

Special Instructions/QC Requirements & Comments:

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:

Figure 23-2. Example: Sample Acceptance Policy

All incoming work will be evaluated against the criteria listed below. Where applicable, data from any samples that do not meet the criteria listed below will be noted on the laboratory report defining the nature and substance of the variation. In addition the client will be notified either by telephone, fax or e-mail ASAP after the receipt of the samples.

1) Samples must arrive with labels intact with a Chain of Custody filled out completely. The following information must be recorded.

   - Client name, address, phone number and fax number (if available)
   - Project name and/or number
   - The sample identification
   - Date, time and location of sampling
   - The collectors name
   - The matrix description
   - The container description
   - The total number of each type of container
   - Preservatives used
   - Analysis requested
   - Requested turnaround time (TAT)
   - Any special instructions
   - Purchase Order number or billing information (e.g. quote number) if available
   - The date and time that each person received or relinquished the sample(s), including their signed name.
   - Information must be legible

2) Samples must be properly labeled.
   - Use durable labels (labels provided by TestAmerica are preferred)
   - Include a unique identification number
   - Include sampling date and time & sampler ID
   - Include preservative used.
   - Use indelible ink
   - Information must be legible

3) Proper sample containers with adequate volume for the analysis and necessary QC are required for each analysis requested. See Lab Sampling Guide.

4) Samples must be preserved according to the requirements of the requested analytical method (See Sampling Guide**.**

5) Most analytical methods require chilling samples to 4° C (other than water samples for metals analysis). For these methods, the criteria are met if the samples are chilled to below 6° C and above freezing (0°C). For methods with other temperature criteria (e.g. some bacteriological methods require $\leq$ 10 ^{o}C), the samples must arrive within $\pm$ 2° C of the required temperature or within the method specified range. **Note:** Samples that are hand delivered to the laboratory immediately after collection may not have had time to cool sufficiently. In this case the samples will be considered acceptable as long as there is evidence that the chilling process has begun (arrival on ice).

5i.) Samples that are delivered to the laboratory on the same day they are collected may not meet the requirements of Section 5. In these cases, the samples shall be considered acceptable if the samples were received on ice.

5ii.) If sample analysis is begun within fifteen (15) minutes of collection, thermal preservation is not required.

5iii.) Thermal preservation is not required in the field if the laboratory receives and refrigerates the sample within fifteen (15) minutes of collection.

- Chemical preservation (pH) will be verified prior to analysis and documented, either in sample control or at the analyst's level. The project manager will be notified immediately if there is a discrepancy. If analyses will still be performed, all affected results will be flagged to indicate improper preservation.

- For Volatile Organic analyses in drinking water (Methods 502.2 or 524.2). Residual chlorine must be neutralized prior to preservation. If there is prior knowledge that the samples are not chlorinated, state it on the COC and use the VOA vials pre-preserved with HCl. The following are other options for a sampler and laboratory where the presence of chlorine is not known:
  - 1. Test for residual chlorine in the field prior to sampling.
    - If no chlorine is present, the samples are to be preserved using HCl as usual.
    - If chlorine is present, add either ascorbic acid or sodium thiosulfate prior to adding HCl.
  - 2. Use VOA vials pre-preserved with sodium thiosulfate or ascorbic acid and add HCl after filling the VOA vial with the sample.

- **FOR WATER SAMPLES TESTED FOR CYANIDE (by Standard Methods or EPA 335)**
  - In the Field: Samples are to be tested for Sulfide using lead acetate paper prior to the addition of Sodium Hydroxide (NaOH). If sulfide is present, the sample must be treated with Cadmium Chloride and filtered prior to the addition of NaOH.

    - If the sulfide test and treatment is not performed in the field, the lab will test the samples for sulfide using lead acetate paper at the time of receipt and if sulfide is present in the sample, the client will be notified and given the option of retaking the sample and treating in the field per the method requirements or the laboratory can analyze the samples as delivered and qualify the results in the final report.

  - It is the responsibility of the client to notify the laboratory if thiosulfate, sulfite, or thiocyanate are known or suspected to be present in the sample. This notification may be on the chain of custody. The samples may need to be subcontracted to a laboratory that performs a UV digestion. If the lab does not perform the UV digestion on samples that contain these compounds, the results must be qualified in the final report.

  - The laboratory must test the sample for oxidizing agents (e.g. Chlorine) prior to analysis and treat according to the methods prior to distillation. (ascorbic acid or sodium arsenite are the preferred choice).

6) Sample Holding Times
- TestAmerica will make every effort to analyze samples within the regulatory holding time. Samples must be received in the laboratory with enough time to perform the sample analysis. Except for short holding time samples (< 48hr HT), sample must be received with at least 48 hrs (working days) remaining on the holding time for us to ensure analysis.

- Analyses that are designated as "field" analyses (Odor, pH, Dissolved Oxygen, Disinfectant Residual; a.k.a. Residual Chlorine, and Redox Potential) should be analyzed ASAP by the field sampler prior to delivering to the lab (within 15 minutes). However, if the analyses are to be performed in the

laboratory, TestAmerica will make every effort to analyze the samples within 24 hours from receipt of the samples in the testing laboratory. Samples for "field" analyses received after 4:00 pm on Friday or on the weekend will be analyzed no later than the next business day after receipt (Monday unless a holiday). Samples will remain refrigerated and sealed until the time of analysis. The actual times of all "field" sample analyses are noted on the "Short Hold Time Detail Report" in the final report. Samples analyzed in the laboratory will be qualified on the final report with an 'H' to indicate holding time exceedance.

7) All samples submitted for Volatile Organic analyses must have a Trip Blank submitted at the same time. TestAmerica will supply a blank with the bottle order.

8) The project manager will be notified if any sample is received in damaged condition. TestAmerica will request that a sample be resubmitted for analysis.

9) Recommendations for packing samples for shipment.

- Pack samples in Ice rather than "Blue" ice packs.
- Soil samples should be placed in plastic zip-lock bags. The containers often have dirt around the top and do not seal very well and are prone to intrusion from the water from melted ice.
- Water samples would be best if wrapped with bubble-wrap or paper (newspaper, or paper towels work) and then placed in plastic zip-lock bags.
- Fill extra cooler space with bubble wrap.

Figure 23-3. Example: Cooler Receipt Form

Login Sample Receipt Checklist

Client: Client X

Job Number: 580-43036-1

Login Number: 43036
List Number: 1
Creator: Blankinship, Tom X

List Source: TestAmerica Seattle

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

TestAmerica Seattle

SECTION 24. ASSURING THE QUALITY OF TEST RESULTS

24.1 Overview

In order to assure our clients of the validity of their data, the laboratory continuously evaluates the quality of the analytical process. The analytical process is controlled not only by instrument calibration as discussed in Section 20, but also by routine process quality control measurements (e.g. Blanks, Laboratory Control Samples (LCS), Matrix Spikes (MS), duplicates (DUP), surrogates, Internal Standards (IS)). These quality control checks are performed as required by the method or regulations to assess precision and accuracy. Quality control samples are to be treated in the exact same manner as the associated field samples being tested. In addition to the routine process quality control samples, Proficiency Testing (PT) Samples (concentrations unknown to laboratory) are analyzed to help ensure laboratory performance.

24.2 Controls

Sample preparation or pre-treatment is commonly required before analysis. Typical preparation steps include homogenization, grinding, solvent extraction, sonication, acid digestion, distillation, reflux, evaporation, drying and ashing. During these pre-treatment steps, samples are arranged into discreet manageable groups referred to as preparation (prep) batches. Prep batches provide a means to control variability in sample treatment. Control samples are added to each prep batch to monitor method performance and are processed through the entire analytical procedure with investigative/field samples.

24.3 Negative Controls

Table 24-1. Example – Negative Controls

Control Type	Details
Method Blank (MB)	are used to assess preparation and analysis for possible contamination during the preparation and processing steps.
	The specific frequency of use for method blanks during the analytical sequence is defined in the specific standard operating procedure for each analysis. Generally it is 1 for each batch of samples; not to exceed 20 environmental samples.
	The method blank is prepared from a clean matrix similar to that of the associated samples that is free from target analytes (e.g., Reagent water, Ottawa sand, glass beads, etc.) and is processed along with and under the same conditions as the associated samples. The method blank goes through all of the steps of the process (including as necessary: filtration, clean-ups, etc.).
	Reanalyze or qualify associated sample results when the concentration of a targeted analyte in the blank is at or above the reporting limit as established by the method or by regulation, AND is greater than 1/10 of the amount measured in the sample.
Calibration Blanks	are prepared and analyzed along with calibration standards where applicable. They are prepared using the same reagents that are used to prepare the standards. In some analyses the calibration blank may be included in the calibration curve.
Instrument Blanks	are blank reagents or reagent water that may be processed during an analytical sequence in order to assess contamination in the analytical system. In general, instrument blanks are used to differentiate between contamination caused by the analytical system and that caused by the sample handling or sample prep process. Instrument blanks may also be inserted throughout the analytical sequence to minimize the effect of carryover from samples with high analyte content.

Table 24-1. Example – Negative Controls

Control Type	Details
Trip Blank [1]	are required to be submitted by the client with each shipment of samples requiring aqueous and solid volatiles analyses (or as specified in the client's project plan). Additionally, trip blanks may be prepared and analyzed for volatile analysis of air samples, when required by the client. A trip blank may be purchased (certified clean) or is prepared by the laboratory by filling a clean container with pure deionized water that has been purged to remove any volatile compounds. Appropriate preservatives are also added to the container. The trip blank is sent with the bottle order and is intended to reflect the environment that the containers are subjected to throughout shipping and handling and help identify possible sources if contamination is found. The field sampler returns the trip blank in the cooler with the field samples.
Field Blanks [1]	are sometimes used for specific projects by the field samplers. A field blank prepared in the field by filling a clean container with pure reagent water and appropriate preservative, if any, for the specific sampling activity being undertaken. (EPA OSWER)
Equipment Blanks [1]	are also sometimes created in the field for specific projects. An equipment blank is a sample of analyte-free media which has been used to rinse common sampling equipment to check effectiveness of decontamination procedures. (TNI)
Holding Blanks	also referred to as refrigerator or freezer blanks, are used to monitor the sample storage units for volatile organic compounds during the storage of VOA samples in the laboratory

[1] When known, these field QC samples should not be selected for matrix QC as it does not provide information on the behavior of the target compounds in the field samples. Usually, the client sample ID will provide information to identify the field blanks with labels such as "FB", "EB", or "TB."

Evaluation criteria and corrective action for these controls are defined in the specific standard operating procedure for each analysis.

24.4 Positive Controls

Control samples (e.g., QC indicators) are analyzed with each batch of samples to evaluate data based upon (1) Method Performance (Laboratory Control Sample (LCS) or Blank Spike (BS)), which entails both the preparation and measurement steps; and (2) Matrix Effects (Matrix Spike (MS) or Sample Duplicate (MD, DUP), which evaluates field sampling accuracy, precision, representativeness, interferences, and the effect of the matrix on the method performed. Each regulatory program and each method within those programs specify the control samples that are prepared and/or analyzed with a specific batch.

Note that frequency of control samples vary with specific regulatory, methodology and project specific criteria. Complete details on method control samples are as listed in each analytical SOP.

24.4.1 Method Performance Control - Laboratory Control Sample (LCS)

The LCS measures the accuracy of the method in a blank matrix and assesses method performance independent of potential field sample matrix affects in a laboratory batch.

The LCS is prepared from a clean matrix similar to that of the associated samples that is free from target analytes (for example: Reagent water, Ottawa sand, glass beads, etc.) and is processed along with and under the same conditions as the associated samples. The LCS is spiked with verified known amounts of analytes or is made of a material containing known and verified amounts of analytes, taken through all preparation and analysis steps along with the field samples. Where there is no preparation taken for an analysis (such as in aqueous volatiles), or when all samples and standards undergo the same preparation and analysis process (such as Phosphorus), a calibration verification standard is reported as the LCS. In some instances where there is no practical clean

solid matrix available, aqueous LCS's may be processed for solid matrices; final results may be calculated as mg/kg or ug/kg, assuming 100% solids and a weight equivalent to the aliquot used for the corresponding field samples, to facilitate comparison with the field samples.

Certified pre-made reference material purchased from a NIST/A2LA accredited vendor may also be used for the LCS when the material represents the sample matrix or the analyte is not easily spiked (e.g. solid matrix LCS for metals, TDS, etc.).

The specific frequency of use for LCS during the analytical sequence is defined in the specific standard operating procedure for each analysis. It is generally 1 for each batch of samples; not to exceed 20 environmental samples.

If the mandated or requested test method, or project requirements, do not specify the spiking components, the laboratory shall spike all reportable components to be reported in the Laboratory Control Sample (and Matrix Spike) where applicable (e.g. no spike of pH). However, in cases where the components interfere with accurate assessment (such as simultaneously spiking chlordane, toxaphene and PCBs in Method 608), the test method has an extremely long list of components or components are incompatible, at a minimum, a representative number of the listed components (see below) shall be used to control the test method. The selected components of each spiking mix shall represent all chemistries, elution patterns and masses, permit specified analytes and other client requested components. However, the laboratory shall ensure that all reported components are used in the spike mixture within a two-year time period.

- For methods that have 1-10 target analytes, spike all components.
- For methods that include 11-20 target analytes, spike at least 10 or 80%, whichever is greater.
- For methods with more than 20 target analytes, spike at least 16 components.
- Exception: Due to analyte incompatibility in pesticides, Toxaphene and Chlordane are only spiked at client request based on specific project needs.
- Exception: Due to analyte incompatibility between the various PCB Aroclors, Aroclors 1016 and 1260 are used for spiking as they cover the range of all of the Aroclors. Specific Aroclors may be used by request on a project specific basis.

24.5 Sample Matrix Controls

Table 24-3. Sample Matrix Control

Control Type	Details	
Matrix Spikes (MS)	Use	used to assess the effect sample matrix of the spiked sample has on the precision and accuracy of the results generated by the method used;
	Typical Frequency [1]	At a minimum, with each matrix-specific batch of samples processed, an MS is carried through the complete analytical procedure. Unless specified by the client, samples used for spiking are randomly selected and rotated between different client projects. If the mandated or requested test method does not specify the spiking components, the laboratory shall spike all reportable components to be reported in the Laboratory Control Sample and Matrix Spike. Refer to the method SOP for complete details
	Description	essentially a sample fortified with a known amount of the test analyte(s).
Surrogate	Use	Measures method performance to sample matrix (organics only).
	Typical Frequency [1]	Are added to all samples, standards, and blanks, for all organic chromatography methods except when the matrix precludes its use or when a surrogate is not available. The recovery of the surrogates is compared to the acceptance limits for the specific method. Poor surrogate recovery may indicate a problem with sample composition and shall be reported, with data qualifiers, to the client whose sample produced poor recovery.
	Description	Are similar to matrix spikes except the analytes are compounds with properties that mimic the analyte of interest and are unlikely to be found in environment samples.
Duplicates[2]	Use	For a measure of analytical precision, with each matrix-specific batch of samples processed, a matrix duplicate (MD or DUP) sample, matrix spike duplicate (MSD), or LCS duplicate (LCSD) is carried through the complete analytical procedure.
	Typical Frequency [1]	Duplicate samples are usually analyzed with methods that do not require matrix spike analysis.
	Description	Performed by analyzing two aliquots of the same field sample independently or an additional LCS.
Internal Standards	Use	Are spiked into all environmental and quality control samples (including the initial calibration standards) to monitor the qualitative aspect of organic and some inorganic analytical measurements.
	Typical Frequency [1]	All organic and ICP methods as required by the analytical method.
	Description	Used to correct for matrix effects and to help troubleshoot variability in analytical response and are assessed after data acquisition. Possible sources of poor internal standard response are sample matrix, poor analytical technique or instrument performance.

[1] See the specific analytical SOP for type and frequency of sample matrix control samples.

[2] LCSD's are normally not performed except when regulatory agencies or client specifications require them. The recoveries for the spiked duplicate samples must meet the same laboratory established recovery limits as the accuracy QC samples. If an LCSD is analyzed both the LCS and LCSD must meet the same recovery criteria and be included in the final report. The precision measurement is reported as "Relative Percent Difference" (RPD). Poor precision between duplicates (except LCS/LCSD) may indicate non-homogeneous matrix or sampling.

24.6 Acceptance Criteria (Control Limits)

As mandated by the test method and regulation, each individual analyte in the LCS, MS, or Surrogate Spike is evaluated against the control limits published in the test method. Where there are no established acceptance criteria, the laboratory calculates in-house control limits with the use of control charts or, in some cases, utilizes client project specific control limits. When this occurs, the regulatory or project limits will supersede the laboratory's in-house limits.

Note: For methods, analytes and matrices with very limited data (e.g., unusual matrices not analyzed often), interim limits are established using available data or by analogy to similar methods or matrices.

Once control limits have been established, they are verified, reviewed, and updated if necessary on an annual basis unless the method requires more frequent updating. Control limits are established per method (as opposed to per instrument) regardless of the number of instruments utilized.

Laboratory generated % Recovery acceptance (control) limits are generally established by taking $\pm$ 3 Standard Deviations (99% confidence level) from the average recovery of a minimum of 20-30 data points (more points are preferred).

- Regardless of the calculated limit, the limit should be no tighter than the Calibration Verification (ICV/CCV). (Unless the analytical method specifies a tighter limit).

- In-house limits cannot be any wider than those mandated in a regulated analytical method. Client or contract required control limits are evaluated against the laboratory's statistically derived control limits to determine if the data quality objectives (DQOs) can be achieved. If laboratory control limits are not consistent with DQOs, then alternatives must be considered, such as method improvements or use of an alternate analytical method.

- The lowest acceptable recovery limit will be 10% (the analyte must be detectable and identifiable). Exception: The lowest acceptable recovery limit for Benzidine will be 5% and the analyte must be detectable and identifiable.

- The maximum acceptable recovery limit will be 185%.

- The maximum acceptable RPD limit will be 35% for waters and 40% for soils. The minimum RPD limit is 10%.

- If either the high or low end of the control limit changes by $\leq$ 5% from previous, the control chart is visually inspected and, using professional judgment, they may be left unchanged if there is no affect on laboratory ability to meet the existing limits.

24.6.1 The lab must be able to generate a current listing of their control limits and track when the updates are performed. In addition, the laboratory must be able to recreate historical control limits. See SOP TA-QA-0600 Quality Control Charting and Establishing Warning and Action Limits.

One example: The QA department generates a Quality Control Limit Summary that contains tables that summarize the precision and accuracy acceptability limits for analyses performed at TestAmerica Seattle. This summary includes an effective date, is updated each time new limits are generated and is located in the LIMS**.** Unless otherwise noted, limits within these tables are laboratory generated. The analysts are instructed to use the current limits in the laboratory (dated and approved by the Technical Manager and QA Manager) and entered into the Laboratory Information Management System (LIMS). The Quality Assurance department maintains an archive of all limits used within the laboratory.

24.6.2 A LCS that is within the acceptance criteria establishes that the analytical system is in control and is used to validate the process. Samples that are analyzed with an LCS with recoveries

outside of the acceptance limits may be determined as out of control and should be reanalyzed if possible. If reanalysis is not possible, then the results for all affected analytes for samples within the same batch must be qualified when reported. The internal corrective action process (see Section 12) is also initiated if an LCS exceeds the acceptance limits. If agreed to by the client, sample results may be qualified and reported without reanalysis if:

- The analyte results are below the reporting limit and the LCS is above the upper control limit.
- If the analytical results are above the relevant regulatory limit and the LCS is below the lower control limit.

Or, for TNI work, there are an allowable number of Marginal Exceedances (ME). (MEs are allowed for DoD/DOE work as long as the analyte is not a chemical of concern):

<11 analytes	0 marginal exceedances are allowed.
11 – 30 Analytes	1 marginal exceedance is allowed
31-50 Analytes	2 marginal exceedances are allowed
51-70 Analytes	3 marginal exceedances are allowed
71-90 Analytes	4 marginal exceedances are allowed
> 90 Analytes	5 marginal exceedances are allowed

- Marginal exceedances are recovery exceedances between 3 SD and 4 SD from the mean recovery limit (TNI).
- Marginal exceedances must be random. If the same analyte exceeds the LCS control limit repeatedly, it is an indication of a systematic problem. The source of the error must be located and corrective action taken. The laboratory has a system to monitor marginal exceedances to ensure that they are random.

Though marginal exceedances may be allowed, the data must still be qualified to indicate it is outside of the normal limits.

24.6.3 If the MS/MSDs do not meet acceptance limits, the MS/MSD and the associated spiked sample is reported with a qualifier for those analytes that do not meet limits. If obvious preparation errors are suspected, or if requested by the client, unacceptable MS/MSDs are reprocessed and reanalyzed to prove matrix interference. A more detailed discussion of acceptance criteria and corrective action can be found in the lab's method SOPs and in Section 12.

24.6.4 If a surrogate standard falls outside the acceptance limits, if there is not obvious chromatographic matrix interference, reanalyze the sample to confirm a possible matrix effect. If the recoveries confirm or there was obvious chromatographic interference, results are reported from the original analysis and a qualifier is added. If the reanalysis meets surrogate recovery criteria, the second run is reported (or both are reported if requested by the client). Under certain circumstances, where all of the samples are from the same location and share similar chromatography, the reanalysis may be performed on a single sample rather than all of the samples and if the surrogate meets the recovery criteria in the reanalysis, all of the affected samples would require reanalysis.

24.7 Additional Procedures to Assure Quality Control

The laboratory has written and approved method SOPs to assure the accuracy of the test method including calibration (see Section 20), use of certified reference materials (see Section 21) and use of PT samples (see Section 15).

A discussion regarding MDLs, Limit of Detection (LOD) and Limit of Quantitation (LOQ) can be found in Section 19.

- Use of formulae to reduce data is discussed in the method SOPs and in Section 20.
- Selection of appropriate reagents and standards is included in Section 9 and 21.
- A discussion on selectivity of the test is included in Section 5.
- Constant and consistent test conditions are discussed in Section 18.
- The laboratories sample acceptance policy is included in Section 23.

SECTION 25. REPORTING RESULTS

25.1 Overview

The results of each test are reported accurately, clearly, unambiguously, and objectively in accordance with State and Federal regulations as well as client requirements. Analytical results are issued in a format that is intended to satisfy customer and laboratory accreditation requirements as well as provide the end user with the information needed to properly evaluate the results. Where there is conflict between client requests and laboratory ethics or regulatory requirements, the laboratory's ethical and legal requirements are paramount, and the laboratory will work with the client during project set up to develop an acceptable solution. Refer to Section 7.

A variety of report formats are available to meet specific needs.

In cases where a client asks for simplified reports, there must be a written request from the client. There still must be enough information that would show any analyses that were out of conformance (QC out of limits) and there should be a reference to a full report that is made available to the client. Review of reported data is included in Section 19.

25.2 Test Reports

Analytical results are reported in a format that is satisfactory to the client and meets all requirements of applicable accrediting authorities and agencies. A variety of report formats are available to meet specific needs. The report is printed on laboratory letterhead, reviewed, and signed by the appropriate project manager or designee. At a minimum, the standard laboratory report shall contain the following information:

25.2.1 A report title (e.g. Analytical Report For Samples) with a "sample results" column header.

25.2.2 Each report cover page printed on company letterhead, which includes the laboratory name, address and telephone number.

25.2.3 A unique identification of the report (e.g. job number) and on each page an identification in order to ensure the page is recognized as part of the report and a clear identification of the end.

Note: Page numbers of report are represented as page # of ##. Where the first number is the page number and the second is the total number of pages.

25.2.4 A copy of the chain of custody (COC).

- Any COCs involved with Subcontracting are included.

25.2.5 The name and address of client and a project name/number, if applicable.

25.2.6 Client project manager or other contact

25.2.7 Description and unambiguous identification of the tested sample(s) including the client identification code.

25.2.8 Date of receipt of sample, date and time of collection, and date(s) of test preparation and performance, and time of preparation or analysis if the required holding time for either activity is less than or equal to 72 hours.

25.2.9 Date reported or date of revision, if applicable.

25.2.10 Method of analysis including method code (EPA, Standard Methods, etc).

25.2.11 Reporting limit.

25.2.12 Method detection limits (if requested)

25.2.13 Definition of Data qualifiers and reporting acronyms (e.g. ND).

25.2.14 Sample results.

25.2.15 QC data consisting of method blank, surrogate, LCS, and MS/MSD recoveries and control limits.

25.2.16 Condition of samples at receipt including temperature. This may be accomplished in a narrative or by attaching sample login sheets (Refer to Sec. 25.2.4 – Item 3 regarding additional addenda).

25.2.17 A statement to the effect that the results relate only to the items tested and the sample as received by the laboratory.

25.2.18 A statement that the report shall not be reproduced except in full, without prior express written approval by the laboratory coordinator.

25.2.19 A signature and title of the person(s) accepting responsibility for the content of the report and date of issue. Signatories are appointed by the Lab Director.

25.2.20 When NELAC accreditation is required, the lab shall certify that the test results meet all requirements of TNI or provide reasons and/or justification if they do not.

25.2.21 Where applicable, a narrative to the report that explains the issue(s) and corrective action(s) taken in the event that a specific accreditation or certification requirement was not met.

25.2.22 When soil samples are analyzed, a specific identification as to whether soils are reported on a "wet weight" or "dry weight" basis.

25.2.23 Appropriate laboratory certification number for the state of origin of the sample, if applicable.

25.2.24 If only part of the report is provided to the client (client requests some results before all of it is complete), it must be clearly indicated on the report (e.g., preliminary). A complete report must be sent once all of the work has been completed.

25.2.25 Any non-TestAmerica subcontracted analysis results are provided as a separate report on the official letterhead of the subcontractor. All TestAmerica subcontracting is clearly identified on the report as to which laboratory performed a specific analysis.

25.2.26 *A Certification Summary Report, where required, will document that, unless otherwise noted, all analytes tested and reported by the laboratory were covered by the noted certifications.*

Note: Refer to the Corporate SOP on Electronic Reporting and Signature Policy (No. CA-I-P-002) for details on internally applying electronic signatures of approval.

25.3 Reporting Level or Report Type

The laboratory offers four levels of quality control reporting. Each level, in addition to its own specific requirements, contains all the information provided in the preceding level. The packages provide the following information in addition to the information described above:

- Level I is a report with the features described in Section 25.2 above, *excluding 25.2.15 (QC data).*
- Level II is a Level I report plus summary information, including results for the method blank reported to the laboratory MDL (if requested), percent recovery for laboratory control samples and matrix spike samples, and the RPD values for all MSD and sample duplicate analyses.
- Level III contains all the information supplied in Level II, but presented on the CLP-like summary forms, and relevant calibration information. A Level II report is not included, unless specifically requested. No raw data is provided.
- Level IV is the same as Level III with the addition of all raw supporting data.

In addition to the various levels of QC packaging, the laboratory also provides reports in diskette deliverable form. Initial reports may be provided to clients by facsimile. All faxed reports are followed by hardcopy. Procedures used to ensure client confidentiality are outlined in Section 25.6.

25.3.1 Electronic Data Deliverables (EDDs)

EDDs are routinely offered as part of TestAmerica's services in addition to the test report as described in section 25.2. When NELAP accreditation is required and both a test report and EDD are provided to the client, the official version of the test report will be the combined information of the report and the EDD. TestAmerica Seattle offers a variety of EDD formats including Environmental Restoration Information Management System (ERPIMS), Staged Electronic Data Deliverable (SEDD) Environmental Quality Information System (EQuIS), Electronic Deliverable Format (EDF), Excel and custom files.

EDD specifications are submitted to the IT department by the PM for review and undergo the contract review process. Once the facility has committed to providing data in a specific electronic format, the coding of the format may need to be performed. This coding is documented and validated. The validation of the code is retained by the IT staff coding the EDD.

EDDs shall be subject to a review to ensure their accuracy and completeness. If EDD generation is automated, review may be reduced to periodic screening if the laboratory can demonstrate that it can routinely generate that EDD without errors. Any revisions to the EDD format must be reviewed until it is demonstrated that it can routinely be generated without errors. If the EDD can be reproduced accurately and if all subsequent EDDs can be produced error-free, each EDD does not necessarily require a review.

25.4 Supplemental Information for Test

The lab identifies any unacceptable QC analyses or any other unusual circumstances or observations such as environmental conditions and any non-standard conditions that may have affected the quality of a result. This is typically in the form of a footnote or a qualifier and/or a narrative explaining the discrepancy in the front of the report.

Numeric results with values outside of the calibration range, either high or low are qualified as 'estimated'.

Where quality system requirements are not met, a statement of compliance/non-compliance with requirements and/or specifications is required, including identification of test results derived from any sample that did not meet TNI sample acceptance requirements such as improper container, holding time, or temperature.

Where applicable, a statement on the estimated uncertainty of measurements; information on uncertainty is needed when a client's instructions so require.

Opinions and Interpretations - The test report contains objective information, and generally does not contain subjective information such as opinions and interpretations. If such information is required by the client, the Laboratory Director will determine if a response can be prepared. If so, the Laboratory Director will designate the appropriate member of the management team to prepare a response. The response will be fully documented, and reviewed by the Laboratory Director, before release to the client. There may be additional fees charged to the client at this time, as this is a non-routine function of the laboratory.

Note: Review of data deliverable packages for submittal to regulatory authorities requires responses to non-conforming data concerning potential impact on data quality. This necessitates a limited scope of interpretation, and this work is performed by the QA Department. This is the only form of "interpretation" of data that is routinely performed by the laboratory.

When opinions or interpretations are included in the report, the laboratory provides an explanation as to the basis upon which the opinions and interpretations have been made. Opinions and interpretations are clearly noted as such and where applicable, a comment should be added suggesting that the client verify the opinion or interpretation with their regulator.

25.5 Environmental Testing Obtained From Subcontractors

If the laboratory is not able to provide the client the requested analysis, the samples would be subcontracted following the procedures outlined in the Corporate SOP on Subcontracting (SOP No. *CW-L-S-004*).

Data reported from analyses performed by a subcontractor laboratory are clearly identified as such on the analytical report provided to the client. Results from a subcontract laboratory outside of TestAmerica are reported to the client on the subcontract laboratory's original report stationary and the report includes any accompanying documentation.

25.6 Client Confidentiality

In situations involving the transmission of environmental test results by telephone, facsimile or other electronic means, client confidentiality must be maintained.

TestAmerica will not intentionally divulge to any person (other than the Client or any other person designated by the Client in writing) any information regarding the services provided by TestAmerica or any information disclosed to TestAmerica by the Client. Furthermore, information known to be potentially endangering to national security or an entity's proprietary rights will not be released.

Note: This shall not apply to the extent that the information is required to be disclosed by TestAmerica under the compulsion of legal process. TestAmerica will, to the extent feasible, provide reasonable notice to the client before disclosing the information.

Note: Authorized representatives of an accrediting authority are permitted to make copies of any analyses or records relevant to the accreditation process, and copies may be removed from the laboratory for purposes of assessment.

25.6.1 Report deliverable formats are discussed with each new client. If a client requests that reports be faxed or e-mailed, the reports are *to meet all requirements of this document, include cover letter.*

25.7 Format of Reports

The format of reports is designed to accommodate each type of environmental test carried out and to minimize the possibility of misunderstanding or misuse.

25.8 Amendments to Test Reports

Corrections, additions, or deletions to reports are only made when justification arises through supplemental documentation. Justification is documented using the laboratory's corrective action system (refer to Section 12).

The revised report is retained on the Archive data server, as is the original report. The revised report is stored in the Archive data server under the job number followed by the appropriate revision number. The revised report will have the "Rev" followed by the revision number in the report file name.

When the report is re-issued, a notation of "Revision" with the appropriate number is placed on the cover/signature page of the report or at the top of the narrative page with a brief explanation of reason for the re-issue and a reference back to the last final report generated. For example: Report was revised on 11/3/08 to include toluene in sample NQA1504 per client's request. This final report replaces the final report generated on 10/27/08 at 10:47am.

25.9 Policies on Client Requests for Amendments

25.9.1 Policy on Data Omissions or Reporting Limit Increases

Fundamentally, our policy is simply to not omit previously reported results (including data qualifiers) or to not raise reporting limits and report sample results as ND. This policy has few exceptions. Exceptions are:

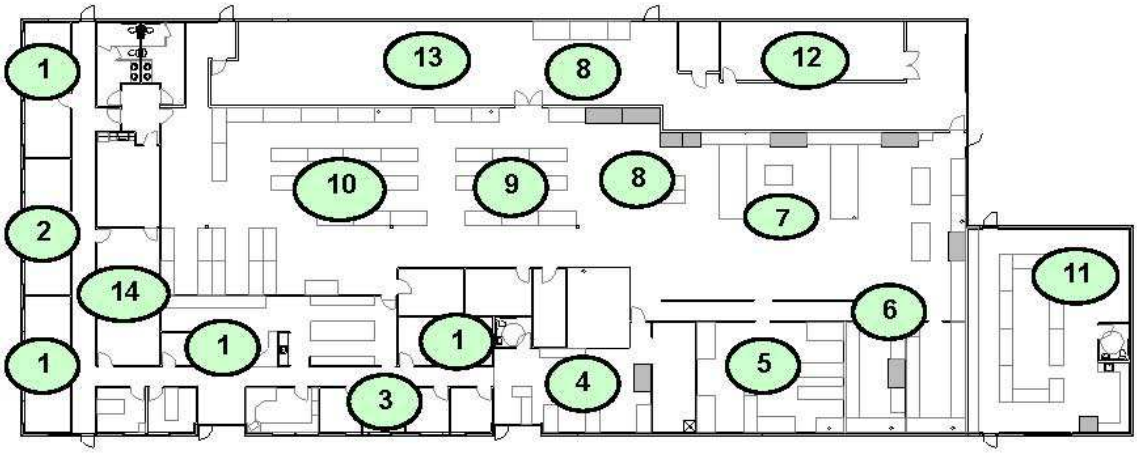
- Laboratory error.
- Sample identification is indeterminate (confusion between COC and sample labels).
- An incorrect analysis (not analyte) was requested (e.g., COC lists 8315 but client wanted 8310). A written request for the change is required.
- Incorrect limits reported based on regulatory requirements.
- The requested change has absolutely no possible impact on the interpretation of the analytical results and there is no possibility of the change being interpreted as misrepresentation by anyone inside or outside of our company.

25.9.2 Multiple Reports

TestAmerica does not issue multiple reports for the same work order where there is different information on each report (this does not refer to copies of the same report) unless required to meet regulatory needs and approved by QA.

Document Uncontrolled When Printed

Appendix 1. Laboratory Floor Plan



Key Areas *

1. Admin/HR
2. QA Offices
3. Project Management
4. Sample Control
5. Metals & Mercury Lab
6. Wet / General Chem
7. Metals Prep
8. Organics Prep
9. GC-MS SVOA
10. GC SVOA
11. GC & GC-MS VOA
12. Sample Disposal
13. GeoTech, Storage, Warehouse
14. Conference Room

Appendix 2. Glossary/Acronyms (EL-V1M2 Sec. 3.1)

Glossary:

Acceptance Criteria: Specified limits placed on characteristics of an item, process, or service defined in requirement documents. (ASQC)

Accreditation: The process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications or standards, thereby accrediting the laboratory.

Accuracy: The degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator. (QAMS)

Analyst: The designated individual who performs the "hands-on" analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality.

Analytical Uncertainty: A subset of Measurement Uncertainty that includes all laboratory activities performed as part of the analysis. (TNI)

Anomaly: A condition or event, other than a deficiency, that may affect the quality of the data, whether in the laboratory's control or not.

Assessment: The evaluation process used to measure or establish the performance, effectiveness, and conformance of an organization and/or its systems to defined criteria (to the standards and requirements of laboratory accreditation). (TNI)

Audit: A systematic and independent examination of facilities, equipment, personnel, training, procedures, record-keeping, data validation, data management, and reporting aspects of a system to determine whether QA/QC and technical activities are being conducted as planned and whether these activities will effectively achieve quality objectives. (TNI)

Batch: Environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A **preparation batch** is composed of one (1) to twenty (20) environmental samples of the same quality systems matrix, meeting the above mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be twenty-four (24) hours. An **analytical batch** is composed of prepared environmental samples (extracts, digestates or concentrates) which are analyzed together as a group. An analytical batch can include prepared samples originating from various quality system matrices and can exceed twenty (20) samples. (TNI)

Bias: The systematic or persistent distortion of a measurement process, which causes errors in one direction (i.e., the expected sample measurement is different from the sample's true value). (TNI)

Blank: A sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results. (ASQC)

Calibration: A set of operations that establish, under specified conditions, the relationship between values of quantities indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material, and the corresponding values realized by standards. (TNI)

1) In calibration of support equipment the values realized by standards are established through the use of reference standards that are traceable to the International System of Units (SI).

2) In calibration according to methods, the values realized by standards are typically established through the use of Reference Materials that are either purchased by the laboratory with a certificate of analysis or purity, or prepared by the laboratory using support equipment that has been calibrated or verified to meet specifications.

Calibration Curve: The mathematical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response. (TNI)

Calibration Standard: A substance or reference material used to calibrate an instrument (QAMS)

Certified Reference Material (CRM): A reference material accompanied by a certificate, having a value, measurement uncertainty, and stated metrological traceability chain to a national metrology institute. (TNI)

Chain of Custody (COC) Form: Record that documents the possession of the samples from the time of collection to receipt in the laboratory. This record generally includes: the number and types of containers; the mode of collection; the collector; time of collection; preservation; and requested analyses. (TNI)

Compromised Samples: Those samples which are improperly sampled, insufficiently documented (chain of custody and other sample records and/or labels), improperly preserved, collected in improper containers, or exceeding holding times when delivered to a laboratory. Under normal conditions, compromised samples are not analyzed. If emergency situation require analysis, the results must be appropriately qualified.

Confidential Business Information (CBI): Information that an organization designates as having the potential of providing a competitor with inappropriate insight into its management, operation or products. TNI and its representatives agree to safeguarding identified CBI and to maintain all information identified as such in full confidentiality.

Confirmation: Verification of the identity of a component through the use of an approach with a different scientific principle from the original method. These may include, but are not limited to Second Column Confirmation; Alternate wavelength; Derivatization; Mass spectral interpretation; Alternative detectors or Additional Cleanup procedures. (TNI)

Conformance: An affirmative indication or judgment that a product or service has met the requirements of the relevant specifications, contract, or regulation; also the state of meeting the requirements. (ANSI/ASQC E4-1994)

Correction: Actions necessary to correct or repair analysis specific non-conformances. The acceptance criteria for method specific QC and protocols as well as the associated corrective actions. The analyst will most frequently be the one to identify the need for this action as a result of calibration checks and QC sample analysis**.** No significant action is taken to change behavior, process or procedure.

Corrective Action: The action taken to eliminate the causes of an existing nonconformity, defect or other undesirable situation in order to prevent recurrence. (ISO 8402)

Data Audit: A qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data re of acceptable quality (i.e., that they meet specified acceptance criteria).

Data Reduction: The process of transforming the number of data items by arithmetic or statistical calculations, standard curves, and concentration factors, and collation into a more useable form. (TNI)

Deficiency: An unauthorized deviation from acceptable procedures or practices, or a defect in an item. (ASQC), whether in the laboratory's control or not.

Demonstration of Capability: A procedure to establish the ability of the analyst to generate analytical results of acceptable accuracy and precision. (TNI)

Document Control: The act of ensuring that documents (and revisions thereto) are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly, and controlled to ensure use of the correct version at the location where the prescribed activity if performed. (ASQC)

Duplicate Analyses: The analyses or measurements of the variable of interest performed identically on two subsamples of the same sample. The results from duplicate analyses are used to evaluate analytical or measurement precision but not the precision of sampling, preservation or storage internal to the laboratory. (EPA-QAD)

Equipment Blank: Sample of analyte-free media which has been used to rinse common sampling equipment to check effectiveness of decontamination procedures.

External Standard Calibration: Calibrations for methods that do not utilize internal standards to compensate for changes in instrument conditions.

Field Blank: Blank prepared in the field by filing a clean container with pure de-ionized water and appropriate preservative, if any, for the specific sampling activity being undertaken (EPA OSWER)

Field of Accreditation: Those matrix, technology/method, and analyte combinations for which the accreditation body offers accreditation.

Holding Times: The maximum time that samples may be held prior to analyses and still be considered valid or not compromised. (40 CFR Part 136)

Internal Standard: A known amount of standard added to a test portion of a sample as a reference for evaluating and controlling the precision and bias of the applied analytical test method. (TNI)

Internal Standard Calibration: Calibrations for methods that utilize internal standards to compensate for changes in instrument conditions.

Instrument Blank: A clean sample (e.g., distilled water) processed through the instrumental steps of the measurement process; used to determine instrument contamination. (EPA-QAD)

Instrument Detection Limit (IDL): The minimum amount of a substance that can be measured with a specified degree of confidence that the amount is greater than zero using a specific instrument. The IDL is associated with the instrumental portion of a specific method only, and sample preparation steps are not considered in its derivation. The IDL is a statistical estimation at a specified confidence interval of the concentration at which the relative uncertainty is $\pm$ 100%. The IDL represents a <u>range</u> where <u>qualitative</u> detection occurs on a specific instrument. Quantitative results are not produced in this range.

Laboratory Control Sample (however named, such as laboratory fortified blank, spiked blank, or QC check sample)**:** A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes, taken through all preparation and analysis steps of the procedure unless otherwise noted in a reference method. It is generally used to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system.

An LCS shall be prepared at a minimum of 1 per batch of 20 or less samples per matrix type per sample extraction or preparation method except for analytes for which spiking solutions are not available such as total suspended solids, total dissolved solids, total volatile solids, total solids, pH, color, odor, temperature, dissolved oxygen or turbidity. The results of these samples shall be used to determine batch acceptance.

Least Squares Regression (1st Order Curve): The least squares regression is a mathematical calculation of a straight line over two axes. The y axis represents the instrument response (or Response ratio) of a standard or sample and the x axis represents the concentration. The regression calculation will generate a correlation coefficient (r) that is a measure of the "goodness of fit" of the regression line to the data. A value of 1.00 indicates a perfect fit. In order to be used for quantitative purposes, r must be greater than or equal to 0.99 for organics and 0.995 for inorganics.

Limit(s) of Detection (LOD) [a.k.a., Method Detection Limit (MDL)]: A laboratory's estimate of the minimum amount of an analyte in a given matrix that an analytical process can reliably detect in their facility. (TNI)

LOD Verification [a.k.a., MDL Verification]: A processed QC sample in the matrix of interest, spiked with the analyte at no more than 3X the LOD for single analyte tests and 4X the LOD for multiple analyte tests and processed through the entire analytical procedure.

Limit(s) of Quantitation (LOQ) [a.k.a., Reporting Limit]: The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. (TNI)

(QS) Matrix: The component or substrate that contains the analyte of interest. For purposes of batch and QC requirement determinations, the following matrix distinctions shall be used:

Aqueous: Any aqueous sample excluded from the definition of Drinking Water or Saline/Estuarine. Includes surface water, groundwater, effluents, and TCLP or other extracts.

Drinking Water: Any aqueous sample that has been designated as a potable or potential potable water source.

Saline/Estuarine: Any aqueous sample from an ocean or estuary, or other salt water source such as the Great Salt Lake.

Non-Aqueous Liquid: Any organic liquid with <15% settleable solids.

Biological Tissue: Any sample of a biological origin such as fish tissue, shellfish, or plant material. Such samples shall be grouped according to origin.

Solids: Includes soils, sediments, sludges, and other matrices with >15% settleable solids.

Chemical Waste: A product or by-product of an industrial process that results in a matrix not previously defined.

Air & Emissions: Whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas or vapor that are collected with a sorbant tube, impinger solution, filter, or other device. (TNI)

Matrix Spike (spiked sample or fortified sample): A sample prepared, taken through all sample preparation and analytical steps of the procedure unless otherwise noted in a referenced method, by adding a known amount of target analyte to a specified amount of sample for which an independent test result of target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency.

Matrix Spike Duplicate (spiked sample or fortified sample duplicate): A replicate matrix spike ~~is~~ prepared and analyzed to obtain a measure of the precision of the recovery for each analyte.

Method Blank: A sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses.

Method Detection Limit: The minimum concentration of a substance (an analyte) that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. (40 CFR Part 136, Appendix B)

Negative Control: Measures taken to ensure that a test, its components, or the environment do not cause undesired effects, or produce incorrect test results.

Non-conformance: An indication, judgment, or state of not having met the requirements of the relevant specifications, contract, or regulation.

Observation: A record of phenomena that (1) may assist in evaluation of the sample data; (2) may be of importance to the project manager and/or the client, and yet not at the time of the observation have any known effect on quality.

Performance Audit: The routine comparison of independently obtained qualitative and quantitative measurement system data with routinely obtained data in order to evaluate the proficiency of an analyst or laboratory.

Positive Control: Measures taken to ensure that a test and/or its components are working properly and producing correct or expected results from positive test subjects.

Precision: The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms. (TNI)

Preservation: Any conditions under which a sample must be kept in order to maintain chemical and/or biological integrity prior to analysis. (TNI)

Proficiency Testing: A means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source. (TNI)

Proficiency Testing Program: The aggregate of providing rigorously controlled and standardized environmental samples to a laboratory for analysis, reporting of results, statistical evaluation of the results and the collective demographics and results summary of all participating laboratories. (TNI)

Proficiency Test Sample (PT): A sample, the composition of which is unknown to the laboratory and is provided to test whether the laboratory can produce analytical results within specified acceptance criteria. (TNI)

Quality Assurance: An integrated system of management activities involving planning, implementation, assessment, reporting and quality improvement to ensure that a process, item, or service is of the type of quality needed and expected by the client. (TNI)

Quality Assurance [Project] Plan (QAPP): A formal document describing the detailed quality control procedures by which the quality requirements defined for the data and decisions pertaining to a specific project are to be achieved. (EAP-QAD)

Quality Control: The overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the customer; operational techniques and activities that are used to fulfill requirements for quality; also the system of activities and checks used to ensure that measurement systems are maintained within prescribed limits, providing protection against "out of control" conditions and ensuring that the results are of acceptable quality. (TNI)

Quality Control Sample: A sample used to assess the performance of all or a portion of the measurement system. One of any number of samples, such as Certified Reference Materials, a quality system matrix fortified by spiking, or actual samples fortified by spiking, intended to demonstrate that a measurement system or activity is in control. (TNI)

Quality Manual: A document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users. (TNI)

Quality System: A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA and QC activities. (TNI)

Raw Data: The documentation generated during sampling and analysis. This documentation includes, but is not limited to, field notes, electronic data, magnetic tapes, untabulated sample results, QC sample results, print outs of chromatograms, instrument outputs, and handwritten records. (TNI)

Record Retention: The systematic collection, indexing and storing of documented information under secure conditions.

Reference Material: Material or substance, one or more properties of which are sufficiently homogeneous and well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials. (TNI)

Reference Standard: Standard used for the calibration of working measurement standards in a given organization or a given location. (TNI)

Sampling: Activity related to obtaining a representative sample of the object of conformity assessment, according to a procedure.

Second Order Polynomial Curve (Quadratic): The 2nd order curves are a mathematical calculation of a slightly curved line over two axis. The y axis represents the instrument response (or Response ratio) of a standard or sample and the x axis represents the concentration. The 2nd order regression will generate a coefficient of determination (COD or r^2) that is a measure of the "goodness of fit" of the quadratic curvature the data. A value of 1.00 indicates a perfect fit. In order to be used for quantitative purposes, r^2 must be greater than or equal to 0.99.

Selectivity: The ability to analyze, distinguish, and determine a specific analyte or parameter from another component that may be a potential interferent or that may behave similarly to the target analyte or parameter within the measurement system. (TNI)

Sensitivity: The capability of a method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest. (TNI)

Spike: A known mass of target analyte added to a blank, sample or sub-sample; used to determine recovery efficiency or for other quality control purposes.

Standard: The document describing the elements of laboratory accreditation that has been developed and established within the consensus principles of standard setting and meets the approval requirements of standard adoption organizations procedures and policies. (TNI)

Standard Operating Procedures (SOPs): A written document which details the method for an operation, analysis, or action, with thoroughly prescribed techniques and steps. SOPs are officially approved as the methods for performing certain routine or repetitive tasks. (TNI)

Storage Blank: A blank matrix stored with field samples of a similar matrix (volatiles only) that measures storage contribution to any source of contamination.

Surrogate: A substance with properties that mimic the analyte of interest. It is unlikely to be found in environment samples and is added to them for quality control purposes.

Surrogate compounds must be added to all samples, standards, and blanks, for all organic chromatography methods except when the matrix precludes its use or when a surrogate is not available. Poor surrogate recovery may indicate a problem with sample composition and shall be reported to the client whose sample produced poor recovery. (QAMS)

Systems Audit (also Technical Systems Audit): A thorough, systematic, qualitative on-site assessment of the facilities, equipment, personnel, training, procedures, record keeping, data validation, data management, and reporting aspects of a total measurement system. (EPA-QAD)

Technical Manager: A member of the staff of an environmental laboratory who exercises actual day-to-day supervision of laboratory operations for the appropriate fields of accreditation and reporting of results

Technology: A specific arrangement of analytical instruments, detection systems, and/or preparation techniques.

Traceability: The ability to trace the history, application, or location of an entity by means of recorded identifications. In a calibration sense, traceability relates measuring equipment to national or international standards, primary standards, basic physical constants or properties, or reference materials. In a data collection sense, it relates calculations and data generated throughout the project back to the requirements for the quality of the project. (TNI)

Trip Blank: A blank matrix placed in a sealed container at the laboratory that is shipped, held unopened in the field, and returned to the laboratory in the shipping container with the field samples.

Uncertainty: A parameter associated with the result of a measurement that characterizes the dispersion of the value that could reasonably be attributed to the measured value.

Acronyms:

CAR – Corrective Action Report
CCV – Continuing Calibration Verification
CF – Calibration Factor
CFR – Code of Federal Regulations

COC – Chain of Custody
DOC – Demonstration of Capability
DQO – Data Quality Objectives
DUP - Duplicate
EHS – Environment, Health and Safety
EPA – Environmental Protection Agency
GC - Gas Chromatography
GC/MS - Gas Chromatography/Mass Spectrometry
HPLC - High Performance Liquid Chromatography
ICP - Inductively Coupled Plasma Atomic Emission Spectroscopy
ICP/MS – ICP/Mass Spectrometry
ICV – Initial Calibration Verification
IDL – Instrument Detection Limit
IH – Industrial Hygiene
IS – Internal Standard
LCS – Laboratory Control Sample
LCSD – Laboratory Control Sample Duplicate
LIMS – Laboratory Information Management System
LOD – Limit of Detection
LOQ – Limit of Quantitation
LOQV - Limit of Quantitation Check Standard
MDL – Method Detection Limit
MDLV – MDL Verification Check Standard
MRL – Method Reporting Limit
MS – Matrix Spike
MSD – Matrix Spike Duplicate
MSDS - Material Safety Data Sheet
NELAP - National Environmental Laboratory Accreditation Program
PT – Performance Testing
TNI – The NELAC Institute
QAM – Quality Assurance Manual
QA/QC – Quality Assurance / Quality Control
QAPP – Quality Assurance Project Plan
RF – Response Factor
RPD – Relative Percent Difference
RSD – Relative Standard Deviation
SD – Standard Deviation
SOP – Standard Operating Procedure
TAT – Turn-Around-Time
VOA – Volatiles
VOC – Volatile Organic Compound

Appendix 3. Laboratory Certifications, Accreditations, Validations

TestAmerica Seattle maintains accreditations, certifications, and approvals with numerous state and national entities. Programs vary but may include on-site audits, reciprocal agreements with another entity, performance testing evaluations, review of the QA Manual, Standard Operating Procedures, Method Detection Limits, training records, etc. At the time of this QA Manual revision, the laboratory has accreditation/certification/licensing with the following organizations:

Organization	Lab ID Number
DoD ELAP	L2236
ISO 17025	L2236
Alaska	UST-022
California	2901
Montana	(UST – no number)
Oregon (NELAP)	WA100007
Washington	C553
USDA Soil Permit	P330-*17-00039*
US Fish & Wildlife	*LE058448-0*

The certificates and accredited parameter lists are available for each State/Program at www.testamericainc.com under Analytical Services Search – Certifications.

APPENDIX B

Example Chain-of-Custody

Columbia Analytical Services™

800.695.7222
www.caslab.com

CHAIN of CUSTODY

Page ___ of ___

Client:

Project:

Method of Shipment

Project Manager

Telephone No.

Fax No.

Special Detection Limit/Reporting

Sample I.D.	Lab Sample No.	No. of Containers	Matrix: Soil	Matrix: Water	Matrix: Air	Matrix: Other	Prsv.: Yes	Prsv.: No	Sampling Date	Sampling Time															Turn Around Time (working days)

MARKS

Sample Received Intact: Yes No

Temperature received: Ice No ice

Relinq. by sampler (Sign & Print Name)	Date Time	Received by (Sign & Print Name)
Relinquished by	Date Time	Received by
Relinquished by	Date Time	Received by
Relinquished by	Date Time	Received by laboratory — Date Time

Lab Work No.

AXYS | Axys Analytical Services Ltd

2045 Mills Road West
Sidney, British Columbia, Canada V8L 5X2

TEL: (250) 655-5800
FAX: (250) 655-5811

CHAIN OF CUSTODY

AXYS CLIENT #:

Please note Canadian soils and freshwater sediments MAY require a CFIA Movement Certificate prior to shipping. Please call your local CFIA agent to know whether one is required. CFIA contact information is available at: http://www.inspection.gc.ca/english/directory/offbure.shtml
Shipments including soils and freshwater sediments from outside of Canada are required to include Axys's current soil importation permit.
Your AXYS Project Manager will be pleased to assist you.

REPORT TO:		***INVOICE TO:***	
Company		Company	
Address		Address	
Contact		Contact	
Phone		Phone	
FAX		FAX	
E-mail		E-mail	
Project Name/Number:		Sampler's Name:	
		Signature:	

ANALYSIS REQUESTED

Client Sample Identification	Matrix	Sampling Date	Sampling Time	Container Type/No.	AXYS Lab Sample ID (Lab use only)					

Relinquished by (Signature)	Date	Time	Received by (Signature)	Date	Time	Courier	Waybill No.
Relinquished by (Signature)	Date	Time	Received by (Signature)	Date	Time	Cooler Sample Receipt	

Remarks:

Cooler Sample Receipt	
Temp °C	
Custody Seal #	
Seal Intact Y / N	
Sample Tags Y / N	

CHAIN OF CUSTODY RECORD (cont'd)

Sample IDs_____

Analysis_____

Relinquished by: (print) (sign)	Date/Time/Location	Received by: (print) (sign)

Relinquished by: (print) (sign)	Date/Time/Location	Received by: (print) (sign)

Relinquished by: (print) (sign)	Date/Time/Location	Received by: (print) (sign)

Relinquished by: (print) (sign)	Date/Time/Location	Received by: (print) (sign)

Relinquished by: (print) (sign)	Date/Time/Location	Received by: (print) (sign)

Relinquished by: (print) (sign)	Date/Time/Location	Received by: (print) (sign)

INSTRUMENT DEPARTMENT CHAIN OF CUSTODY

Analysis_____

WG	SAMPLE ID	DATE	TIME	RELEASED FROM	RELEASED TO

>>> Select a Laboratory <<<

#N/A
#N/A
#N/A
#N/A

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:

TestAmerica Laboratories, Inc.

Client Contact	**Project Manager:**	**Site Contact:**	**Date:**	COC No:
Your Company Name here	**Tel/Fax:**	**Lab Contact:**	**Carrier:**	_____ of _____ COCs
Address	**Analysis Turnaround Time**			Sampler:
City/State/Zip	☐ CALENDAR DAYS ☐ WORKING DAYS			**For Lab Use Only:**
(xxx) xxx-xxxx Phone	TAT if different from Below _____			Walk-in Client:
(xxx) xxx-xxxx FAX	☐ 2 weeks			Lab Sampling:
Project Name:	☐ 1 week			
Site:	☐ 2 days			Job / SDG No.:
P O #	☐ 1 day			

Sample Identification	**Sample Date**	**Sample Time**	**Sample Type** (C=Comp, G=Grab)	**Matrix**	**# of Cont.**	**Filtered Sample (Y / N)**	**Perform MS / MSD (Y / N)**																	Sample Specific Notes:

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other _____

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☐ Disposal by Lab ☐ Archive for _____ Months

Special Instructions/QC Requirements & Comments:

Custody Seals Intact: ☐ Yes ☐ No | Custody Seal No.: | Cooler Temp. (^{o}C): Obs'd:_____ Corr'd:_____ Therm ID No.:_____

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

APPENDIX C

PDI Field Sampling Plans

- Bathymetry Field Sampling Plan
- Surface Sediment Field Sampling Plan
- Subsurface Sediment Core Field Sampling Plan
- Fish Tissue Field Sampling Plan
- Surface Water and Sediment Trap Field Sampling Plan
- Acoustic Fish Tracking Study Field Sampling Plan
- Porewater Field Sampling Plan

FINAL

Bathymetry Survey Field Sampling Plan

Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling

Portland Harbor Superfund Site

AECOM Project Number: 60554349
Geosyntec Project Number: PNG0767

February 20, 2018

Prepared for:

United States Environmental Protection Agency, Region 10
1200 Sixth Avenue, Suite 900
Seattle, Washington 98101

On behalf of:

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USA

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CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

February 16, 2018

Kenneth M. Tyrrell
PDI Project Coordinator
AECOM Technical Services

Date

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Appendix A. David Evans & Associates, 2018 Hydrographic Survey Work and Quality Control Plan Portland Harbor PDI Studies

ACRONYMS AND ABBREVIATIONS

AECOM	AECOM Technical Services
ASAOC	Administrative Settlement Agreement and Order on Consent
CRD	Columbia River Datum
DEA	David Evans & Associates, Inc.
EPA	United States Environmental Protection Agency
FC	Field Coordinator
FS	feasibility study
FSP	Field Sampling Plan
Geosyntec	Geosyntec Consultants, Inc.
GNSS	Global Navigation Satellite System
HAZWOPER	Hazardous Waste Operations and Emergency Response
HIPS	Hydrographic Image Processing System
LWG	Lower Willamette Group
NAD83/91	North American Datum of 1983/1991
NAVD88	North American Vertical Datum of 1988
OSHA	Occupational Safety and Health Administration
PDI	Pre-Remedial Design Investigation
PHSS	Portland Harbor Superfund Site
Pre-RD AOC Group	Pre-Remedial Design Agreement and Order on Consent Group
PWC	personal water craft
QAPP	Quality Assurance Project Plan
RI	remedial investigation
RM	river mile
ROD	Record of Decision
SIPS	Sonar Image Processing System
Site	Portland Harbor Superfund Site
SOW	Statement of Work
USACE	U.S. Army Corps of Engineers

1. INTRODUCTION

The Record of Decision (ROD) described a post-ROD sampling effort for the Portland Harbor Superfund Site (Site or PHSS; Figure 1) located in Portland, Oregon, to delineate and better refine the sediment management area footprints, refine the Conceptual Site Model, determine baseline conditions, and support remedial design (United States Environmental Protection Agency [EPA] 2017a). Geosyntec Consultants, Inc. (Geosyntec), and AECOM Technical Services (AECOM) have submitted a Work Plan for Pre-Remedial Design Investigations (PDI) on behalf of a group of industrial parties called the Pre-Remedial Design Agreement and Order on Consent Group (Pre-RD AOC Group). In winter 2017, EPA entered into an Administrative Settlement Agreement and Order on Consent (ASAOC) with the Pre-RD AOC Group to conduct the PDI studies at the Site (EPA 2017b). The Statement of Work (SOW), which is an appendix to the ASAOC, and the Work Plan (as an attachment to the SOW) generally describe the field investigation activities, data analyses, schedule, and deliverables for the PDI.

A remedial investigation (RI)/feasibility study (FS) was initiated in 2001 by a group of potentially responsible parties known as the Lower Willamette Group (LWG) and completed by EPA in 2016 (EPA 2016a, 2016b). The RI consisted of three rounds of data collection, including surface and subsurface sediment, bank soils, surface water, sediment traps, porewater, and fish tissue from 2001 through 2007.

The Work Plan (Geosyntec 2017) is a focused and foundational step in what will be a multi-phase effort to update current conditions from the collection of data over the past 15 years. It provides an overview of studies that will be prepared for the PDI at the PHSS. This Field Sampling Plan (FSP) was prepared to support the bathymetric survey efforts outlined in the Work Plan and the project Quality Assurance Project Plan (AECOM and Geosyntec 2018). The Site-wide bathymetry survey is intended to refresh and update the surface bed elevations to current conditions and fill in no-coverage areas (especially nearshore) to support the initial remedial design activities.

1.1 Project Setting

The PHSS is located in Portland, Oregon, on the lower Willamette River immediately downstream of the urban downtown. The Willamette River is a dynamic waterbody that originates within Oregon in the Cascade Mountain Range and flows approximately 187 miles north to its confluence with the Columbia River. The Site extends from river mile (RM) 1.9 near the mouth of the Willamette River upstream to RM 11.8 (Figure 1). The Downtown Reach, which includes the urbanized area of downtown Portland, is defined by EPA as extending from RM 11.8 to RM 16.6. EPA defines the Upriver Reach as extending from RM 16.6 to RM 28.4.

The Site includes a water-dependent, highly industrialized area, which contains a multitude of facilities and both private and municipal outfalls. Land use along the lower Willamette River in the Portland Harbor includes marine terminals, manufacturing and other commercial and

municipal operations, and public facilities, parks, and open spaces (EPA 2016b). A federally maintained Navigation Channel, extending nearly bank-to-bank in some areas, doubles the natural depth of the river and allows transit of large ships into the active harbor; the PHSS serves as a major shipping route for containerized and bulk cargo. Common shoreline features within the harbor include constructed bulkheads, piers, wharves, buildings extending over the water, and steeply sloped banks armored with riprap or other fill materials (EPA 2016b). The State of Oregon owns certain submerged and submersible lands underlying navigable and tidally influenced waters.

1.2 Project Overview and Objectives

The scope of this FSP includes conducting a bank-to-bank[1] bathymetric survey of the lower Willamette River from RM 1.9 to 11.8 and down the Multnomah Channel to the Sauvie Island Bridge; see Figure 1 for the coverage area. Vertically, the coverage area will extend up the riverbanks to an elevation of +13.0 feet North American Vertical Datum of 1988 [NAVD88] or approximately +7.8 feet Columbia River Datum (CRD) where practical (Figure 2). The vertical coverage elevation of +13.0 feet NAVD88 was selected as the target for the bathymetric survey extent based on the Final 2016 Portland Harbor RI/FS Figure 2.2-1 (Figure 3).

The bathymetric survey will document current bed elevations throughout the Site. This survey will include all accessible nearshore areas (e.g., Swan Island Lagoon), as well as the federal Navigation Channel. The data set will also assess changes in elevation/sedimentation as technically feasible using the pre-existing surveys; the most comprehensive survey of the Site was conducted in 2004 (and was used in the FS). Multi-beam sonar will be used to collect high-resolution data with maximum coverage of the riverbed where accessible. If additional coverage is needed in nearshore areas that are difficult to access, then custom personal water crafts (PWCs) or Remote-Controlled Q-boat equipped with single-beam sonar, lead-line measurements, or airborne LiDAR data may be used. Equipment used in each area will depend on the water elevation at the time of surveying. David Evans and Associates, Inc. (DEA), the preferred contractor for conducting the bathymetric survey, will utilize the highest quality equipment it has that meets the minimum survey depth capable, 2.5 feet for PWCs or 1.5 feet for the Q-boat; additional equipment specifications are provided in DEA's 2018 *Hydrographic Survey Work and Quality Control Plan* (Appendix A). To maximize efficiency and extend multi-beam coverage, the survey should be conducted during high river levels that exceed 15.0 feet NAVD88. Surveying at lower river levels will increase survey time.

If needed for spatial coverage, DEA will develop a second Work Plan that will describe how LiDAR will be collected or adapted from other studies and include the technical specifications. The LiDAR Work Plan would be a post-approval addendum to this FSP if it is determined that LiDAR is necessary to collect data up to the desired +13.0 feet NAVD88. This data gap assessment will be conducted after the multi-beam and single-beam field work has been

[1] For this FSP, the "bank" is defined as an elevation of +13 feet above the NAVD88 or approximately +7.8 feet above the CRD.

completed. The data collection and processing methods will follow procedures outlined in DEA's *Hydrographic Survey Work and Quality Control Plan* (Appendix A).

DEA has acquired five surveys of the Portland Harbor since 2002 on behalf of the LWG. DEA performed surveys for the LWG in January and July 2002, May 2003, February 2004, and February 2007 as part of the Portland Harbor RI/FS. Additionally, a June 2009 survey of the Willamette River was conducted by DEA for the National Ocean and Atmospheric Administration to update nautical charts.

The new bathymetric data, collected as part of this PDI study, will be used to:

- Update baseline maps;
- Support sediment sampling efforts;
- Refine the elevation clearances for dredging and capping;
- Help estimate shoaling and scouring areas relative to previous surveys; and
- Support confirmation of the estimated dredge volume.

Bathymetry results may serve as a line of evidence for evaluating riverbed slope conditions, recovery potential, and bed stability (e.g., erosional versus depositional areas).

1.3 Project Organization

Team organization is detailed in the PDI Work Plan and in Section 2 of the Quality Assurance Project Plan (QAPP) (AECOM and Geosyntec 2018a). As it relates to this FSP, AECOM and Geosyntec are coordinating activities including management of all subcontractors, field sampling, analysis, and reporting scoping tasks. The PDI Project Coordinator, Ken Tyrrell, and PDI Project Manager, Jennifer Pretare, (AECOM), will be responsible for overall project coordination and providing oversight on all project deliverables. Anne Fitzpatrick (Geosyntec) is the project's senior technical lead for this task. Nicky Moody (AECOM) and Keith Kroeger (Geosyntec) will be the Project Field Coordinators (FCs) and will be generally responsible for field quality assurance/quality control oversight.

Luke Smith (Geosyntec) will be the technical lead for this FSP and responsible for communication with DEA and provide oversight during field work. Luke Smith is a licensed Professional Engineer that maintains 40-hour Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER) training and 8-hour OSHA HAZWOPER Supervisor training. While providing oversight, Geosyntec will ensure that DEA accurately collects critical data and will work with DEA to analyze post-survey data.

DEA will perform vessel support with Jon Dasler as the point of contact. Details of DEA boats and crew are provided in Appendix A. The hydrographic survey crew will consist of one boat with two hydrographers from DEA and one Professional Engineer from Geosyntec. The DEA survey crew has conducted numerous multi-beam and side-scan sonar surveys and has had

extensive training in hydrographic surveys. DEA hydrographic staff members have attended training courses and have many years of experience in multi-beam and side-scan sonar operations. DEA's hydrographic staff has completed a 1-week training session in the use of CARIS Hydrographic Image Processing System (HIPS) and the Sonar Image Processing System (SIPS).

1.4 Communication/Information Flow

The communication strategy is outlined in Section 2 of the QAPP (AECOM and Geosyntec 2018a). In brief, the FCs will be the points of contact for field staff during the implementation of this FSP. Luke Smith will be the point person for the team on the boat with DEA. Deviations from this FSP or the project-specific QAPP will be reported to the project's senior technical lead and PDI Project Manager, for consultation. Significant deviations from the FSP/QAPP will be further reported to representatives of the Pre-RD AOC Group and EPA by the PDI Project Coordinator.

1.5 Coordination with EPA

The PDI Project Coordinator will notify the EPA Project Manager 1 week prior to beginning any field activities so that EPA can schedule any oversight activities required. The PDI Project Coordinator will also notify the EPA Project Manager once field activities have been completed.

2. SCOPE OF WORK

This FSP will follow the technical approaches presented by DEA in Appendix A, which follows the National Geospatial Data Policy (EPA 2008) and National Geospatial Data Policy Procedure for Geospatial Metadata Management (EPA 2010). DEA's 2018 *Hydrographic Survey Work and Quality Control Plan* (Appendix A) provides horizontal/vertical control methods, instrumentation, and survey methodology associated with providing hydrographic services, mapping, and data management.

The primary vessel that will be used during the multi-beam bathymetry survey is the William R. Broughton; a 24-foot survey vessel outfitted with dual Teledyne Reson SeaBat T50-P precision multi-beam sonars. Prior to deploying survey vessels, the DEA crew will perform a static position check using the check antenna; this process verifies correctors are being obtained and validates geodetic parameters. Validation of base station position and height relative to project datum will follow procedures discussed in Appendix A.

All bathymetric surveying will be consistent with prior surveys for the RI/FS and will conform to the standards established by the U.S. Army Corps of Engineers (USACE) *Hydrographic Surveying (Engineer Manual 1110-2-1003)* (USACE 2013), in accordance with requirements for "Navigation & Dredging Support Surveys." DEA has developed an updated Work Plan associated with this planned survey work (Appendix A) that discusses the technical specifications that will be used in the field. Targeted vertical and horizontal accuracy for the

surveying is plus or minus 0.3 feet at a 95% confidence level. All work will be supervised and final deliverables approved by a DEA Oregon-registered Professional Land Surveyor and National Society of Professional Surveyors/The Hydrographic Society of America Certified Hydrographer. The bathymetric surveying will be based on the remedial design and performance monitoring data needs and will be consistent with previous site surveys.

As a modification to the multi-beam surveys performed by DEA on behalf of the LWG, fill lines will be run by DEA with a custom PWC equipped with a survey-grade, single-beam bathymetric sonar system to supplement data gaps. The multi-beam bathymetric data will be used to create a digital terrain model of the riverbed morphology from which hillshade images will be generated. During lower times in the daily tide cycle and when there is less daylight, deeper water will be surveyed (Navigation Channel). When there is better daylight and higher water elevations, shoreline areas will be surveyed. The river will be worked in sections covering bank-to-bank to minimize vessel travel time and maximize survey time.

To check the accuracy of the positioning system and confirm that the geodetic parameters used in the real-time projection to the North American Datum of 1983/1991 (NAD83/91) Oregon North Zone coordinate system are correct, a position check on established monuments will be conducted. Figure 4 shows historical monuments that were referenced in DEA's 2004 field survey report for the Portland Harbor RI, and Table 1 lists the coordinates, which includes their permanently operating Global Navigation Satellite System (GNSS) reference station. The GNSS station will be used for survey control. Trimble SPS-855 dual frequency GNSS receiver will be the primary equipment used for recording and processing GNSS signals.

3. PROJECT SCHEDULE

The bathymetry survey is anticipated to take place in late February/early March of 2018. The survey is expected to take 7 days, with 2 days of contingency. Possible scheduling conflicts that will be considered to optimize field time are barge fleeting, vessels at berth, oil booms, structures, and restrictions around United States Navy vessels. Schedule adjustments may take place if water levels do not accommodate shallow nearshore/bank elevation goals.

4. DATA MANAGEMENT AND REPORTING

Data verification and data management will be performed according to the Final Data Quality Management Plan, current draft dated January 17, 2018 (AECOM 2018b). Data management while in the field will follow protocols as put forth in Appendix A, *Hydrographic Survey Work and Quality Control Plan*. Following data collection, DEA will provide data processing and associated mapping consistent with prior surveys conducted by DEA for the LWG. Sounding and topographic data will be recorded to a resolution of one tenth of a foot, vertical and horizontally. Processed data will be binned to a grid size of 3 feet by 3 feet to be used for contour generation, hillshade imagery, and differencing to available prior surveys.

Post-processing of multi-beam data will be conducted using CARIS Onboard and CARIS HIPS multi-beam analysis software. Patch test data will be analyzed, and any alignment corrections will be applied. The CARIS HIPS system allows for simultaneous viewing of the side-scan and multi-beam data to analyze anomalies on the riverbed during post-processing. Additional multi-beam data processing conducted by DEA is presented in Appendix A.

Processing will begin with review of each survey line using CARIS HIPS editor. Verified water surface correctors will be applied to the data set at this time. Position and sensor data will be reviewed and accepted. Sounding data will be reviewed and edited for data flyers such as returns from piling and passing vessel wakes. These data points are flagged and not used as part of the final data set. Sounding data, including sonar beams reflecting from sediment in the water column or noise due to aeration in the water column, are carefully reviewed before flagging as a data flyer. In each case, data will not be eliminated and can be unflagged during the subset editing process (Appendix A).

After swath editing, all data will be reviewed through the CARIS HIPS subset editing program to ensure no flyers remain in the data set or to re-accept data previously flagged in the swath editor. A series of subsets are made to cover multiple lines in the CARIS session. Using this method, sequential lines will be reviewed together to ensure agreement to one another (Appendix A).

5. DELIVERABLES

A series of map products will be provided at a scale of 1 inch to 400 feet and will include a hard copy set and digital data (in AutoCAD or ESRI compatible files) of the following:

- Contour maps of the surveyed area at a 2-foot contour interval
- Hill-shaded relief maps color-coded by depth of the surveyed area
- ASCII x, y, z point data files for final merged data
- Metadata that conforms to the National Geospatial Data Policy
- Report in PDF format outlining survey equipment, methods, and analysis and describing any deviations from the Work Plan.

6. REFERENCES

AECOM (AECOM Technical Services) and Geosyntec (Geosyntec Consultants, Inc.). 2018a. Quality Assurance Project Plan. Draft. Portland Harbor Superfund Site, Portland, Oregon. January 2018.

AECOM and Geosyntec. 2018b. Data Quality Management Plan. Draft. Portland Harbor Superfund Site, Portland, Oregon. January 2018.

EPA (United States Environmental Protection Agency). 2008. National Geospatial Data Policy. August 24.

EPA. 2010. National Geospatial Data Policy Procedure for Geospatial Metadata Management. October.

EPA. 2016a. Portland Harbor RI/FS, Final Remedial Investigation Report, Portland Oregon. United States Environmental Protection Agency Region 10, Seattle, Washington. 8 February.

EPA. 2016b. Portland Harbor RI/FS, Final Feasibility Study, Portland Oregon. United States Environmental Protection Agency Region 10, Seattle, Washington. June.

EPA. 2017a. Record of Decision Portland Harbor Superfund Site, Portland, Oregon. United States Environmental Protection Agency Region 10, Seattle, Washington. January.

EPA. 2017b. ASAOC between US EPA and the Pre-RD AOC Group for Pre-Remedial Design Investigation Studies, Portland Harbor Superfund Site, Portland Oregon. United States Environmental Protection Agency Region 10, Seattle, Washington. 18 December.

Geosyntec (Geosyntec Consultants, Inc.). 2017. Pre-Remedial Design Investigation Work Plan. Portland Harbor Superfund Site. Prepared for the Portland Harbor Pre-RD AOC Group. December.

USACE (U.S. Army Corps of Engineers). 2013. Hydrographic Surveying (Engineer Manual 1110-2-1003). November

TABLES

Table 1: Lower Willamette River, Control Network Coordinates

Monument Designation	NAD83 OR North		NAD83 OR North		NAVD88	
	North m	East m	North ft	East ft	El m	El Ft.
A81 (Destroyed)	216879.768	2322669.168	711547.800	7620305.670	9.022	29.60
T-4-28, 1999	217122.581	2322537.596	712344.427	7619874.001	9.038	29.65
BLDG10	213233.670	2325671.863	699585.530	7630157.030	10.495	34.43
DEA2828	*206352.805*	*2330026.319*	*677010.520*	*7644443.300*	*28.738*	*94.28*
2100	206776.182	2330254.088	678399.547	7645190.577	48.647	159.60
EAGLE GPS 36	211213.728	2328090.742	692958.430	7638092.990	10.146	33.29
N19	207968.621	2330368.700	682311.750	7645566.600	10.447	34.27
NELSON	202701.014	2326430.157	665029.570	7632644.870	125.250	410.93
RAINDEER	220200.425	2321017.341	722442.340	7614886.290	10.829	35.53
REF B718	211672.417	2326043.648	694463.310	7631376.800	12.600	41.34
REF N723	201209.507	2332677.212	660136.180	7653140.460	15.105	49.56
T-5-3	221705.879	2322489.162	727381.490	7619715.100	9.208	30.21
VAN CBL 0	225260.113	2325154.017	739042.370	7628458.060	9.220	30.25

Notes:
-Figure taken from February 2004 Lower Willamette River Multibeam Bathymetric Survey Report, Table 2

DEA 2004 Monument Table

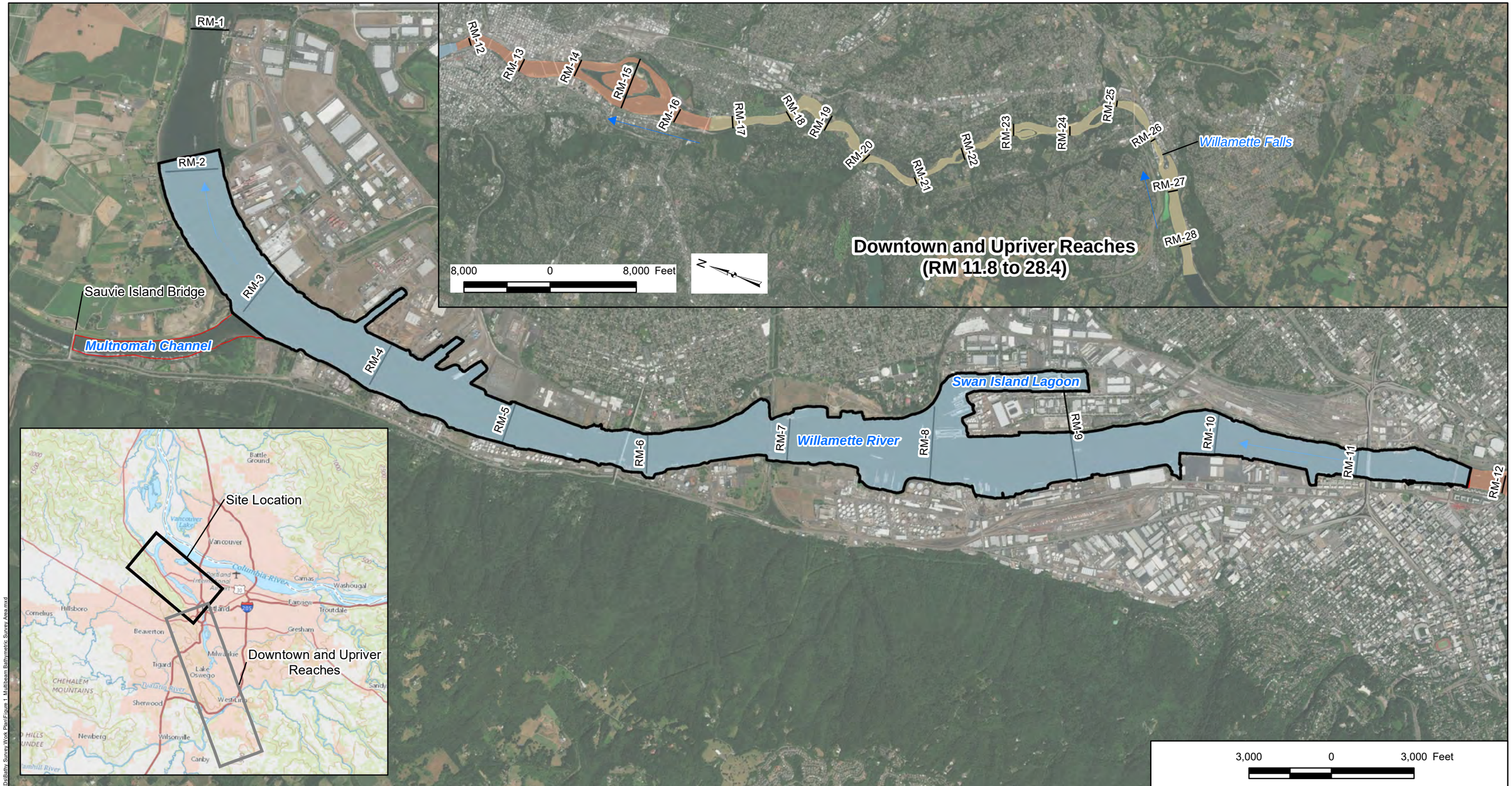
Portland Harbor Superfund Site
Bathymetric Survey FSP

AECOM Geosyntec consultants

MI/SEA | February 12, 2018

Table 1

FIGURES



Legend

- Bathymetry Survey Study Area – includes Superfund Site Boundary and Mouth of Multnomah Channel to Sauvie Island Bridge
- Flow Direction
- River Mile Marker

Study Area

- Superfund Study Area (RM 1.9 to 11.8)
- Downtown Reach (RM 11.8 to 16.6)
- Upriver Reach (RM 16.6 to 28.4)

Note:
1. Aerial Imagery provided by ESRI Basemaps 2016

Multibeam Bathymetric Survey Area

Portland Harbor Superfund Site
PDI Bathymetric Survey FSP

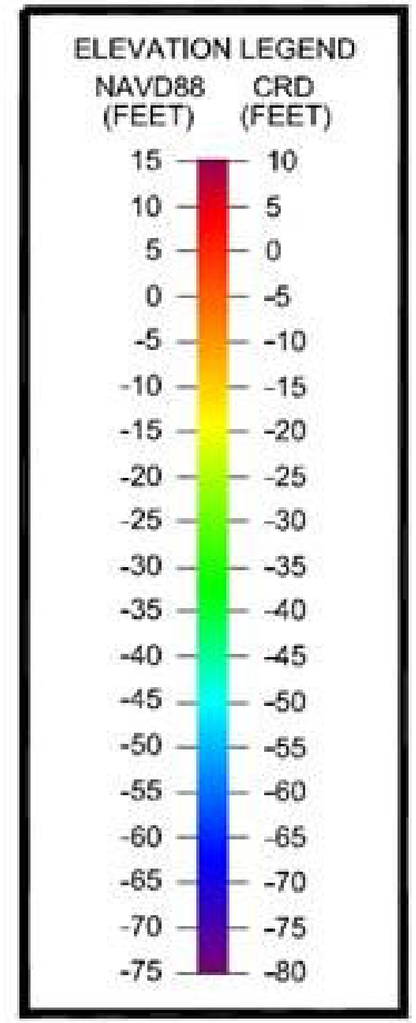
AECOM | Geosyntec consultants

MI/SEA | February 12, 2018

Figure 1

Path: P:\Projects\Portland Pre-Design\PN\0767A\900 GIS and CAD\MXDs\Bathy Survey Work Plan\Figure 1. Multibeam Bathymetric Survey Area.mxd

Vertical Datum Conversion Table		
River Mile	NAVD88 Elevation	CRD Elevation
4	10.0' 0.0' -10.0'	4.9' -5.1' -15.1'
5	10.0' 0.0' -10.0'	4.8' -5.2' -15.2'
6	10.0' 0.0' -10.0'	4.8' -5.2' -15.2'
7	10.0' 0.0' -10.0'	4.8' -5.2' -15.2'
8	10.0' 0.0' -10.0'	4.7' -5.3' -15.3'
9	10.0' 0.0' -10.0'	4.7' -5.3' -15.3'
10	10.0' 0.0' -10.0'	4.7' -5.3' -15.3'
11	10.0' 0.0' -10.0'	4.7' -5.3' -15.3'



Note:
1. Table taken from Figure S1, David Evans and Associates, 2014 Bathymetric Survey Report.

Vertical Datum Conversion Table

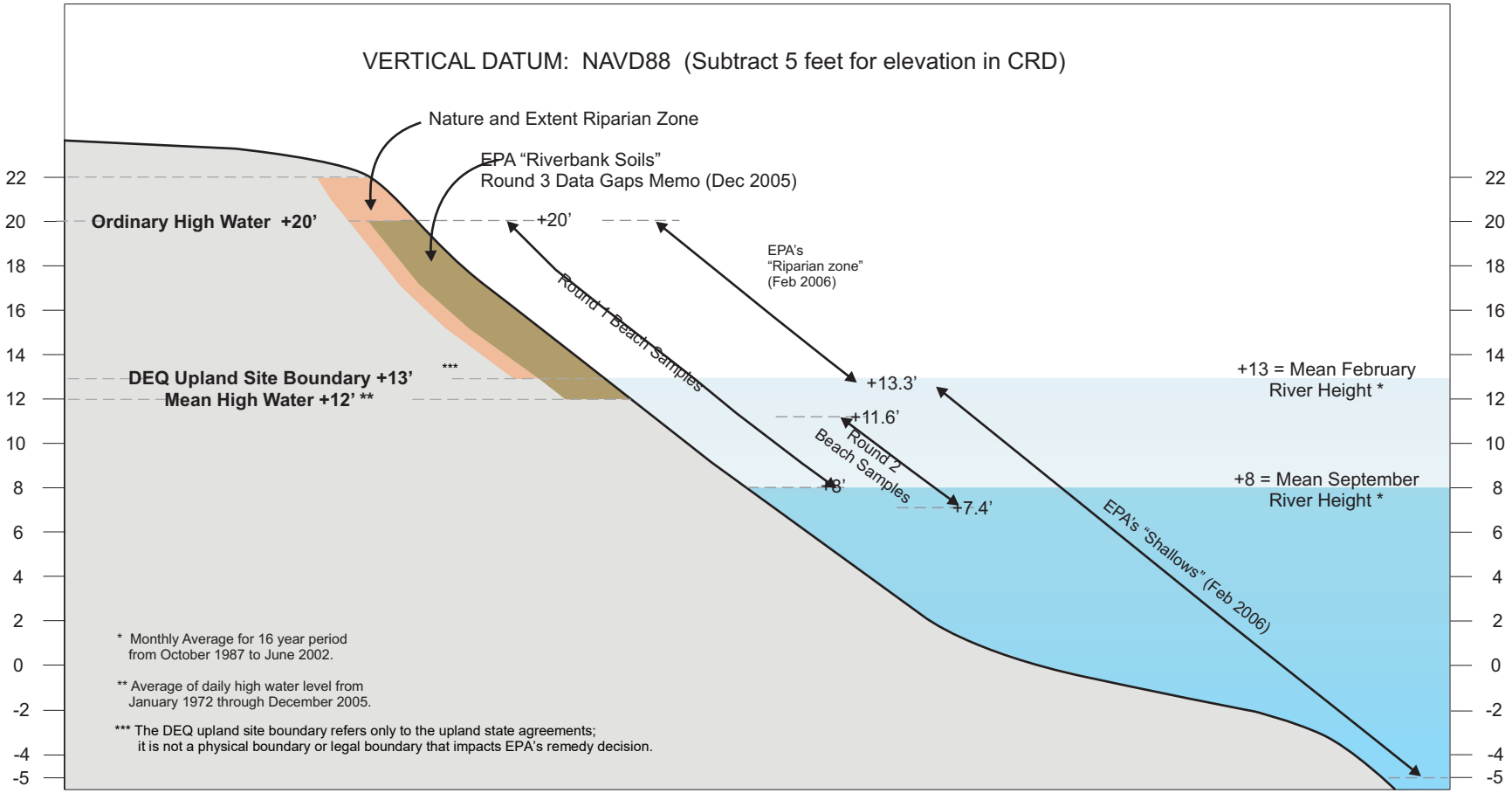
Portland Harbor Superfund Site
PDI Bathymetric Survey FSP

AECOM Geosyntec consultants

Figure 2

MI/SEA | February 12, 2018

Path: P:\Projects\Portland Pre-Design PNG0767A\900 GIS and CAD\MXDs\Bathy Survey Work Plan\Figure 2_CRD_NAVD88 Conversion.mxd



Notes:
-Figure taken from Portland Harbor RI/FS Final Remedial Investigation Report dated February 8, 2016, Figure 2.2-1
-Vertical Datum is NAVD88

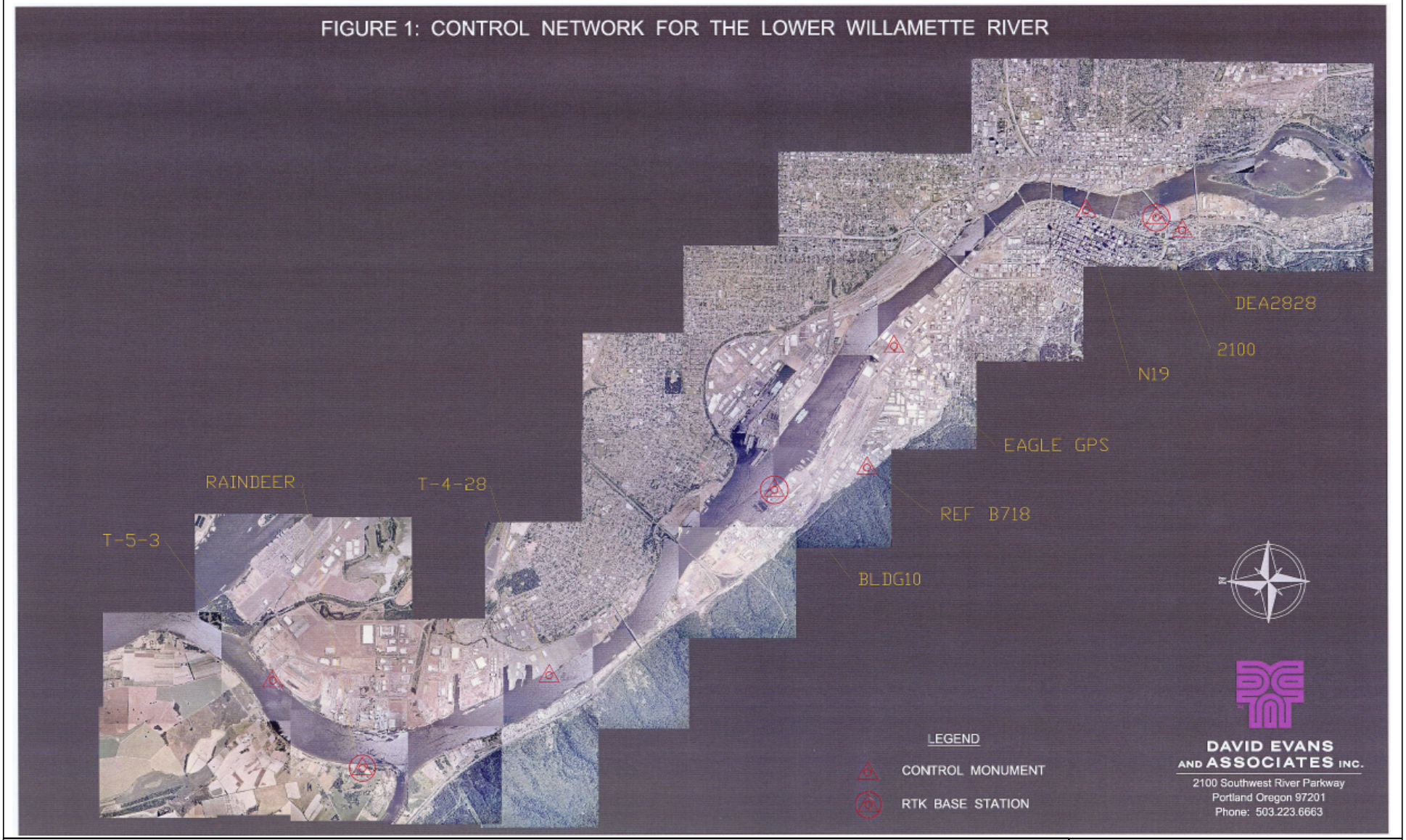
DEQ Upland Site Boundary

Portland Harbor Superfund Site
Bathymetric Survey FSP

AECOM Geosyntec consultants

MI/SEA | February 12, 2018

Figure 3



Notes:
-Figure taken from February 2004 Lower Willamette River Multibeam Bathymetric Survey Report, Figure 1

DEA 2004 Monument Map
Portland Harbor Superfund Site
Bathymetric Survey FSP

AECOM | Geosyntec consultants | Figure 4

MI/SEA | February 12, 2018

APPENDIX A

David Evans & Associates, 2018 Hydrographic Survey Work and Quality Control Plan
Portland Harbor PDI Studies

HYDROGRAPHIC SURVEY
WORK AND QUALITY CONTROL PLAN
PORTLAND HARBOR PDI STUDIES
WILLAMETTE RIVER, OREGON

FEBRUARY 2018

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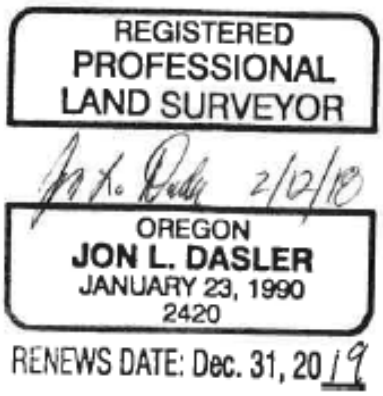
HYDROGRAPHIC SURVEY
WORK AND QUALITY CONTROL PLAN
PORTLAND HARBOR
WILLAMETTE RIVER, OREGON

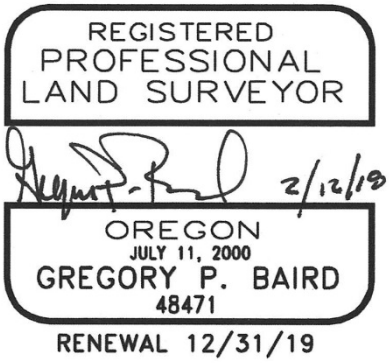
FEBRUARY 2018

Prepared by:



Jon L. Dasler, PE, PLS, CH
NSPS/THSOA Certified Hydrographer #107
David Evans and Associates, Inc.
Senior Vice President/Director of Marine Services

Reviewed by:



Gregory P. Baird, PLS, CH
NSPS/THSOA Certified Hydrographer #201
David Evans and Associates, Inc.
Senior Associate/Lead Hydrographer

I. INTRODUCTION

A precision multibeam bathymetric survey of the Portland Harbor over the winter of 2018 will be conducted by David Evans and Associates, Inc. (DEA) to develop an accurate basemap of riverbed elevations. The data collection and processing methods will follow the procedures used by DEA for similar surveys of the Portland Harbor. The effort will also include an evaluation of existing lidar data for suitability for use in an overall model with optional airborne lidar surveys of the shoreline at low river levels. The results of this survey will update riverbed elevations in the Lower Willamette, develop updated map products, and conducting a terrain model difference analysis against the 2004 survey conducted for the Lower Willamette Group (LWG).

This work and quality control plan covers staff, equipment, datums, methodology, and quality procedures to be employed to satisfy the bathymetric component of the site characterization. Target accuracy is plus or minus 0.3 feet at a 95% confidence level (two sigma).

II. WORK PLAN GENERAL APPROACH

DEA will conduct a hydrographic survey of the Portland Harbor from Willamette River Mile (RM) 1.9 to RM 11.8. and extend down the Multnomah Channel to the Sauvie Island Bridge. The extent of coverage is outlined in Figure 1.

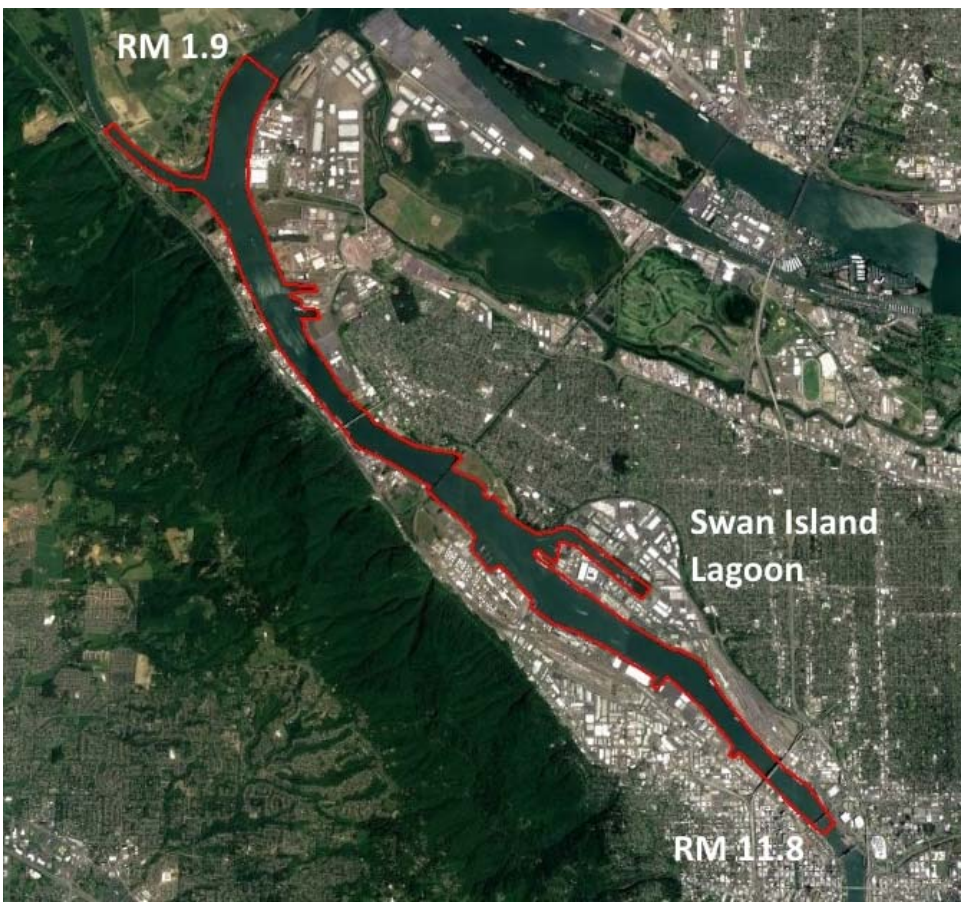


Figure 1: Hydrographic Survey Coverage

Although the sonar swath will extend toward shore from the vessel track, coverage in Swan Island Lagoon will be riverward of the USCG station, docks along the east bank and outboard of the drydocks. Coverage will remain outboard (river side) of marinas and floating homes in Multnomah Channel. Multibeam coverage toward shore will depend on river level at the time of survey with the intent to map to elevation 13 feet relative to the North American Vertical Datum of 1988 (NAVD88). There may be additional coverage gaps around ships or other restricted areas. All bathymetric surveying will be consistent with prior surveys for the LWG with updated instrumentation and exceed the standards established by the U.S. Army Corps of Engineers, Engineering and Design Manual for Hydrographic Surveying (EM 1110-2-1003), "Hydrographic Surveying", in accordance with requirements for "Navigation & Dredging Support Surveys." All work will be supervised and final deliverables approved by a DEA Oregon registered Professional Land Surveyor and National Society of Professional Surveyors (NSPS) / The Hydrographic Society of America (THSOA) Certified Hydrographer.

The primary coverage will be obtained using high resolution multibeam bathymetric sonars and may be augmented with supplemental single beam sonars and/or airborne topographic lidar after assessment of coverage gaps from the multibeam bathymetric survey. To maximize efficiency and extend multibeam coverage, the survey should be conducted during high river levels that exceed 15 feet NAVD88 or 10 feet relative to Columbia River Datum (CRD). Surveying at lower river levels will increase survey time and reduce coverage.

The primary vessel for this survey will be DEA's 24-foot survey vessel *William R. Broughton*, based in Vancouver, WA (Figure 2). The *Broughton* is outfitted with dual Teledyne Reson SeaBat T50-P precision multibeam sonars with one on either side of the vessel. Each sonar logs 512 soundings with each sonar ping over a nominal swath angle of 140 degrees (70 degrees to each side of the sonar). The effective swath width will be determined through cross line analysis to determine the maximum swath angle that meets survey requirements. To maximize swath coverage and extend coverage up slope along the shoreline, the sonar heads will be tilted 15 degrees outboard.

Figure 2: DEA Survey Vessel *William R. Broughton*

To extend coverage in tight areas behind wharfs, DEA's 19-foot survey vessel *River Hawk* will be employed (Figure 3). The *River Hawk* is outfitted with a Teledyne Reson SeaBat 7101 sonar with 210 degree mapping capability. Sonar beams can be steered to map upslope from the sonar head to maximize shoreline coverage.

Figure 3: DEA's Survey Vessel *River Hawk*

For consistent density mapping to 13 feet NAVD88, airborne topographic lidar would be the best method to extend coverage. Use of this method would require data acquisition at a lower water level than the water level at the time of multibeam sonar data acquisition.

Supplemental soundings in shallow areas and tight areas, single beam echosounder data may be acquired with DEA's custom outfitted Personal Watercraft (PWC). DEA has custom configured two PWC platforms that are equipped with Trimble dual frequency GNSS receivers, Submersible monitors, 12 volt acquisition computers, and Teledyne ODOM CV100 survey grade echo sounders (Figure 4). The PWCs have been used to extend mapping coverage along the Columbia River from the estuary to Bonneville Dam, used for eelgrass mapping in Coos Bay and beach profile surveys along the Oregon Coast. They are efficient, shallow draft, platforms that can extend mapping over tide flats or similar shallow gradual slopes where multibeam sonar coverage is not possible due to the low grazing angle over an extended distance. Minimum survey depth is approximately 2.5 feet.

Figure 4: DEA's Personal Watercraft for Single Beam Surveys

Less productive but a vast improvement over lead line soundings is DEA's remote-controlled *Q-Boat* (Figure 5). The *Q-Boat* is equipped with identical equipment as the PWC platforms other than data acquisition is transmitted via a wireless connection to a laptop near the vessel operator. Typical minimum depths acquired with this system is 1.5 feet. Q-Boat operations will be supported by one of DEA's larger survey vessels.

Figure 5: DEA's Remote-Controlled *Q-Boat* for Single Beam Surveys

A. Specific Equipment to be Employed

1. Primary Survey Vessel:
   The *William R. Broughton* will be used as the primary survey platform for survey operations. The *Broughton* is a modified Duckworth Offshore 24-foot aluminum hull vessel with twin 115 horsepower engines, owned by DEA. The vessel is designed for safe and efficient hydrographic survey operations and equipped with dual VHF radios, radar, chart plotter, emersions suites, an Emergency Position Indicator Radio Beacon (EPIRB), and emergency offshore life raft. The vessel is inspected annually by a marine Surveyor and meets all USCG requirements for a vessel of its class. For hydrographic operations the vessel is equipped with an integrated navigation and data acquisition system, mounts for an integrated GNSS (Global Navigation Satellite System that incorporate other navigational satellite systems beyond the U.S. Navstar GPS system such as the Russian system GLONASS, Galileo, Beidou and other regional systems) and inertial positioning and motion reference system, custom mounts for the Reson SeaBat sonar heads, and is ideal for operating in the Portland Harbor.

2. Secondary Survey Vessel:
   The *River Hawk* is a purpose-built river sled for wild river single beam surveys and has been modified for multibeam data acquisition in shallow water and tight quarters. The vessel is powered by a 105 horsepower outboard with jet drive and has a 9.9 horsepower auxiliary motor. Both motors are started and controlled at the vessel helm. Additional equipment includes VHF radio, integrated GPS chart plotter/depth sounder. The vessel is inspected annually by a marine Surveyor and meets all USCG requirements for a vessel of its class. For hydrographic operations the vessel is equipped with an integrated navigation and data acquisition system, mounts for an integrated GNSS and inertial positioning and motion reference system, custom mounts for the Reson SeaBat sonar head, and is ideal for operating in the Portland Harbor.

3. Personal Watercraft:
   SeaDoo GTX 4-stoke personal watercraft customized by DEA with Vartech submersible monitors, ATOM personal computer, Trimble SPS 855 survey grade GNSS receiver (instrument for recording and processing GNSS signals), and Teledyne ODOM CV100 survey grade echosounder.

4. Remote Controlled Vessel:
   Teledyne Ocean Science Q-Boat customized by DEA with wireless data transfer of Trimble SPS 855 survey grade GNSS receiver and Teledyne ODOM CV100 survey grade echosounder.

5. Position, Heading and Motion Reference System:
   Applanix POS/MV-320 (Version 5 with POSPac and True Heave capabilities) with kinematic corrections from a land side GNSS base station receiver. Real-time positioning will use real-time kinematic GNSS techniques (RTK GNSS) with the POS/MV system logging raw GNSS and inertial data for post-processing kinematic (PPK) correctors to improve horizontal and vertical positioning.

6. Sonar Systems:
   Teledyne Reson SeaBat T50-P dual system deployed on the *Broughton*.
   Teledyne Reson SeaBat 7101 multibeam sonar deployed on the *River Hawk*.
   Teledyne ODOM CV100 single beam echosounder deployed on PWCs and *Q-Boat*.

7. Sound Speed Profiler:
   Applied Microsystems Smart SvT&P (Sound velocity, Temperature, and Pressure) sound speed and temperature profiler.
   AML MicroSV sound speed probe will be located at the Reson T50-P sonar head for input directly to the sonar processor.
   All sound speed systems have had recent calibrations.

8. Data Acquisition System:
   Hypack Hysweep multibeam sonar data acquisition system (*Broughton* and *River Hawk*).
   CARIS Onboard data conversion and display software (*Broughton).*
   Hypack single beam data acquisition software (PWC and *Q-Boat*).

9. Data Processing:
   CARIS Onboard, CARIS Hydrographic Information Processing System (HIPS), Applanix POSPac MMS, Trimble TerraModel, and ArcGIS software.

10. GNSS Base Station:
    Trimble Net R9 GNSS receiver permanently deployed on DEA Marine Services office with correctors received on survey platforms via Networked Transport of RTCM via Internet Protocol (NTRIP) and Intuicom cellular modems.

11. Secondary dual frequency GNSS for real-time and post-processed kinematic positioning:
    Trimble SPS-855 dual frequency receiver or equivalent (Primary positioning system on PWC and *Q-Boat*).

B. Mobilization and Demobilization

All vessels and equipment listed are based in DEA's Marine Services office near the Marine Park in Vancouver, Washington. Equipment will be configured, tested and position checks conducted at DEA's Marine Services office. Larger vessels will be staged at Fred's Marina in Multnomah Channel where they can take on fuel as required and moored with shore power. After completion of the survey, vessels and crew will return to Vancouver, Washington.

C. Key Personnel

The hydrographic survey and associated mapping will be conducted under the direction of an Oregon Professional Land Surveyor and National Society of Professional Surveyors / The Hydrographic Society of America (NSPS/THSOA) Certified Hydrographer. The hydrographic crew will consist of two DEA staff hydrographers per survey vessel, one being a Senior Hydrographer in charge of survey operations. All of DEA Marine Services field staff are well versed in the conduct of hydrographic surveys, hold state boating licenses, and are trained in CPR, First Aid and use of our onboard AED. When running shoreline in areas of submerged piling a third crew member may be used to spot obstructions.

Key staff includes:

Jon L. Dasler, PE, PLS, Certified Hydrographer (Principal-In-Charge)
Mr. Dasler is DEA's director of Marine Services and brings more than 32 years of experience in hydrographic surveying and over 40 years of land and geodetic control surveying. Mr. Dasler has been principal-in-charge, project manager and lead hydrographer on large nautical charting surveys for NOAA and hydrographic survey contracts for the USACE. Mr. Dasler is Board Member of the NSPS/THSOA Hydrographer Certification Board, served on NOAA's Hydrographic Services Review Panel, is a member of The Hydrographic Society of America, attends conferences and symposiums to keep abreast of changing technology, and has presented papers to advance the profession of hydrography. He was involved in the earliest applications of shallow water multibeam for the monitoring of coastal structures and has management expertise proven to be beneficial for complex hydrographic projects. He is a recognized expert on Columbia River Datum and works closely with the Columbia River Pilots to provide updated accurate information at Port terminals for their portable navigation systems to improve safety of navigation.

Gregory P. Baird, PLS, Certified Hydrographer (Project Surveyor)
Mr. Baird has more than 30 years of experience as a hydrographer and land surveyor, ten of those years have been with DEA. He is a Certified Hydrographer by the National Society of Professional Surveyors and The Hydrographic Society of America (NSPS/THSOA), and a professional land surveyor, registered in the State of Oregon. As Project Manager, Mr. Baird is responsible for project planning, geodetic control, coordination, and oversight of data acquisition, processing, and the preparation of final mapping and report products. His extensive hydrographic and land survey experience includes a detailed knowledge of geodesy and extensive work on navigable and non-navigable waterways, ship terminals, ports and harbors, hydroelectric dams, reservoirs, lakes, and coastal jetties for port authorities, the U.S. Army Corps of Engineers, municipalities and the private sector.

David T. Moehl, PLS, Certified Hydrographer (Senior Hydrographer)
Mr. Moehl is an Oregon Professional Land Surveyor, an NSPS/THSOA Certified Hydrographer, and holds a US Coast Guard 100-Ton Master License. Mr. Moehl has been with DEA Marine Services for three years and has served as a field hydrographer and data processor under DEA's projects for NOAA, the Environmental Protection Agency, U.S. Army Corps of Engineers, and Port of Portland. Mr. Moehl's responsibilities include data acquisition, processing, and analysis of multibeam and single-beam surveys using Hypack, CARIS HIPS and Bathy Data Base, POSPAC MMS, and ESRI ArcGIS software. Prior to joining DEA in 2015, Mr. Moehl served as a hydrographic senior survey technician aboard the NOAA ships *F.R. Hassler* and *Fairweather*. Aboard the *Hassler* he was the hydrographer in charge and responsible for data acquisition and processing. His responsibilities included installing, configuring, and maintaining equipment used during the acquisition and processing of multibeam and side scan sonar data; supervising rotating personnel; overseeing data prior to public archival; supervised and mentored staff on appropriate data collection and processing methods; and conduced training classes for GNSS-aided inertial navigation prost-processing.

John M. Staly (Senior Hydrographer)
Mr. Staly is a senior hydrographer for DEA and has been with DEA for 11 years. His responsibilities include the collection, processing, analysis, management and quality control of hydrographic data. He has served as Senior Hydrographer on projects for the US Army Corps of Engineers, NOAA, Port of Portland and numerous other DEA clients. Prior to joining DEA, Mr. Staly was employed as an oceanographer with the Naval Oceanographic Office where he served as a Mine Warfare (MIW) survey member and geophysics/acoustics lead on board T-AGS60 class survey vessels, and a project lead for Mine Countermeasures (MCM) fleet side scan sonar (SSS) training. He received two Survey Excellence Awards for his work at the Naval Oceanographic Office in 2005.

Kathleen Schacht (Data Manager and Processing Lead)
Ms. Schacht has been acquiring, processing, and providing quality review of hydrographic data with the DEA Marine Services team since 2008. She serves as a hydrographer in the field and in the office as a multibeam data analyst. She served as multibeam processing lead on DEA's contracts with NOAA, USACE, Port of Portland and numerous other clients. Prior to joining DEA, Ms. Schacht was a survey technician with NOAA on board the ship *Rainier* performing multibeam surveys, processing data and preparing technical reports. She has specialized training in the use of CARIS Hydrographic Information Processing System (HIPS), Hypack/Hysweep, ESRI ArcGIS, and attended the Shallow Water Multibeam Course presented by NOAA and University of New Brunswick.

Jason Dorfman (Hydrographer/Vessel Operator)
Mr. Dorfman is a hydrographer in the Marine Services Division of DEA and has been with DEA for four years. His responsibilities include field data acquisition, vessel operation, data processing, and preparation of final mapping and report products. Mr. Dorfman has extensive hydrographic survey experience and is well-versed in the use of acoustic imaging technologies and precision geospatial tools. He is most familiar with multibeam, single-beam, and side scan sonar surveying methods and data processing/analysis, and has performed numerous hydrographic surveys in various environments along the Gulf Coast, the Oregon and Washington coastlines, the Willamette and Columbia Rivers, the Eastern Seaboard, Alaska, and the Bahamas. He has completed the Advanced CARIS HIPS/SIPS Training Course, attended Hypack/Hysweep training seminars, and has experience utilizing a variety of other hydrographic acquisition/processing software and geospatial analysis programs.

Daniel M. Prince (Hydrographic Technician/Vessel Operator)
Mr. Prince is a hydrographic technician and has been with DEA for one year. His responsibilities include field data acquisition, vessel operation, and data processing on projects for NOAA and local projects in the Pacific Northwest. Prior to joining DEA Mr. Prince was a Hydrographic Assistant Survey Technician on the NOAA ship *Rainier* and served as a land and hydrographic survey technician for a private survey company. At Cape Fear Community College, he received an Associate in Applied Sciences in Marine Technology and participated on several research cruises.

C. Datums and Survey Control

The horizontal datum used for this survey will be the North American Datum of 1983/91 (NAD83/91), State Plane Coordinate System – Oregon North, with units in International Feet. This

is the datum used for prior survey Universal Time Coordinated (UTC) time stamps will be used for all-time records.

The vertical datum for this survey will be the North American Vertical Datum of 1988 (NAVD88) using the National Geodetic Survey (NGS) separation model Geoid 2009 (GEOID09), which is one of the separation models that converts NAD83/91 ellipsoid heights obtained from GNSS receivers to NAVD88 orthometric heights. Prior surveys transitioned from a custom separation model, Geoid 2003, and Geoid 2009 to obtain NAVD88 orthometric heights. All of these models and datums have been superseded by more accurate models with the current datum being NAD83(2011) and Geoid 12b is the current separation model to determine NAVD88 orthometric heights. Lidar data and any future surveys for design efforts will be based on updated datums, which provide superior results to superseded datums. It is a relatively easy process to bring data based on old superseded datums forward to current datums, which is advisable when integrating disparate data sets to avoid conflicting data.

Control for this survey will be based on DEA's permanently operating GNSS reference station, which was one of the primary stations used for the 2009 survey of the Portland Harbor conducted for the National Oceanic and Atmospheric Administration, Office of Coast Survey by DEA with data used to update map products for the LWG. The suggested maximum distance for a single base station to any point in a survey area is 20 kilometers. The maximum distance to the Portland Harbor survey area from DEA's permanent GNSS reference station is 14 kilometers (Figure 6).

Although not advisable, the Latitude, Longitude, and Ellipsoid Height of the DEA reference station will be reverted to NAD83/91 values for this survey. The horizontal shift from NAD83/91 to NAD83(2011) is approximately 0.5 feet in northing and 0.25 feet in easting. The vertical shift between NAD83/91 using GEOID09 to NAD83(2011) using GEOID12b is less than 0.1 feet. GNSS observations will be made on a few of the remaining original monuments used in the 2004 and older surveys, such as RAINDEER and DEA Roof, to verify reverted values reference the desired results. Location of this monuments are shown in Figure 6.

Figure 6: DEA's GNSS base station and old control relative to the survey area

D. Data Acquisition

The *Broughton* and *River Hawk* will operate 10 hours a day, as daylight and weather allow, and return to Fred's Marine daily where data will be transferred to backup drives.

Survey Operations

DEA hydrographers will acquire hydrographic data, ensuring that all field data acquisition requirements and standards are met.

A Reson SeaBat T50-P or 7101 multibeam sonar will be used to acquire multibeam bathymetric data over the survey area. Confidence checks will be performed to confirm that the acquisition system and survey sensors are functioning properly prior to initial survey operations, if any significant changes are made, and after completion of survey operations. They will include a bar check or lead line to multibeam comparison, a sound speed confidence check, and a position check at DEA's Marine Services office in Vancouver. During acquisition of multibeam data, preliminary coverage displays will be generated during acquisition to monitor sonar coverage of the site.

Cross-lines will be run for a quality analysis of the data. This will verify sonar swath angle used on a flat bottom meets survey accuracy requirements of plus or minus 0.3 feet at two sigma or 95% percent confidence level.

E. Processing, Mapping and Deliverables Production

Multibeam Processing

Post-processing of multibeam data will be accomplished using CARIS Onboard and CARIS Hydrographic Information Processing System (HIPS) software. CARIS Onboard will be running on the survey vessel and will automatically convert data and apply preliminary processing routines during acquisition. This workflow will allow hydrographers to evaluate data as it is being acquired. CARIS HIPS will be used in the office to apply sound speed correctors and any other post-processing correctors to improve data quality. The CARIS system will maintain a record of all processing steps and summarize information on a line-by-line basis. The information will include: line identification, data files included in each line, and corrector information. Post-processing will take place at DEA Marine Services facility in Vancouver, Washington and will consist of the following:

- Analysis of patch test data and applying sensor bias in the vessel configuration file;
- Creation and application of correction files (sound speed, tide, delayed heave);
- Filter data based on swath width and sounding quality;
- Analyze surface(s) for errors and artifacts;
- Removal of fliers;
- Analysis of cross-line data and computation of uncertainties;
- Export of gridded soundings at project specification resolution from the accepted data of the seafloor to be used for bathymetric contour generation and other deliverables; and
- Metadata generation that meets the National Geospatial Data Policy.

Hydrographic Survey Report

A Project Report documenting survey operations shall include the following:

- A description of the navigation system including a statement of its estimated accuracy for the survey area;
- A description of survey instrumentation;
- A description of the survey vessel, including its size, sensor configuration, instrument set-backs, and navigation antennae locations;
- A description of survey procedures;
- Survey Logs documenting the survey;
- Analysis of cross-lines and uncertainty; and
- Documentation that the survey meets the required accuracy and guidance as set by the U.S. Army Corps of Engineers Manual EM 110-2-1003, November 30, 2013.

Map Products

DEA will produce a digital model from the survey in ArcGIS or other mutually agreed upon mapping platform, Drawings documenting the survey will be produced consisting of the following:

- Basemap of the Willamette River from existing aerial imagery;
- Title block, legend, notes, coordinate graticules, north arrow, and scale bar;
- Contours with 2-foot minor and 10-foot major intervals; and
- Hillshade image colored by depth; and
- Difference maps from the 2004 multibeam survey.

F. Specific Deliverables

Specific deliverables will consist of the following:

1. A series of map products will be provided at a scale of 1”=400’and will include one hard copy set of the following:
   - Contour maps of the surveyed area at a 2-foot contour interval; and
   - Hill shaded relief maps color coded by depth of the surveyed area.
2. A hard copy report outlining survey equipment, methodology and analysis.
3. Digital data including:
   - Electronic versions of all final map products in AutoCAD or ESRI compatible files;
   - Georeferenced TIFF images for each difference analysis;
   - ASCII X,Y,Z point data files of final merged data model and difference data;
   - Polygon of the spatial extent of each survey used in the difference analysis;
   - Metadata that conforms to the National Geospatial Data Policy; and
   - Report in PDF format.

III. QUALITY CONTROL PLAN

The quality of hydrographic data depends on precise calibration and maintenance of the accuracy through automatic calibration techniques, and periodic verification of the results through data monitoring and statistical analysis of the multibeam data set. The proposed system for this task continuously monitors data quality, checks system conditions, and allows for the delivery of quality data.

A. Survey Operations, Quality Control and Quality Assurance

The accuracy of any shallow water multibeam system relies on a number of contributing factors. These factors include settlement and squat (dynamic draft); sensor biases for roll, pitch, yaw and latency; static draft; and changes in the sound velocity profile. To verify multibeam sonar optimal accuracy, a battery of tests will be conducted.

Vessel Baseline Survey

A baseline survey was performed prior to survey operations. No changes to sensor mounting points have occurred since the vessel survey. The sensor offset values calculated during the baseline survey will be used for the surveys under this project. Measurement accuracies from the baseline survey will be entered into the CARIS HIPS vessel file (HVF).

Vessel File (.hvf) TPE Values
All values in the CARIS HIPS TPE sensor will be populated with sensor, offset, and tidal error estimates for the creation of an accurate uncertainty model. For sensor values, the manufacturer's reported accuracy values will be used. DEA will calculate the uncertainty for the other values.

Settlement and Squat Test (Dynamic Draft)
A settlement and squat test was performed prior to survey operations using post-processed kinematic (PPK) GNSS techniques. Dynamic draft measurements were measured to a precision of 1 centimeter. No modifications have been made to the vessels that would impact dynamic draft.

Settlement and squat values will be used as a quality measure to compare to other water level observations and will not be applied when using ellipsoid heights from RTK GNSS processing and application of the NOAA VDatum model.

Initial System Calibration
A patch test will be conducted for each survey vessel to confirm alignment of the IMU sensor with the sonar transducer and to verify delay times applied to the time-tagged sensor data. The patch test will consist of a series of lines run in a specific pattern, then used in pairs to analyze roll, pitch and heading alignment bias angles, as well as latency (time delays) in the time tagging of the sensor data. The patch test lines will be run according to NOAA and USACE specifications and evaluated in the following order: latency, pitch, roll, and heading.

Pitch bias will be determined by running reciprocal lines over a smooth slope or noticeable feature, perpendicular to the depth curves. Roll alignment will be determined by running reciprocal lines over a flat bottom, in the deepest part of the survey area. Heading bias will be determined from running reciprocal lines, made on each side of a submerged feature, in relatively shallow water. Lines will be run at a speed allowing for forward overlap. For this survey the Applanix POS/MV will provide precise timing to the Reson SeaBat T50-P and 7101 sonars and all acquisition computers.

A precise timing latency test will be performed by running reciprocal lines over a flat bottom in a slight to moderate sea state and evaluating a small along-track slice of data in the outer swath for motion artifacts. Two sets of lines will be run and analyzed for pitch, latency, roll and heading. If analysis of both sets does not yield similar results, then the set will be re-run until a satisfactory solution is obtained.

Once final mounting angles have been determined, the values will be entered into the CARIS HVF and a confidence check will be performed to verify accuracy requirements. Patch tests will be repeated whenever changes are made to equipment hardware or software, sensor failure, replacement, or whenever assessment of the data indicates that system accuracies do not meet specified requirements.

Draft Measurement and Bar Check Comparison (Static Draft Check)
While secured to the dock, draft relative to the multibeam sonar will be recorded from port and starboard draft marks abeam of the multibeam sonar mount. A bar check will be conducted pre and post survey to document the sonar static draft.

Independent Verification of Sonar Data (Lead Line or Pole Sounding Check)
While secured to the dock, the survey crew will log multibeam data that is RTK GNSS corrected to the project datum. A lead line or pole sounding will be acquired at the multibeam sonar head and an RTK GNSS water line observation will be simultaneously acquired. After applying the manual sounding depth to the measured water level, the resultant bottom elevation will be compared to the corrected multibeam elevation directly below the sonar.

Sound Speed Profiles
Sound speed profiles are vital to multibeam data acquisition programs. Sound speed profiles shall be measured frequently enough to meet multibeam depth accuracies and to maximize daily acquisition time. A real-time comparison will be made between the sound speed profiler near surface sound speed to the sound speed measured at the sonar head and any deviation noted in the log. In addition, confidence checks will be performed by comparing cast data from the primary sound velocity profiler and a secondary system at the start of the project.

Crossline Comparisons
Crossline comparisons will be conducted to document that sensor biases, GNSS height data, and sound velocity profiles are accounted for in the data set. A statistical analysis of the crossline comparisons will be conducted using CARIS HIPS which provides a report, compiling statistics by beam number for each junction. In addition, a statistical analysis of the cross-line data to main scheme survey lines will be conducted and included in the survey report.

B. Positioning System Quality Control and Quality Assurance

The primary positioning system for this project will be an Applanix POS/MV-320 (Version 5) integrated RTK GNSS/inertial reference system. For quality control, a secondary RTK GNSS positioning system will be simultaneously acquired in Hypack software. Both systems will be receiving RTK GNSS correctors from the project base station GNSS receiver. As the GNSS base station antenna is a permanent mount, there is no need for daily position checks to verify base station setup. The base station is monitored periodically for stability by use of NGS Continuously Operating Reference Stations (CORS) and has not moved since installation in 2009. Hypack will display the vessel track from both positioning systems in real-time for monitoring of the RTK GNSS/Inertial position relative to the RTK GNSS position. Any deviation between the two positioning systems will be apparent on the navigation display screen, which is presented at the data acquisition station and at vessel helm. Deviations will be noted in the log; lines will be re-run if deemed necessary by the Senior Hydrographer.

Validation of Base Station Position and Height Relative to Project Datums
To verify the GNSS NAD83/91 position, ellipsoid height, and separation model GEOID09 to obtain NAVD88 orthometric heights, GNSS observations will be made on select monuments used for some of the original surveys of the Willamette River. These observations will be made prior to survey operations and results will be in the final report.

Position Check

For quality assurance, an independent position check will be conducted prior to the survey. A permanently mounted antenna is affixed to the rood at DEA Marine Services with a cable leading to the survey vessels in the warehouse. This is an independent antenna from the GNSS base station. Prior to deploying survey vessels, DEA crew will perform a static position check using the check antenna. This process verifies correctors are being obtained and validates geodetic parameters are entered correctly in Hypack software. DEA will use this information in the survey report for documentation of survey positioning accuracy.

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UPDATED FINAL

Surface Sediment Field Sampling Plan

Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling

Portland Harbor Superfund Site

AECOM
Geosyntec Project Number: PNG0767

September 19, 2018 (Revision 3; updated final)

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CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

September 19, 2018

Kenneth M. Tyrrell
PDI Project Coordinator
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Date

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ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
AECOM	AECOM Technical Services
ALS	ALS Environmental in Kelso, Washington
ASAOC	Administrative Settlement Agreement and Order on Consent
ASTM	American Society for Testing and Materials
BL	baseline/stratified random samples
cm	centimeter
COCs	contaminants of concern
CRD	Columbia River Datum
CSM	Conceptual Site Model
D/U Reach	the Downtown Reach and the Upriver Reach
DDx	dichlorodiphenyltrichloroethane and its derivatives
D/F	dioxins/furans
DGPS	differential global positioning system
DQOs	data quality objectives
EPA	United States Environmental Protection Agency
FC	Field Coordinator
FS	feasibility study
FSP	Field Sampling Plan
Geosyntec	Geosyntec Consultants, Inc.
GIS	geographic information systems
Gravity	Gravity Marine Services
GSI	GSI Water Solutions, Inc.
ID	identification number
IDW	Investigation-Derived Waste
Integral	Integral Consulting
LWG	Lower Willamette Group
NAD83	North American Datum of 1983
NAVD88	North American Vertical Datum of 1988
ODEQ	Oregon Department of Environmental Quality
PAHs	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
PDI	Pre-Remedial Design Investigation
PHSS	Portland Harbor Superfund Site

Pre-RD AOC Group	Pre-Remedial Design AOC Investigation Group
Pre-RD	Pre-Remedial Design
PSEP	Puget Sound Estuary Program
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RI	remedial investigation
RM	river mile
ROD	Record of Decision
SG	surface sediment grabs
Site	Portland Harbor Superfund Site
SMA	sediment management area
SOP	Standard Operating Procedure
SOW	Statement of Work
SWAC	surface weighted average concentration
TestAmerica	TestAmerica Laboratories
TOC	total organic carbon

1. INTRODUCTION

The Record of Decision (ROD) described a post-ROD sampling effort for the Portland Harbor Superfund Site (Site or PHSS; Figure 1) located in Portland, Oregon, to delineate and better refine the sediment management area (SMA) footprints, refine the Conceptual Site Model (CSM), determine baseline conditions, and support remedial design (United States Environmental Protection Agency [EPA] 2017a). Geosyntec Consultants, Inc. (Geosyntec), and AECOM Technical Services (AECOM) submitted a detailed Work Plan for Pre-Remedial Design Investigation and Baseline Sampling (PDI) on behalf of a group of industrial parties called the Pre-Remedial Design Agreement and Order on Consent Investigation Group (Pre-RD AOC Group). On December 19, 2017, EPA entered into an Administrative Settlement Agreement and Order on Consent (ASAOC) with the Pre-RD AOC Group to conduct the PDI studies at the Site (EPA 2017b). The ASAOC includes a Statement of Work (SOW) and the PDI Work Plan (as an attachment to the SOW), which generally describe the agreed upon field investigation activities, data analyses, schedule, and deliverables for the PDI.

These PDI studies are a foundational step in what will be a multi-phase effort to update current conditions from the collection of data during the remedial investigation (RI)/feasibility study (FS). The RI/FS was initiated by a group of potentially responsible parties known as the Lower Willamette Group (LWG) and completed by EPA in 2016 (EPA 2016a, 2016b). The RI consisted of three rounds of data collection, including surface and subsurface sediment, bank soils, surface water, sediment traps, porewater, fish tissue, and other media from 2001 through 2007.

This Field Sampling Plan (FSP) was prepared to support the surface sediment sampling efforts outlined in the PDI Work Plan (Geosyntec 2017) and the project Quality Assurance Project Plan (QAPP) (AECOM and Geosyntec 2018a). To the extent practicable, previously approved FSPs from the RI will be referenced.

1.1 Project Setting

The PHSS is located in Portland, Oregon, on the lower Willamette River immediately downstream of the urban downtown area from river mile (RM) 1.9 upstream to 11.8 and covers 2,190 acres. There are two reaches located immediately upstream of the Site. The Downtown Reach, which includes the urbanized area of downtown Portland, is defined by EPA as extending from RM 11.8 to RM 16.6. EPA defines the Upriver Reach as extending from RM 16.6 to RM 28.4. Collectively, RM 11.8 to RM 28.4 is referred to as the D/U Reach.

1.2 Project Overview

Two kinds of surface sediment data will be collected within the Site: 1) random stratified samples within a grid system (for establishing a new baseline dataset); and 2) targeted (non-random) samples located in SMA areas to support further refinement of the SMA footprints. Additional surface sediment samples may be collected to reoccupy 2004 RI surface sediment

locations. If this reoccupation of 2004 RI sampling activity was to occur, the same protocols would be followed outlined in this FSP and the description of the sampling activities would be developed as an addendum to this FSP and provided to EPA for consideration prior to sampling.

Surface sediment will be collected from a target depth of 0- to 30-centimeter depths, consistent with the RI (Integral 2004).[1] Additionally, surface sediment samples will be collected from the D/U Reach. The D/U Reach stations will be located in sediment areas targeting fine-grained sediment and higher total organic carbon (TOC), generally similar to surface sediment within the Site; target ranges are discussed in Section 2.1.4. The sampling scheme and RAOs are also discussed in the PDI Work Plan (Geosyntec 2017).

Baseline surface sediment samples will be analyzed for the ROD contaminants of concern (COCs). Surface sediment samples from targeted (non-random) stations will be analyzed for the focused COCs, which include dichlorodiphenyltrichloroethane and its derivatives (DDx), polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and dioxin/furans (D/F). All stations will be analyzed for grain size and TOC, and a portion of the fine-grained samples may be selected for Atterberg Limits geotechnical testing.

1.3 Data Quality Objectives

The stratified random surface sediment sampling effort, in conjunction with surface water and fish tissue data, will be used to update the current conditions for the full ROD suite of COCs (see ROD Table 17, relisted in Table 3 of the PDI Work Plan) and will provide a baseline for long-term monitoring and remedy effectiveness evaluations. As described in the PDI Work Plan (Geosyntec 2017), the SMA surface sediment sampling effort, along with baseline sampling, will help refine the CSM for the Site. Data quality objectives (DQOs) for surface sediment sampling are detailed in Table 3 of the project QAPP (AECOM and Geosyntec 2018a).

[1] See notable exceptions in Section 4.4.

2. SAMPLING DESIGN AND APPROACH

This FSP has been prepared to ensure DQOs are met. Methods for surface sediment sampling are consistent with EPA-approved sampling plans from the RI (Integral Consulting [Integral] 2002, 2004, 2006), EPA guidance on collecting sediment data (EPA 2014), and Puget Sound Estuary Program (PSEP) protocols (PSEP 1996).

For clarification, terminology used in this FSP includes:

- Surface Sediment Sample = is a grab sample targeting the upper 30 centimeters of the sediment bed.
- Sample Location = is the sampling point shown on maps from which a chemistry sample was collected.
- Sample Station = is the place in space where the vessel is located to collect a sample or sub-station composite sample (a, b, and c stations).
- Upriver or Upstream Area = the spatial area located immediately upstream of the Site and includes the Downtown Reach and Upriver Reach.

2.1 Surface Sediment

Two kinds of surface sediment data will be collected within the Site: stratified random samples within a grid system to establish a baseline dataset and targeted (non-random) samples located in SMA areas to support further refinement of the SMA footprints. All surface sediment sampling stations within the Site are presented in Figure 2. In addition, upriver surface sediment data will be collected to evaluate current conditions and incoming contaminant loads. All surface sediment samples will consist of a three-point composite. At each proposed station, three “grabs” will be collected within a relatively small footprint and composited into one sample for analysis.

2.1.1 Stratified Random Sampling

A total of 428 sediment samples will be collected for this DQO. The gridded random stations will be applied throughout the Site, including areas where other parties are collecting post-RI data. All surface sediment sample types, numbers, and analyses are summarized in Table 1. Section 3.2.2 of the PDI Work Plan details the rationale and statistical justification for the stratified random sampling design. In summary, the total sample count reflects the number of samples required to improve upon the level of variability in the 2004 surface weighted average concentrations (SWAC) and to enable the design to statistically detect differences ($\alpha = 0.05$) between 2004 SWACs and current SWAC estimates with an approximate 80 percent level of statistical power. The dataset will be used to establish a baseline for future long-term monitoring. All stratified random surface stations will be analyzed for the full ROD Table 17 suite of COCs, plus grain size and TOC (see Section 5 for details).

Combined with the SMA samples (see below), this sample design represents the estimated 666 surface sediment sampling stations needed to yield a statistically robust new dataset for determining SWACs at varying scales.

2.1.2 Targeted SMA Delineation

A total of 178 targeted surface sediment sample stations will be collected to support further refinement of the SMA footprints. In addition, 60 surface grab samples will be co-located with the 60 deep in-water core stations in SMA areas. A total of 233 surface sediment grab samples will be collected for targeted SMA delineation. Details regarding the sediment core sampling are provided in the Subsurface Sediment Coring FSP (AECOM and Geosyntec 2018b).

The criteria considered for the placement of SMA surface sediment samples include:

- **Pairing with Core Collection in Deep Water Areas**: collect a co-located grab sample at each of the 60 proposed sediment core locations (rationale for core locations provided in the Subsurface Sediment Coring FSP)
- **Spatial Resolution**: Place adequate number of grab samples such that a sediment sample would be present approximately every 300 feet within the SMAs
- **Reduced Uncertainty for Future Planning**: The density of SMA sampling achieves the level of precision needed to delineate SMAs within an approximate 30 percent level of uncertainty, sufficient for the needs of the Pre-RD AOC Group to support SMA delineation need during remedial design.

2.1.3 Downtown/Upriver Reaches

A total of 30 surface sediment samples will be collected from the Downtown Reach located immediately upstream of the Site, and 30 surface sediment samples will be collected from the Upriver Reach, for a total of 60 D/U Reach samples. All D/U locations will target fine-grained sediments similar to Site sediments to facilitate matching the D/U sediments with the Site sediments.

A review of previous sediment studies' available grain size data and bathymetry data was conducted to select initial target areas in the D/U Reach (RI/FS database; GSI Water Solutions, Inc. [GSI] and Hart Crowser 2010; GSI 2014; Kleinfelder 2015; Hart Crowser 2002). Samples were randomly placed in areas with more than 35 percent fines (sum of clay and silt fractions) from the FS dataset. Percent fines is defined as material passing through a #200 sieve for American Society for Testing and Materials (ASTM) grain size. The random placement process is comparable to the stratified random sampling design used within the Site as both used the same industry standard geospatial randomization algorithm for spatial coverage in GIS. However, where the stratified random samples within the Site were placed using a weighted grid (smaller cells near the banks, wider in the navigation channel), no grid was used for the D/U Reach samples as these are being randomized across areas with more than 35 percent fines

(Note: a grid was used for the revised locations to provide more spatial coverage: see FSP Addendum). The randomization of each sampling location within a grid cell is comparable to the randomization of a sample location within the targeted area of more than 35 percent fines. Figure 3 presents the available percent fines data in the D/U Reach, and Figure 4 presents randomly placed proposed locations based on the results of the visual reconnaissance and data evaluation as discussed in Appendix C. However, the actual collection locations will be selected based on confirmation of sufficient fine-grained sediment (see below).

2.1.4 Pre-Screening D/U Sediments for Grain Size

It is critical that D/U Reach samples have grain size and TOC fractions similar to Site conditions, so they can be representative comparisons to the Site. In addition, cleanup levels for organic sediment COCs in the ROD are dry weight-based values (i.e., not normalized for organic carbon content); therefore, TOC should be within the range of Site conditions for concentrations of organic chemicals in D/U sediments to be evaluated within the context of cleanup levels for the Site. For reference, the average site-wide TOC is 1.8 percent (median of 1.7 percent) with a distribution range of 0.04 to 27 percent. The mean grain size distribution of site surface sediments is classified as a sandy silt. The average upriver TOC concentration is 1.1 percent with a range of 0.033 to 13 percent depending on the river reach. The TOC distribution in the Downtown Reach appears to be different from the upper reaches, especially from RM 22.7 to RM 28.4 where the sediment facies may be different. The historical data generally show good correlation between percent fines and TOC ($r2 = 0.9$, $p < 0.001$), however neither percent fines alone or TOC alone are always well correlated with concentrations of organics. Based on an evaluation of paired upstream data, the correlation between percent fines and concentrations of total PCBs is low ($r2 = 0.18$), however the correlation between TOC and concentrations of total PCBs in sediment is significant ($r2 =0.42$, $p = 0.015$). Therefore, both parameters will be considered to ensure that the D/U Reach samples are appropriate for comparison to Site data. While grain size data will be considered prior to sample collection, TOC will be evaluated as a post-processing statistical evaluation of the data.

The process for determining D/U Reach sample locations based on grain size considerations is provided in Figure 5, and described below. In brief, the following steps will be performed:

1. Soft sediment probing and visual reconnaissance to map areas of fine grain sediments (>35 percent fines)
2. Placement of randomized sample locations within mapped areas targeting >35 percent fines
3. Collection of surface sediment samples for full volume of sediment needed for analyses
4. Visual assessment of grain size at the target sampling location
5. Expedited analysis of grain size

As shown in Figure 5, geotechnical analyses may be performed based on grain size results; however, these do not impact the decision criteria. This process has been designed to result in a total of 60 D/U Reach surface sediment samples as presented in the PDI Work Plan with the highest likelihood of grain size that are appropriate for comparison to Site data. Each step is described in detail below.

Visual and Soft Sediment Probing Reconnaissance. A field reconnaissance survey will be conducted prior to sampling to confirm a target area containing fine sediments. First, the sediment bottom will be probed using a steel-tipped rod and BioSonar to confirm the presence of fine-grained sediments in expected areas based on the desktop review of available grain size data. Best professional judgment can easily distinguish between predominantly coarse-grained material (sand and gravel) versus predominantly fine-grained material (silt and clay, and up to some sand). BioSonar[2] will be utilized as an additional field tool in order to acquire sediment hardness over a large spatial area (RM 11.8 to 28.4), and specifically in areas not reachable during hand-probing. Second, an aliquot of mud will be collected (using the hydraulic power grab) and the sediment grain size fractions will be visually classified according to ASTM visual-manual soil classification methods for particle size (e.g., cobbles, gravel, silt, sand). The field staff will refer to the ASTM Unified Soil Classification System Log Key 2 (Appendix A-1). Visual inspections will include recording of the presence/absence of organic matter, organic silt, leaf litter, roots, rootlets, and other organic matter that may indicate the presence of TOC. Lastly, field wet sieving will be conducted in areas where fine-grained sediment is identified based on visual classification (Appendix B-4 Standard Operating Procedure [SOP]). Additional details on the visual reconnaissance are provided in Appendix C.

Mapping of Grain Size and Placement of Sample Locations. Areas containing an estimated >35 percent fines and presence of organic matter based on the visual reconnaissance will be mapped in GIS. Following the field survey, the BioSonar data will be processed through the BioSonics® software and classified as soft, medium, and hard bottom. The soundings will then be compared and correlated to the probe sampling, visual grabs, and the historic 2004 RI/FS data. Details of this process and results are provided in Appendix C. Figure 4 presents 60 re-randomized locations based on the visual probing survey.

Sample Collection. Following the mapping of grain size and re-randomization of sample locations, it is anticipated that surface sediment sampling within the Site will still be on-going. At this point, the sampling vessel will return to the D/U Reach and all 60 D/U Reach sample locations will be sampled. Surface sediment samples will be collected, processed, and packaged (as described below) from all 60 D/U Reach sample locations.

Expedited Grain Size Analysis. The full sets of samples and jars collected will be submitted to the designated analytical lab. All analyses will be held, pending the result of a quick turnaround analysis of grain size by ASTM D7928 / D6913. Grain size analysis will include both the coarse-

[2] Use of the Biosonar tool was approved by EPA in May 2018 in a Change Request Form #4.

and fine- fraction estimation of the sample (sieves and hydrometer), including determination of silts and clays.

- The target recovery depth is an average recovery depth of 10 centimeters or greater among the three deepest grab attempts (up to six attempts). If fewer than three grabs are accepted, then a one or two-point composite will be collected (following the same decision criteria described in Section 4.3).
- The target criteria for grain size is > 35 % fines with some clay present. No samples will be analyzed if < 25 % fines (based on recent Oregon Department of Environmental Quality [ODEQ] 2018 sampling results [ODEQ 2018]).[3]

Review of Decision Criteria - Analysis of ROD Table 17 COCs or Resample. Following expedited analysis of grain size, all samples meeting the criteria described above will be analyzed for the complete list of ROD Table 17 sediment COCs and TOC by EPA Method 9060. Samples that do not meet the criteria for grain size will be archived pending discussion with the PDI Project Manager and EPA.

In the event that data indicate areas with target ranges of grain size in the D/U Reach are spatially limited, then multiple samples may be grouped in smaller areas. However, no samples below the minimum requirements for grain size (< 25 percent fines) will be analyzed unless field conditions warrant additional discussion with EPA.

Once laboratory grain size fractions are confirmed to be within the targeted range, a subset of up to 10 samples with > 50 percent fines will be analyzed for Atterberg Limits testing to further classify fine-grained sediments. Methods for Atterberg Limits are noted in FSP Table 7 and in the project QAPP (AECOM and Geosyntec, 2018a).

2.2 Sample Identification

2.2.1 Sample Types, Locations, Depths

Consistent with the previous RI/FS protocol, surface sediment samples will target collection of sediment from 0 to 30 centimeters (See Section 4.3.2 for details on Substrate Types). Proposed surface sediment sample stations within the Site are provided in Figure 2 and in the D/U Reach in Figure 4. Sample location coordinates and sample identification numbers (IDs) are provided in Table 2. All surface grab samples will be collected as three-point composites with a hydraulic power grab sampler (see Section 4.3 below for more details).

[3] TOC and percent fines are correlated such that samples with > 25% fines should also have TOC > 0.5%, so we recommend relaxing the minimum percent fines criteria from 35% to 25% to account for (i) recent ODEQ 2018 upriver data, which all had less than 30% fines based on lab results; 5 of 9 samples were between 25 and 30% fines; and (ii) differences between lab/field wet sieve measurements.

Additionally, two alternative stations for the stratified random samples are provided in Figure 6 and Figure 7. Stations were re-randomized within each grid, using the same approach as the parent sample (see Section 4.4 below for more details on the rationale for selection of the two alternative stations).

2.2.2 Sample Nomenclature

Sample nomenclature will be developed in a manner similar to the RI Round 1 FSP (Integral 2002, Section 4.2). In brief, all samples will have a unique identifying sample ID that includes the following:

- Project phase (PDI).
- Sample matrix (SG [sediment grab]).
- Sample Area (B for baseline/stratified random samples and D/U Reach). All baseline sample stations will be numbered B001 through B428 and D/U Reach stations will be numbered B429 through B489 (N=60). All SMA or in-water core location stations will be numbered sequentially S001 through S238 (N=178 targeted SMA grab samples, N=60 in-water SMA core location samples). All surface sediment sample locations are numbered sequentially from downstream to upstream.
- Unique, sequential station number (001 to ### per sample area).
- Sampling round (BL1 [baseline monitoring round 1]).

For example, a surface grab sample from the 428th stratified random sampling location would have the sample ID PDI-SG-B428-BL1. See Section 4.2.1 of the QAPP for nomenclature associated with field duplicates and other quality assurance (QA)/quality control (QC) samples. Additional data fields that describe each unique sample features, location, and composite type will be recorded in the field forms and will be included in the project database, as described in the project Data Quality Management Plan (DQMP).

2.3 Sampling Schedule

The overall project schedule is outlined in the PDI Work Plan (Geosyntec 2017). Surface sediment grab sampling is targeted to begin First Quarter of 2018. EPA will be notified 1 to 2 weeks prior to sampling. Surface sediment sampling is expected to last 2 months using two sampling vessels. About 1 month into the program, progress will be assessed and, if it appears that the sampling effort is behind schedule, a third boat and crew will be mobilized to complete the sampling in the targeted 2-month period.

3. PROJECT ORGANIZATION/FIELD TEAM

3.1 Team Organization and Responsibilities

Team organization is detailed in the PDI Work Plan and in Section 2 of the QAPP (AECOM and Geosyntec 2018a). As it relates to this FSP, AECOM and Geosyntec are coordinating activities including management of all subcontractors, field sampling, analysis, and reporting scoping tasks. The PDI Project Coordinator, Mr. Ken Tyrrell, and PDI Project Manager, Dr. Jennifer Pretare, PhD (AECOM), will be responsible for overall project coordination and providing oversight on all project deliverables. Ms. Anne Fitzpatrick (Geosyntec) is the project's senior technical lead for this task. Ms. Nicky Moody (AECOM) and Mr. Keith Kroeger (Geosyntec) will be the Project Field Coordinators (FCs) and will be generally responsible for general field QA/QC oversight. The project chemists, Ms. Julia Klens-Caprio (Geosyntec), Ms. Amy Dahl (AECOM), and Ms. Karen Mixon (AECOM), will be responsible for coordination with labs regarding sample volumes, logistics, schedule, detection limits and matrix interferences, and ensuring overall data quality.

Gravity Marine (Gravity), of Fall City, Washington, will perform vessel support, with Shawn Hinz acting as a point of contact. Analytical laboratories include ALS Environmental (ALS) in Kelso, Washington, and TestAmerica Laboratories (TestAmerica) in Fife, Washington, Sacramento, California, and Knoxville, Tennessee.

3.2 Communication/Information Flow

The communication strategy is outlined in Section 2 of the QAPP (AECOM and Geosyntec 2018a). In brief, the Field Coordinators, Ms. Nicky Moody (AECOM) and Mr. Keith Kroeger (Geosyntec), will be the points of contact for field staff during the implementation of this FSP. Anne Fitzpatrick (Geosyntec) will be the senior technical lead for this task. Deviations from this FSP or the project-specific QAPP will be reported to Dr. Pretare, the PDI Project Manager, for consultation. Significant deviations from the FSP/QAPP will be further reported to representatives of the Pre-RD AOC Group and EPA by the PDI Project Coordinator.

3.3 Coordination with EPA

The PDI Project Coordinator will notify the EPA Project Manager 1 to 2 weeks prior to beginning any field activities so that EPA can schedule any oversight activities required. The PDI Project Coordinator will also notify the EPA Project Manager once field activities have been completed.

Split samples for chemical analyses can be provided to EPA upon its request. EPA's Project Manager should contact the PDI Project Coordinator to coordinate this activity and determine appropriate logistics. If EPA elects to collect split samples, collection at stations where field

duplicates are taken is recommended so that EPA's comparison samples can be evaluated relative to the field and analytical variability measured by the project team.

4. SAMPLE COLLECTION PROCEDURES

The following sections describe the procedures and methods that will be used during surface sediment sampling, including sampling procedures; recordkeeping; sample handling, storage and shipping; and field quality control procedures. All field sampling activities will follow procedures outlined in the project Health and Safety Plan (AECOM and Geosyntec 2018c).

4.1 Sampling Vessels and Equipment

Gravity will perform the surface sediment sampling activities. Gravity will utilize two sampling vessels, RV *Cayuse* and RV *Tieton*, equipped with hydraulic power grab samplers to complete the work. Both vessels have a virtual anchoring system that incorporates an autopilot and two small motors to keep the vessel on station without needing to set fixed anchors. The RV *Cayuse* is a 26-foot research vessel with landing craft design, crew cabin, and forward working area. The vessel has an A-frame with a custom research winch and dynamic positioning system. The RV *Tieton* is a 34-foot research vessel with landing craft design and crew cabin, pilot house, and forward working area. The vessel has an A-frame with custom research winch and dynamic positioning system. Supplemental vessels are available if additional or backup support for in-water sampling is needed. All vessels will be mobilized from Swan Island Launch.

Equipment and supplies will include all equipment for positioning, sampling, processing, recording, and shipping samples. Sample containers and preservatives, as well as coolers and packing material, will be supplied by the analytical laboratory. An equipment checklist is provided in Appendix A-2.

4.2 Station Positioning and Vertical Control

Station positioning and vertical control will be performed as detailed in the attached SOP (Appendix B-1). A differential global positioning system (DGPS) unit will be used to confirm the horizontal sampling locations to an accuracy of 1 to 2 meters. The DGPS accuracy will be confirmed each morning and evening at the PH-1 benchmark installed at the Swan Island boat launch for the project (see GPS station log in Appendix B-1). Confirmed station locations will be recorded to the nearest whole foot in North American Datum of 1983 National Adjustment of 2011, NAD83 (2011), State Plan Coordinate System (SPCS) Oregon North Zone, International Feet.

Vertical control will be established using an on-board fathometer or lead line to measure depth to mudline at sampling locations. The fathometer accuracy will be checked regularly by Gravity and calibrated when necessary following ASTM D6318 Standard Practice for Calibrating a Fathometer Using a Bar Check Method or other similar practice. Water depths will be converted to elevations in feet North American Vertical Datum of 1988 (NAVD88) based on synchronizing timestamped gauge data downloaded from the Northwest River Forecast Center for gauge PRT03, located near RM 12.8. As described in Appendix B-1, this river stage gauge data are

reported in the Columbia River Datum (CRD), so a correction will be needed to convert to NAVD88. Water levels will be recorded to the nearest one tenth of a foot in the datum specified in the DQMP (AECOM and Geosyntec 2018d).

4.3 Sample Collection and Processing

In general, sample collection will be performed as described in the RI Round 1 FSP (Integral 2002), RI Round 2 FSP for Sediment Sampling and Benthic Toxicity Testing (Integral 2004), and the RI Round 3 FSP for Upstream and Downstream Sediment Sampling (Integral 2006) with modifications described herein.

- Key changes from the RI Round 1 FSP include the following:
- Samples will be collected as three-point composite samples.
- Sediment will be collected from 0 to 30 centimeters, depending on sediment substrate conditions. Section 4.3.2 provides details on encountering different substrate types.
- Samples will be processed on the sampling vessel. Samples will be transported in coolers on ice to the field lab for sample packaging and shipment. The AECOM Sample Processing Facility at 1115 SE Caruthers Street, Portland, Oregon, is approximately 20 blocks from the Site and will be used as a base for staging work, core sample processing, sample storage, sample packaging and shipping, daily field team meetings, gear storage, decontamination, and other field support needs.
- The pneumatic/hydraulic power grab was designed and manufactured by Gravity Marine. The power grab is 26 inches long by 16 inches wide with a 14-inch grab depth, with a closing force of 1,000 pounds per square foot. The approximate sampling volume is 0.3 cubic meters.

Standard Operating Procedures (SOPs) from the RI will be followed. The Surface Sediment Sampling SOP from Appendix F of the LWG FSP for RI Round 2 (Integral 2004), is provided in Appendix B-2, and consistent with Appendix D of the LWG FSP for RI Round 3 (Integral 2006), which was previously approved by EPA. These SOPs include lists of needed supplies and equipment, equipment decontamination, sediment sample collection, and sediment sample processing procedures. Procedures regarding the chain-of-custody, packaging, and shipping samples are presented in Section 4.3 of the project QAPP (AECOM and Geosyntec 2018a), and are consistent with those in the Surface Sediment Sampling SOP (Integral 2004).

4.3.1 Sample Compositing

The power grab samplers (similar to a van Veen grab sampler but with power-assist) will target collection of sediment from the upper 0 to 30 centimeters of sediment at three sampling points at each sample location; the three grab samples will be composited into a single sample for analysis. The three-point composite sample will be collected within a relatively small footprint

around the sampling vessel (i.e., less than 25 feet) where possible. For example, grab #1 will be deployed, accepted, and processed on the deck of the vessel. The sampling vessel will then shift approximately 5 to 10 feet from the original sample location either using the vessels engines or by pulling in 5 feet on one anchor while releasing 5 feet on the other anchor. This process will be repeated until there is an equal volume of sediment from the three grabs. Approximately 20 ounces (oz) (equal volume) of sediment will be collected from each of the three surface grabs. The sediment will be sampled using a stainless-steel spoon, then placed in a 20-oz jar or similar container, scoop or device (to estimate the equal volume), then transferred to a stainless-steel bowl for compositing. The spoon and container will be rinsed free of solids between subsample composite stations, but not decontaminated. Decontamination of the power grab and field equipment will take place between sample stations (as detailed in Section 4.7).

In general, the volume of sediment from the three-point surface grabs will be homogenized until uniform in color and texture. Color and texture will be described following the ASTM visual-soil classification method (Appendix A-1). Sediments will be collected from the hydraulic power grab using a stainless-steel spoon, avoiding sediments in contact with the sides of the power grab. Large organisms and pieces of debris will be removed and noted in the sample log sheet (Appendix A-3). Acceptance criteria include the following (PSEP 1996; Integral 2004):

1. No or minimal excess water leaking from the jaws of the sampler.
2. No excessive turbidity in the overlaying water of the sampler.
3. Sampler did not over-penetrate.
4. Sediment surface appears to be intact with minimal disturbance.
5. Program-specific penetration depth has been achieved (target of 20 centimeter or more, but less can be accepted after several attempts).

After sample acceptance, the sediment will be placed in a large, stainless-steel bowl for homogenization. Once the volume of sediment from each grab has been homogenized to a uniform consistency and color, composited sediments will be visually described following ASTM visual-soil classification procedure in the field log book (Appendix A-1). Sediments will be placed in the appropriate laboratory-provided sampling containers and stored in a cooler at 0 to 6 degrees Celsius (°C) until transport to the laboratory.

4.3.2 Substrate Types

Field conditions will not consistently achieve target penetration depths because of varying substrate conditions. These conditions may range from woody debris, gravel/rock in sampler jaws, sand and gravel bottom conditions, stiff silts, steep slopes, and areas of no recoverable sediment (e.g., bedrock, riprap). To help quantify these substrate conditions, a documentation protocol has been added to the sediment grab collection activities. Field crews will classify the sample location into one of four substrate types:

- Substrate Bin #1 - Soft Sediment; over-penetration may be expected and sampling weights adjusted
- Substrate Bin #2 - Soft Sediment With Debris; silt, sandy silt, and silty sand with good recovery expected; however, the presence of debris makes it difficult to consistently achieve a target recovery depth of >20 cm (especially when debris is caught in the jaws and some material is lost during retrieval because the jaws did not make a tight seal). Debris is specifically classified as wood, trash, scrap metal, concrete, or subsurface obstructions such as steep slopes that prevent collection of soft sediment under Bin #1 conditions.
- Substrate Bin #3 – Natural Hard Sediment Bottom; this type of dense sand and gravel, stiff silt, or uncemented cobble substrate is expected to produce consistently low penetration depths (less than the target recovery depth of 20 cm) in each grab.
- Substrate Bin #4 - No Recoverable Sediment: this type of substrate is expected to be impenetrable bedrock, riprap, or very dense/cemented cobbles.

4.4 Contingency Plan for Field Condition Impediments to Collecting Samples

During the sediment grab sampling efforts, the field crew may encounter substrate and other field conditions that preclude collection of grab samples at the planned stations (e.g., limited access, poor recovery, safety concerns, debris/rock/bedrock causing refusal). To account for difficult substrate conditions, contingency protocols will be adapted for each of the four substrate types listed above. The sampling protocol will be slightly different for random and SMA sample locations. The inset table below summarizes the revised protocol discussed with EPA on May 18, 2018, to address anomalous field conditions; these protocols are detailed in the following subsections.

Substrate Type	Substrate Description	Acceptance Criteria for Recovery Depths [a, b]
1	Soft Sediment: full penetration depth expected	Minimum of 20 cm recovery depth in each accepted grab (adjust weights if overpenetration encountered).
2	Soft Sediment with Debris: wood, trash, scrap metal, concrete, slopes; difficult to consistently achieve good recovery depth (e.g., 20 cm depth)	Up to 6 attempts at primary location; retain 3 deepest recovery bucket attempts within 50 ft radius of primary location. If composite avg >10 cm depth then analyze; if avg <10 cm then archive pending discussion; if less than 3 recoveries are obtained for 3-point composite then archive pending discussion; only go to Alt 1 if no recovery or access issues. [c]
3	Natural Hard Sediment Bottom: dense sand and gravel, stiff silt, uncemented cobbles; lower recovery depth expected	Up to 6 attempts at primary location. Using all weights, retain 3 deepest bucket attempts within 50 ft radius of primary location. If composite avg >10 cm depth then analyze; if avg <10 cm then archive pending discussion and probe the area to determine if Bin 4 conditions; if less than 3 recoveries are obtained for 3-point composite then archive pending discussion; only go to Alt 1 if access issues. [c, d]
4	No Recoverable Sediment: bedrock, riprap, very dense/cemented cobbles	After three grab attempts, if no acceptable sample (NR), use probe to confirm bottom substrate is not recoverable and document; only go to Alt 1 if access issues. Discussions with EPA will determine if resample or sampling at Alt 1/Alt 2 locations is necessary under these conditions.

Notes:

a) All grabs attempts should be documented in the field notes.

b) Target three attempts in 25-ft radius and three attempts at 50-ft radius = total of 6 attempts.

c) For Bins 2 and 3, a maximum of 6 field attempts will be made unless field crews recommend additional attempts based on professional judgement. The best /deepest 3 of 6 attempts will be retained.

d) In natural hard sediment bottom area (Bin 3), stay on primary location and collect best possible sample.

4.4.1 Substrate #1 - Soft Sediment

A minimum of 20 cm recovery depth is expected in each acceptable grab in this type of substrate. Sampler weights will be adjusted to minimize over-penetration. It is expected that a three-point composite can be obtained within the 25-foot radius of the Primary location.

4.4.2 Substrate #2 – Soft Sediment with Debris

In this type of substrate, the goal for minimum average composite recovery depth is 10 cm for each subsample. This substrate type may range from soft silt, to soft sandy silt, to loose silty sand and sand. Contingency plan and acceptance criteria for recovery depths at areas encountering Substrate #2 include the following steps:

- At the Primary target location, conduct up to six bucket attempts within a 50-foot radius to collect acceptable grabs (target three attempts within 25-foot radius and three attempts in 50-foot radius). All attempts will be logged and documented in the field form. Retain the three best/deepest penetrating samples and calculate the average sample recovery depth.
- If less than 3 acceptable recoveries are obtained after 6 bucket attempts then archive pending discussions with EPA.
- If the average composite sample depth is >10 cm, then submit sample for analytical testing. If the average composite sample depth is <10 cm or if only one or two grabs has recoverable sediment, then archive pending further discussions with EPA.
- (For Stratified Random Samples) The Alternate 1 location (Figure 6) will only be visited in the event that the Primary location is inaccessible or no recovery/very low recovery is achieved after several attempts. Repeat steps above at Alternate 1 location.
- (For Stratified Random Samples) The Alternate 2 location (Figure 7) will only be visited in the event that both the Primary and Alternate 1 locations are inaccessible.

4.4.3 Substrate #3 – Natural Hard Sediment Bottom

Acceptance criteria and contingency planning at areas encountering low sample recoveries in Substrate #3 include the following steps:

- At the Primary target location, conduct up to six bucket attempts within a 50-foot radius using all weights and retain the three best/deepest bucket attempts. All attempts will be logged and documented in the field form. Calculate the average sample depth of the three best samples.
- If less than 3 acceptable recoveries are obtained after 6 bucket attempts then archive pending discussions with EPA.
- If the average composite sample depth >10 cm, then submit sample for analytical testing. If the average composite depth is <10 cm at the Primary location or if only one or two grabs has recoverable sediment (one-point or two-point composite), then archive pending further discussions with EPA and probe the general target area to confirm substrate type.
- (For Stratified Random Samples) The Alternate 1 location will only be visited in the event that the Primary location is inaccessible. Repeat steps above. Sampling an Alternate 1 location for reasons other than access issues will be discussed and determined with EPA input.
- (For Stratified Random Samples) The Alternate 2 location will only be visited in the event that both the Primary and Alternate 1 locations are inaccessible. Repeat steps above.

4.4.4 Substrate #4 - No Recoverable Sediment

Acceptance criteria and contingency planning for areas encountering Substrate #4 include the following steps:

- At the Primary target location, three attempts will be made to collect an acceptable sample within a 50-foot radius. If no acceptable sample is obtained after three attempts (e.g., no recoverable amount of sediment), a hand probe will be used in the general target area to confirm the bottom substrate. All attempts will be logged and documented in the field form.
- If no recoverable sediment is obtained following the protocol above, then the location will be abandoned and no sample collected. A description of bottom substrate and probing efforts will be recorded in the field log form.
- (For Stratified Random Samples) The Alternate 1 location (Figure 6) will only be visited in the event that the Primary location is inaccessible.
- (For Stratified Random Samples) If field crews judge that the Alternate 1 or 2 locations represent the general area, then initiate further discussions with EPA and consider collecting a sample at these alternate locations.

All attempts will be logged and recorded in the field notebooks. Sample location coordinates for Alternate 1 and Alternate 2 are provided in Tables 3 and 4, respectively. Alternate sampling locations were re-randomized using a GIS randomization program to maintain the geostatistical methods used during development of the PDI Work Plan (Geosyntec 2017). The rationale for moving to Alternate Location 1 or, if needed, Alternate Location 2, will be documented in the field log.

For SMA target locations, the radius protocol described above will be used. The re-randomization geostatistical methods are not necessary as a contingency plan for the SMA locations as these locations were not randomly generated. Field crews will conduct three grab attempts within a 25-foot radius of the target location. In the event that field conditions preclude the field crews from collecting proposed target samples within SMAs, up to three additional attempts within a 50-foot or larger radius (depending on access or other issues) will be continued (maximum of six attempts). As described in Section 2.1.2, the criteria considered for SMA sample placement is to maintain a 300-foot spatial resolution between SMA samples within SMAs; therefore, larger radius locations will be considered on an SMA by SMA basis with a goal of sampling within the SMA footprint. If no recoverable amount of sediment is obtained within (and up to) a 300-foot radius of the target location (and within the SMA footprint), then abandon the station, document substrate conditions in the field logbook, and notify the PDI Project Manager and EPA.

After six attempts, the three best/deepest recovery of six samples will be retained and composited. If three subsamples are not recovered, the available samples will be processed for analysis (composite if two grab samples if available or collect a single grab sample if necessary). If the average composite sample depth is >10 cm, submit the sample for analytical testing. If the average composite depth is <10 cm, then archive pending further discussions with EPA. If no recoverable amount of sediment (e.g., less than ~4 cm) is obtained, then abandon the station and notify the PDI Project Manager and EPA.

4.5 Contingency Plan for Downtown/Upriver Reach Sampling in Areas with Soft Sediment

Collection of surface sediment samples for Downtown and Upriver sampling in areas with soft sediment will follow the revised protocol outlined in Section 4.4, with some notable changes as described below and in Appendix C: [4]

- Go to primary target area and begin attempting to collect a three-point composite sample within a 50-foot radius of primary target.
- Following the first grab sample at the primary target, classify the substrate as described in Section 4.3.2 of the Surface Sediment FSP, including a visual estimate of percent fines. If the substrate is classified as:
    - Substrate #1 – Soft Sediment: Collect the surface sediment samples per the FSP protocol. At the field team's discretion, wet sieving may be performed on the first sediment grab sample to evaluate percent fines by volume.
        - Selecting Alternate 1 Location: If wet sieving results indicate insufficient fine material at the primary target location, probe the surface sediment moving toward the shoreline (beginning at ½ the distance to shore) or laterally along the shoreline until soft sediment is encountered. The field crew will use best professional judgement to determine where to probe based on the grid cell size, shape, and physical features present. Once an area of soft sediment has been identified, this will be designated Alternate 1. A three-point composite sample will be attempted within a 50-foot radius of the selected Alternate 1 location.
    - Substrates #2 (Soft Sediment with Debris) or #3 (Natural Hard Sediment Bottom): Field staff will collect up to six attempts and will retain the three grabs with the deepest/best recovery depths. If significant debris is encountered, the field staff may decide to attempt an Alternate 1 location, determined in the field, before completing the six grab sample attempts.

[4] These guidelines are for optimal sample recovery. See sentence following the bullets for minimum acceptable criteria in the case of challenging field conditions.

        - Selecting Alternate 1 Location: If significant debris is encountered at the primary target location, field staff may move towards the shoreline or laterally along the shoreline remaining within the grid cell.
        - The default distance will be ½ the distance towards shore, and then laterally at 25-foot increments towards the known probe point explored during the D/U reconnaissance. Each incremental step will include a probing assessment with substrate conditions noted at each incremental move.
        - Movement will continue, as practicable, until soft sediment is encountered. This station becomes the Alternate 1 Location. A three-point composite sample (up to six grab attempts) will be attempted within a 50-foot radius of the selected Alternate 1 location.
    - Substrate #4 – No Recoverable Sediment: If Substrate 4 is encountered, attempt three grab samples. If any of the three grab samples do not have sufficient recovery, the field crew may move to an Alternate 1 location determined in the field.
        - Selecting Alternate 1 Location: the field team will probe the surface sediment moving toward the shoreline (beginning ½ distance to shore) or laterally along the shoreline until soft sediment is encountered. The field crew will use best professional judgement to determine where to probe based on the grid cell size, shape and physical features present. Once an area of soft sediment has been identified, this station becomes the Alternate 1. A three-point composite sample (up to six attempts) will be attempted within a 50-foot radius of the selected Alternate 1 location.
- If the bottom is soft, then conduct wet sieving on the first successful grab sample prior to sample collection to confirm > 35 percent fines by volume in the field; and
- Field crews will document field conditions, weights used, probing/wet sieving results, each grab sample attempt, and will note boundaries between hard and soft sediments during probing. Where attempted sampling locations are not yielding fine sediment, field crews have the flexibility to move off station to sample in areas of soft sediments as described in the selection of Alternate 1 locations above.

The minimum acceptable field criteria for a sample will include a one-point composite of at least 4-centimeter recovery, with visual characterization indicating > 35% fines (by volume). If the field crew is unable to collect an acceptable soft sediment sample with > 35% fines within a grid cell, then alternate options for that grid cell will be discussed with the Project Manager and EPA. The field crew may move to another grid cell while alternate options are being decided.

4.6 Sample Custody and Transport

Chain-of-custody procedures will be followed as detailed in Section 4.3 of the project QAPP (AECOM and Geosyntec 2018a). These methods are consistent with the RI Round 1 FSP (Integral 2002) and similarly described in the RI Round 2 FSP and RI Round 3 FSP (Integral 2004 and 2006). Samples will be stored on ice at a temperature of 0 to 6°C in a field cooler and shipped to appropriate laboratories (See Section 4.3.4 Sample Packing and Shipping in project QAPP).

4.7 Field Logbook and Forms

All field activities will be recorded in a field logbook as outlined in Section 4.10.1 in the project QAPP (AECOM & Geosyntec, 2018d), consistent with Section 5.3 of the RI Round 1 FSP (Integral 2002). Field forms (Appendix A-3 of this FSP) will be completed as outlined in the project QAPP (AECOM & Geosyntec, 2018d), consistent with the RI Round 1 FSP (Integral 2002).

4.8 Decontamination Procedures

Equipment decontamination procedures will be performed as outlined in the RI Round 2 FSP Appendix F Sediment Sampling SOP (Integral 2004) provided in this FSP as Appendix B-2. This SOP is consistent with the RI Round 3 FSP Appendix D Sediment Sampling SOP (Integral 2006). Decontamination of field sampling equipment will occur between stations. For the 3-point composite sub-stations from which a composite sample will be generated, the grab sampler will be rinsed/sprayed with river water until all solid material is removed. Stainless steel sampling spoons will be rinsed with river water to remove residual solids between sub-stations and re-used among sub-sampling composite stations. Re-usable sampling equipment will be decontaminated between stations. In summary, the decontamination steps will include an initial rinse with vessel river water to dislodge particles, a scrub with brush and Alconox™ or other phosphate-free detergent, and then a rinse with deionized water. Additional rinses with nitric acid or methanol are not anticipated but may be considered based on sample conditions (e.g., excessive oily/tar residue). Sampling spoons and bowls will be covered with aluminum foil until use (dull side down).

4.9 Investigation-Derived Waste Disposal

Investigation-derived waste (IDW) disposal will occur as described in the Management of IDW SOP (Appendix B-3). In general, any excess water or sediment remaining after processing will be returned to the vicinity of the collection site. Any water or sediment spilled on the deck of the sampling vessel will be washed into the surface waters at the collection site before proceeding to the next station. Phosphate-free detergent-bearing liquid wastes from decontamination of the sampling equipment will be washed overboard or disposed into the sanitary sewer system.

Tyvek, gloves, paper towels, plastic sheeting, and other waste material generated during sampling will be placed in heavyweight garbage bags or other appropriate containers and placed in normal refuse containers for disposal at a solid waste landfill.

4.10 Field Quality Control

All QA/QC procedures are detailed in the QAPP (AECOM and Geosyntec 2018a). Requirements for QA/QC samples are provided in Table 5, and a summary of all field QA/QC sample numbers is provided in Table 6. In brief, homogenized field duplicates will be collected from the same composited bowl of homogenized sample on 5 percent of the samples to assess variability within samples. Other field QC samples, such as trip blanks, temperature blanks, and rinsate blanks, will be collected per sampling vessel (as needed) as outlined in Section 4.6.1 of the QAPP.

5. LABORATORY ANALYSIS

With the large numbers of samples and multiple analytes, it is best to separate the sample analyses among laboratories that specialize in certain analytical methods and have the capacity to complete the work on schedule. As such, the Pre-RD AOC Group has selected the following laboratories to perform the physical and chemical analyses:

- ALS in Kelso, Washington, will analyze for chlorinated pesticides, PAHs, bis-(2-ethylhexyl) phthalate, tributyltin, and total solids.
- TestAmerica in:
    - Fife, Washington, will analyze for total petroleum hydrocarbons diesel range, metals, TOC, grain size, and total solids.
    - Sacramento, California, will analyze for dioxins/furans.
    - Knoxville, Tennessee, will analyze for PCB congeners.

The analytes and analytical methods are provided in Table 7 for each sample type. Additional details on the analytical methods, QA/QC requirements and procedures, and laboratory-specific QA/QC requirements are detailed in Section 4.6 of the QAPP (AECOM and Geosyntec 2018a). All samples will be placed in laboratory-supplied sample containers and preserved according to analytical protocols. Sample containers, preservation requirements, holding times, and sample sizes are provided for all analyses in Table 8.

6. DATA MANAGEMENT AND REPORTING

6.1 Field Data Management

The procedures and activities outlined in this FSP are designed to ensure DQOs outlined in the PDI Work Plan are met. Specifically, and as detailed in Sections 4.2, 4.3, 4.6, and 4.10 in the QAPP (AECOM and Geosyntec 2018a), the following data management procedures will be performed in the field:

- All samples will be given a unique identifier (Section 2.2 of this FSP).
- All samples will be collected and transported under chain-of-custody control (Section 4.6 of this FSP).
- Field logbooks and data sheets will be maintained (Section 4.7 of this FSP).
- Field QA/QC samples will be collected according to the QAPP (Section 4.10 of this FSP).

6.2 Post-Analysis Data Management and Reporting

Analytical laboratories will be required to adhere to all QA/QC procedures outlined in the QAPP. Laboratories will provide all data for field investigations in electronic format and QA/QC reports, including a narrative of the standard QA/QC protocols. Data validation and data management will be performed according to the QAPP and DQMP (AECOM and Geosyntec 2018d). Following data validation, all data, supplementary information, and validator qualifiers will be compiled into an SQL Server database for the project. Data summary files will be provided to EPA as they become available after data validation and database management.

Results from the implementation of this FSP will be used to support the data use objectives described in Section 1.3 of the PDI Work Plan (Geosyntec 2017: Table 5). Data summaries and evaluations will be included in the PDI Evaluation Report.

7. REFERENCES

AECOM (AECOM Technical Services) and Geosyntec (Geosyntec Consultants, Inc.). 2018a. Draft Quality Assurance Project Plan Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling. Portland Harbor Superfund Site. March.

AECOM and Geosyntec. 2018b. Subsurface Sediment Coring Field Sampling Plan Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling. Portland Harbor Superfund Site, Portland Oregon. Prepared for the Pre-RD AOC Group for submittal to EPA Region 10, Seattle, WA. March.

AECOM and Geosyntec. 2018c. Health and Safety Plan Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling. Portland Harbor Superfund Site. 13 March.

AECOM and Geosyntec. 2018d. Data Quality Management Plan Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling. Portland Harbor Superfund Site. 22 February.

American Society of Testing and Materials (ASTM). ASTM D-2488-93. Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). pg. 225-235.ASTM D6318-03. 2014. Standard Practice for Calibrating a Fathometer Using a Bar Check Method, ASTM International, West Conshohocken, PA.

EPA (United States Environmental Protection Agency). 2014. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846), Third Edition, Update V.

EPA. 2016a. Portland Harbor RI/FS, Final Remedial Investigation Report, Portland Oregon. United States Environmental Protection Agency Region 10, Seattle, Washington. 8 February.

EPA. 2016b. Portland Harbor RI/FS, Final Feasibility Study, Portland Oregon. United States Environmental Protection Agency Region 10, Seattle, Washington. June.

EPA. 2017a. Record of Decision Portland Harbor Superfund Site, Portland Oregon. United States Environmental Protection Agency Region 10, Seattle, Washington. January.

EPA. 2017b. ASAOC between US EPA and the Pre-RD AOC Group for Pre-Remedial Design Investigation Studies, Portland Harbor Superfund Site, Portland Oregon. United States Environmental Protection Agency Region 10, Seattle, Washington. 18 December.

Geosyntec (Geosyntec Consultants, Inc.). 2017. Final Work Plan, Portland Harbor Pre-Remedial Design Investigation Studies, Portland Harbor Superfund Site, Portland, Oregon. Prepared for the Pre-RD AOC Group for submittal to EPA Region 10. Attachment to the Statement of Work. 19 December.

GSI Water Solutions, Inc. (GSI), and Hart Crowser, Inc. 2010. Field and Data Report, Downtown Portland Sediment Characterization Phase II, Willamette River, Portland, Oregon. Prepared for Oregon Department of Environmental Quality. June.

GSI. 2014. Supplemental Remedial Investigation/Feasibility Study Field Sampling and Data Report, River Mile 11 East, Portland, Oregon. Prepared for RM11E Group. July.

Hart Crowser. 2002. Volume I Lower Willamette River Reference Area Study. Prepared for the U.S. Army Corps of Engineers. 9 April.

Integral (Integral Consulting). 2002. Round 1 Field Sampling Plan. Prepared for the Lower Willamette Group (LWG) for submittal and approval by EPA Region 10. 14 June.

Integral. 2004. Round 2 Round 2 Field Sampling Plan - Sediment Sampling and Benthic Toxicity Testing Prepared for the Lower Willamette Group (LWG) for submittal and approval by EPA Region 10. 21 June.

Integral. 2006. Preliminary Upstream & Downstream Sediment Data Evaluation and Round 3A Field Sampling Plan for Upstream & Downstream Sediment Sampling. Prepared for the Lower Willamette Group (LWG) for submittal and approval by EPA Region 10. 13 October.

Kleinfelder. 2015. Sediment Sampling Data Report, Portland Harbor, Portland, Oregon. Prepared for de maximis Inc. 1 June.

ODEQ (Oregon Department of Environmental Quality). 2018. Final Field and Data Report, Upriver Reach Sediment Characterization, Lower Willamette River, Portland, Oregon. Prepared by GSI Water Solutions Inc. and Hart Crowser and prepared for State of Oregon Department of Environmental Quality. 8 May.

PSEP (Puget Sound Estuary Program). 1996. Puget Sound Estuary Program: Recommended Protocols for Measuring Selected Environmental Variables in Puget Sound. Final Report. TC-3991-04. Prepared for U.S. Environmental Protection Agency, Region 10 and Puget Sound Estuary Program, Seattle, Washington. Tetra Tech and HRA, Inc., Bellevue, Washington.

TABLES

Table 1. Summary of Surface Sediment Sample Types, Numbers, and Analytes
Portland Harbor PDI Surface Sediment FSP
Portland, OR

Surface Sediment Sample Type	Number of Samples	Analyses
Stratified Random Site Samples	428	All ROD Table 17 Analytes
SMA Site Samples	178	Focused COCs
Co-located Grabs at In-water Core Stations	60	Focused COCs
Downtown Reach	30	All ROD Table 17 Analytes
Upriver Reach	30	All ROD Table 17 Analytes
Total Count	**726**	

General Notes:
1. All samples will be 0 to 30 cm depth.
2. All samples will be 3-point composites over a small footpring (< 25 ft).
3. Site = Portland Harbor Superfund Site RM 1.9 to 11.8
4. Downtown Reach = RM 11.8 to 16.6
5. Upriver Reach = RM 16.6 to 28.4

Table 2. Station Location Coordinates, Target Depth, and Identification Scheme
Portland Harbor PDI Surface Sediment FSP, rev 2
Portland, OR

Sample Type	Sample ID	Mudline Elevation (CRD - Feet) [a]	Proposed Location Coordinates (NAD 1983; Intl Feet) [b]		Sequential Station Count
			Easting	Northing	
Stratified random Site Samples	PDI-SG-B001-BL1	NA	7616223	726382	001
	PDI-SG-B002-BL1	-38.3	7616865	725994	002
	PDI-SG-B003-BL1	-41.6	7617552	725384	003
	PDI-SG-B004-BL1	-45.2	7617360	725438	004
	PDI-SG-B005-BL1	-49.0	7616987	725480	005
	PDI-SG-B006-BL1	-14.5	7616168	725962	006
	PDI-SG-B007-BL1	-45.1	7617274	725225	007
	PDI-SG-B008-BL1	-9.0	7616026	725856	008
	PDI-SG-B009-BL1	-45.6	7617115	724852	009
	PDI-SG-B010-BL1	-12.1	7615787	725287	010
	PDI-SG-B011-BL1	-30.3	7617513	724549	011
	PDI-SG-B012-BL1	-18.4	7615838	725048	012
	PDI-SG-B013-BL1	-49.0	7616429	724771	013
	PDI-SG-B014-BL1	-36.5	7617117	724302	014
	PDI-SG-B015-BL1	-43.9	7616457	724443	015
	PDI-SG-B016-BL1	NA	7615435	724765	016
	PDI-SG-B017-BL1	-36.9	7617158	724020	017
	PDI-SG-B018-BL1	-13.9	7615557	724533	018
	PDI-SG-B019-BL1	-33.2	7615583	723961	019
	PDI-SG-B020-BL1	-35.7	7616505	723723	020
	PDI-SG-B021-BL1	-34.2	7616599	723675	021
	PDI-SG-B022-BL1	-42.6	7615714	723434	022
	PDI-SG-B023-BL1	-34.4	7615581	723415	023
	PDI-SG-B024-BL1	-33.0	7616931	723304	024
	PDI-SG-B025-BL1	-46.2	7616151	723279	025
	PDI-SG-B026-BL1	-42.9	7615836	723147	026
	PDI-SG-B027-BL1	NA	7615152	723123	027
	PDI-SG-B028-BL1	-22.0	7616982	722941	028
	PDI-SG-B029-BL1	-3.9	7615256	722977	029
	PDI-SG-B030-BL1	-34.2	7616857	722699	030
	PDI-SG-B031-BL1	-32.1	7616836	722509	031
	PDI-SG-B032-BL1	-9.3	7615254	722326	032
	PDI-SG-B033-BL1	NA	7615163	721939	033
	PDI-SG-B034-BL1	-40.8	7616472	721953	034
	PDI-SG-B035-BL1	-54.7	7615532	721775	035
	PDI-SG-B036-BL1	-44.9	7616323	721720	036
	PDI-SG-B037-BL1	-43.6	7616122	721593	037
	PDI-SG-B038-BL1	-41.3	7616506	721652	038
	PDI-SG-B039-BL1	-45.0	7615969	721331	039
	PDI-SG-B040-BL1	-8.5	7615132	721046	040
	PDI-SG-B041-BL1	NA	7614939	720797	041
	PDI-SG-B042-BL1	NA	7616859	721056	042
	PDI-SG-B043-BL1	NA	7615002	720453	043
	PDI-SG-B044-BL1	-38.0	7616561	720789	044
	PDI-SG-B045-BL1	-44.0	7616117	720585	045
	PDI-SG-B046-BL1	-43.1	7616200	720559	046
	PDI-SG-B047-BL1	-41.9	7616580	720489	047
	PDI-SG-B048-BL1	-32.6	7613979	720275	048
	PDI-SG-B049-BL1	-7.8	7612801	720887	049
	PDI-SG-B050-BL1	-16.6	7615017	719963	050
	PDI-SG-B051-BL1	-41.3	7616668	720238	051
	PDI-SG-B052-BL1	-7.9	7614776	719726	052
	PDI-SG-B053-BL1	-11.1	7615032	719597	053
	PDI-SG-B054-BL1	NA	7616932	719955	054
	PDI-SG-B055-BL1	-16.9	7615493	719528	055
	PDI-SG-B056-BL1	-47.2	7616388	719570	056

Table 2. Station Location Coordinates, Target Depth, and Identification Scheme
Portland Harbor PDI Surface Sediment FSP, rev 2
Portland, OR

Sample Type	Sample ID	Mudline Elevation (CRD - Feet) [a]	Proposed Location Coordinates (NAD 1983; Intl Feet) [b]		Sequential Station Count
			Easting	Northing	
Stratified random Site Samples	PDI-SG-B057-BL1	NA	7615139	719197	057
	PDI-SG-B058-BL1	-45.5	7616134	719341	058
	PDI-SG-B059-BL1	-32.9	7616937	719319	059
	PDI-SG-B060-BL1	-25.6	7615665	718978	060
	PDI-SG-B061-BL1	-43.4	7616694	718944	061
	PDI-SG-B062-BL1	-6.1	7617080	719063	062
	PDI-SG-B063-BL1	-40.0	7616930	718861	063
	PDI-SG-B064-BL1	-34.6	7615895	718389	064
	PDI-SG-B065-BL1	-30.9	7615779	718210	065
	PDI-SG-B066-BL1	-43.7	7616398	718313	066
	PDI-SG-B067-BL1	-22.5	7617278	718377	067
	PDI-SG-B068-BL1	-42.1	7617183	718225	068
	PDI-SG-B069-BL1	-46.1	7616565	718055	069
	PDI-SG-B070-BL1	-36.6	7616117	717965	070
	PDI-SG-B071-BL1	-36.4	7616265	717583	071
	PDI-SG-B072-BL1	-44.4	7617290	717850	072
	PDI-SG-B073-BL1	-51.9	7617416	717666	073
	PDI-SG-B074-BL1	-33.4	7616310	717241	074
	PDI-SG-B075-BL1	-45.7	7617627	717363	075
	PDI-SG-B076-BL1	-49.7	7617698	717197	076
	PDI-SG-B077-BL1	-38.0	7618030	717200	077
	PDI-SG-B078-BL1	-10.9	7619956	717203	078
	PDI-SG-B079-BL1	-45.1	7616746	716853	079
	PDI-SG-B080-BL1	-35.1	7616547	716760	080
	PDI-SG-B081-BL1	-30.7	7616513	716599	081
	PDI-SG-B082-BL1	-31.6	7617869	716776	082
	PDI-SG-B083-BL1	-26.6	7616599	716189	083
	PDI-SG-B084-BL1	NA	7618120	716555	084
	PDI-SG-B085-BL1	-44.4	7617364	716252	085
	PDI-SG-B086-BL1	-51.8	7617651	716168	086
	PDI-SG-B087-BL1	-26.6	7618103	716297	087
	PDI-SG-B088-BL1	-17.7	7616828	715518	088
	PDI-SG-B089-BL1	-34.8	7618148	716034	089
	PDI-SG-B090-BL1	NA	7616826	715201	090
	PDI-SG-B091-BL1	-21.5	7616981	715113	091
	PDI-SG-B092-BL1	-40.9	7617312	715070	092
	PDI-SG-B093-BL1	-43.4	7617600	715093	093
	PDI-SG-B094-BL1	-16.6	7618474	715577	094
	PDI-SG-B095-BL1	-59.1	7618290	715307	095
	PDI-SG-B096-BL1	NA	7617115	714676	096
	PDI-SG-B097-BL1	NA	7618610	715242	097
	PDI-SG-B098-BL1	NA	7617185	714478	098
	PDI-SG-B099-BL1	-26.6	7618646	715118	099
	PDI-SG-B100-BL1	-34.8	7618892	714586	100
	PDI-SG-B101-BL1	-22.0	7619525	714384	101
	PDI-SG-B102-BL1	-34.8	7620153	714455	102
	PDI-SG-B103-BL1	NA	7617357	713841	103
	PDI-SG-B104-BL1	NA	7617560	713699	104
	PDI-SG-B105-BL1	-18.0	7619021	714287	105
	PDI-SG-B106-BL1	-24.2	7617800	713484	106
	PDI-SG-B107-BL1	-24.4	7619107	714002	107
	PDI-SG-B108-BL1	-70.9	7618632	713521	108
	PDI-SG-B109-BL1	-13.1	7619349	713804	109
	PDI-SG-B110-BL1	NA	7617843	713024	110
	PDI-SG-B111-BL1	-51.4	7618289	713159	111
	PDI-SG-B112-BL1	-8.6	7618138	712695	112
	PDI-SG-B113-BL1	-59.7	7618634	712845	113

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			Easting	Northing	
Stratified random Site Samples	PDI-SG-B114-BL1	-46.7	7619531	713352	114
	PDI-SG-B115-BL1	NA	7618159	712484	115
	PDI-SG-B116-BL1	-38.2	7619707	713147	116
	PDI-SG-B117-BL1	-40.1	7619969	713212	117
	PDI-SG-B118-BL1	-66.7	7619241	712696	118
	PDI-SG-B119-BL1	-6.8	7618367	712152	119
	PDI-SG-B120-BL1	-14.0	7619712	712826	120
	PDI-SG-B121-BL1	-30.6	7619809	712521	121
	PDI-SG-B122-BL1	NA	7618475	711792	122
	PDI-SG-B123-BL1	-47.0	7618979	711926	123
	PDI-SG-B124-BL1	-65.8	7619575	712072	124
	PDI-SG-B125-BL1	-39.8	7619944	712113	125
	PDI-SG-B126-BL1	-31.9	7618818	711480	126
	PDI-SG-B127-BL1	-40.3	7620085	711863	127
	PDI-SG-B128-BL1	-13.8	7618964	711098	128
	PDI-SG-B129-BL1	-19.5	7619124	710850	129
	PDI-SG-B130-BL1	-22.6	7620378	711474	130
	PDI-SG-B131-BL1	-27.5	7620401	711377	131
	PDI-SG-B132-BL1	-77.4	7619946	711038	132
	PDI-SG-B133-BL1	-35.5	7619335	710638	133
	PDI-SG-B134-BL1	-31.6	7620573	710980	134
	PDI-SG-B135-BL1	NA	7619508	710115	135
	PDI-SG-B136-BL1	-40.5	7619758	710194	136
	PDI-SG-B137-BL1	NA	7619635	709986	137
	PDI-SG-B138-BL1	NA	7620817	710617	138
	PDI-SG-B139-BL1	-19.6	7619912	709809	139
	PDI-SG-B140-BL1	-45.2	7620050	709917	140
	PDI-SG-B141-BL1	-11.1	7621028	710377	141
	PDI-SG-B142-BL1	-31.1	7621075	710135	142
	PDI-SG-B143-BL1	-53.1	7620965	709796	143
	PDI-SG-B144-BL1	-8.4	7620205	709319	144
	PDI-SG-B145-BL1	-22.5	7621328	709783	145
	PDI-SG-B146-BL1	-46.2	7620660	709266	146
	PDI-SG-B147-BL1	-31.9	7620494	709050	147
	PDI-SG-B148-BL1	NA	7621459	709649	148
	PDI-SG-B149-BL1	-32.9	7620583	708939	149
	PDI-SG-B150-BL1	-54.6	7621237	709164	150
	PDI-SG-B151-BL1	-16.8	7621572	709342	151
	PDI-SG-B152-BL1	-21.9	7620874	708595	152
	PDI-SG-B153-BL1	-17.4	7621085	708293	153
	PDI-SG-B154-BL1	-32.5	7621846	708885	154
	PDI-SG-B155-BL1	-16.0	7622091	708750	155
	PDI-SG-B156-BL1	-45.7	7621918	708530	156
	PDI-SG-B157-BL1	NA	7621324	707900	157
	PDI-SG-B158-BL1	-34.3	7621554	707828	158
	PDI-SG-B159-BL1	NA	7622233	708556	159
	PDI-SG-B160-BL1	-25.9	7621686	707653	160
	PDI-SG-B161-BL1	NA	7621756	707507	161
	PDI-SG-B162-BL1	-43.7	7622420	708161	162
	PDI-SG-B163-BL1	-37.8	7622493	708153	163
	PDI-SG-B164-BL1	-52.8	7622683	707805	164
	PDI-SG-B165-BL1	NA	7622000	707091	165
	PDI-SG-B166-BL1	-13.0	7622217	706965	166
	PDI-SG-B167-BL1	-10.5	7623016	707770	167
	PDI-SG-B168-BL1	-45.8	7622578	707128	168
	PDI-SG-B169-BL1	-46.9	7623053	707443	169
	PDI-SG-B170-BL1	-16.9	7622551	706680	170

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Portland, OR

Sample Type	Sample ID	Mudline Elevation (CRD - Feet) [a]	Proposed Location Coordinates (NAD 1983; Intl Feet) [b]		Sequential Station Count
			Easting	Northing	
Stratified random Site Samples	PDI-SG-B171-BL1	-47.3	7623258	707067	171
	PDI-SG-B172-BL1	-5.0	7622702	706401	172
	PDI-SG-B173-BL1	-53.0	7623400	706796	173
	PDI-SG-B174-BL1	-10.1	7622912	706126	174
	PDI-SG-B175-BL1	-47.6	7623548	706865	175
	PDI-SG-B176-BL1	-57.1	7623277	706482	176
	PDI-SG-B177-BL1	-51.5	7623623	706712	177
	PDI-SG-B178-BL1	-38.3	7623543	706020	178
	PDI-SG-B179-BL1	NA	7623610	705858	179
	PDI-SG-B180-BL1	-42.8	7624151	706660	180
	PDI-SG-B181-BL1	-44.7	7623768	705961	181
	PDI-SG-B182-BL1	NA	7623843	705709	182
	PDI-SG-B183-BL1	-48.8	7624178	706187	183
	PDI-SG-B184-BL1	-25.3	7624403	706537	184
	PDI-SG-B185-BL1	-19.2	7624738	706488	185
	PDI-SG-B186-BL1	NA	7624283	705458	186
	PDI-SG-B187-BL1	-38.0	7624407	705530	187
	PDI-SG-B188-BL1	-51.4	7624609	705861	188
	PDI-SG-B189-BL1	NA	7624492	705341	189
	PDI-SG-B190-BL1	-43.1	7624954	706047	190
	PDI-SG-B191-BL1	-43.7	7625178	705894	191
	PDI-SG-B192-BL1	NA	7625008	704995	192
	PDI-SG-B193-BL1	NA	7625099	704992	193
	PDI-SG-B194-BL1	-42.6	7625455	705395	194
	PDI-SG-B195-BL1	-49.6	7625602	705583	195
	PDI-SG-B196-BL1	-41.4	7625369	704990	196
	PDI-SG-B197-BL1	-50.4	7626034	705608	197
	PDI-SG-B198-BL1	-33.0	7625624	704770	198
	PDI-SG-B199-BL1	-16.4	7625705	704679	199
	PDI-SG-B200-BL1	-25.3	7626544	705786	200
	PDI-SG-B201-BL1	-28.9	7626061	704510	201
	PDI-SG-B202-BL1	-44.7	7626480	704945	202
	PDI-SG-B203-BL1	-28.0	7626718	705358	203
	PDI-SG-B204-BL1	-22.1	7626955	705370	204
	PDI-SG-B205-BL1	-34.6	7626347	704356	205
	PDI-SG-B206-BL1	-45.2	7626570	704436	206
	PDI-SG-B207-BL1	NA	7626403	703870	207
	PDI-SG-B208-BL1	-20.7	7627365	704792	208
	PDI-SG-B209-BL1	NA	7626510	703675	209
	PDI-SG-B210-BL1	-43.8	7627321	704274	210
	PDI-SG-B211-BL1	-47.4	7627454	704204	211
	PDI-SG-B212-BL1	-39.7	7627079	703734	212
	PDI-SG-B213-BL1	NA	7626878	703454	213
	PDI-SG-B214-BL1	NA	7628162	704529	214
	PDI-SG-B215-BL1	-25.7	7628014	704229	215
	PDI-SG-B216-BL1	NA	7627106	703159	216
	PDI-SG-B217-BL1	NA	7628505	704240	217
	PDI-SG-B218-BL1	-16.6	7627563	702927	218
	PDI-SG-B219-BL1	NA	7627584	702769	219
	PDI-SG-B220-BL1	-46.4	7628122	703075	220
	PDI-SG-B221-BL1	-60.2	7628432	703284	221
	PDI-SG-B222-BL1	-35.8	7628152	702596	222
	PDI-SG-B223-BL1	NA	7628032	702321	223
	PDI-SG-B224-BL1	-57.1	7628824	703173	224
	PDI-SG-B225-BL1	-13.4	7628174	702214	225
	PDI-SG-B226-BL1	-9.2	7629476	703298	226
	PDI-SG-B227-BL1	-42.5	7628726	702265	227
	PDI-SG-B228-BL1	-49.3	7628994	702411	228

Table 2. Station Location Coordinates, Target Depth, and Identification Scheme
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Sample Type	Sample ID	Mudline Elevation (CRD - Feet) [a]	Proposed Location Coordinates (NAD 1983; Intl Feet) [b]		Sequential Station Count
			Easting	Northing	
Stratified random Site Samples	PDI-SG-B229-BL1	-54.5	7629186	702585	229
	PDI-SG-B230-BL1	-25.5	7628536	701853	230
	PDI-SG-B231-BL1	-51.6	7629323	702392	231
	PDI-SG-B232-BL1	NA	7628614	701604	232
	PDI-SG-B233-BL1	-18.0	7630137	702514	233
	PDI-SG-B234-BL1	-44.0	7629711	702151	234
	PDI-SG-B235-BL1	-41.1	7629189	701648	235
	PDI-SG-B236-BL1	-19.7	7628694	701204	236
	PDI-SG-B237-BL1	-26.9	7628589	700934	237
	PDI-SG-B238-BL1	-16.3	7630464	702247	238
	PDI-SG-B239-BL1	-35.8	7628723	700679	239
	PDI-SG-B240-BL1	-10.4	7630610	702121	240
	PDI-SG-B241-BL1	-20.3	7629090	700309	241
	PDI-SG-B242-BL1	-52.8	7630100	701206	242
	PDI-SG-B243-BL1	-20.0	7631008	701861	243
	PDI-SG-B244-BL1	NA	7631240	701810	244
	PDI-SG-B245-BL1	-9.2	7629632	700257	245
	PDI-SG-B246-BL1	-10.9	7629848	700119	246
	PDI-SG-B247-BL1	-36.2	7631400	701516	247
	PDI-SG-B248-BL1	-20.3	7631597	701592	248
	PDI-SG-B249-BL1	NA	7631939	701629	249
	PDI-SG-B250-BL1	-40.4	7630574	700344	250
	PDI-SG-B251-BL1	NA	7630148	699860	251
	PDI-SG-B252-BL1	-29.6	7632256	701598	252
	PDI-SG-B253-BL1	NA	7630330	699532	253
	PDI-SG-B254-BL1	-23.5	7632677	701777	254
	PDI-SG-B255-BL1	-32.6	7632109	701132	255
	PDI-SG-B256-BL1	-44.0	7631135	699980	256
	PDI-SG-B257-BL1	-13.7	7630632	699464	257
	PDI-SG-B258-BL1	-42.8	7631704	700269	258
	PDI-SG-B259-BL1	-32.8	7632116	700590	259
	PDI-SG-B260-BL1	-49.6	7632675	701227	260
	PDI-SG-B261-BL1	NA	7631938	700224	261
	PDI-SG-B262-BL1	-16.1	7630768	699211	262
	PDI-SG-B263-BL1	-27.9	7633388	701785	263
	PDI-SG-B264-BL1	-58.5	7632140	700244	264
	PDI-SG-B265-BL1	-29.6	7633513	701483	265
	PDI-SG-B266-BL1	-33.5	7632235	699964	266
	PDI-SG-B267-BL1	-31.5	7631463	699206	267
	PDI-SG-B268-BL1	-9.5	7631196	698783	268
	PDI-SG-B269-BL1	-11.1	7631292	698677	269
	PDI-SG-B270-BL1	-48.7	7632207	699406	270
	PDI-SG-B271-BL1	-34.0	7633484	701223	271
	PDI-SG-B272-BL1	-37.5	7632535	699645	272
	PDI-SG-B273-BL1	-33.1	7633887	701103	273
	PDI-SG-B274-BL1	-36.1	7632665	699558	274
	PDI-SG-B275-BL1	-12.2	7631501	698100	275
	PDI-SG-B276-BL1	-45.4	7632542	698917	276
	PDI-SG-B277-BL1	-13.5	7631722	697935	277
	PDI-SG-B278-BL1	-40.4	7632981	699260	278
	PDI-SG-B279-BL1	-23.7	7634346	700967	279
	PDI-SG-B280-BL1	-32.2	7634458	700657	280
	PDI-SG-B281-BL1	-38.0	7633219	699056	281
	PDI-SG-B282-BL1	-25.0	7632337	698186	282
	PDI-SG-B283-BL1	NA	7631774	697610	283
	PDI-SG-B284-BL1	NA	7634868	700603	284
	PDI-SG-B285-BL1	-41.9	7633352	698900	285
	PDI-SG-B286-BL1	-6.6	7632185	697491	286

Table 2. Station Location Coordinates, Target Depth, and Identification Scheme
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Sample Type	Sample ID	Mudline Elevation (CRD - Feet) [a]	Proposed Location Coordinates (NAD 1983; Intl Feet) [b]		Sequential Station Count
			Easting	Northing	
Stratified random Site Samples	PDI-SG-B287-BL1	-38.7	7633089	698217	287
	PDI-SG-B288-BL1	-29.9	7634887	700392	288
	PDI-SG-B289-BL1	-38.0	7633722	698591	289
	PDI-SG-B290-BL1	NA	7632621	697143	290
	PDI-SG-B291-BL1	-14.7	7632907	697095	291
	PDI-SG-B292-BL1	-34.0	7633442	697663	292
	PDI-SG-B293-BL1	NA	7634072	698575	293
	PDI-SG-B294-BL1	-23.5	7635412	700151	294
	PDI-SG-B295-BL1	-37.5	7633711	697721	295
	PDI-SG-B296-BL1	-25.9	7635402	699676	296
	PDI-SG-B297-BL1	-13.1	7634411	698221	297
	PDI-SG-B298-BL1	NA	7633314	696787	298
	PDI-SG-B299-BL1	-28.0	7633527	696813	299
	PDI-SG-B300-BL1	-29.4	7633846	697210	300
	PDI-SG-B301-BL1	NA	7634572	698170	301
	PDI-SG-B302-BL1	-20.3	7635524	699491	302
	PDI-SG-B303-BL1	-23.2	7635971	699580	303
	PDI-SG-B304-BL1	-33.1	7634678	697884	304
	PDI-SG-B305-BL1	NA	7633798	696564	305
	PDI-SG-B306-BL1	-32.3	7634433	696984	306
	PDI-SG-B307-BL1	NA	7635056	697778	307
	PDI-SG-B308-BL1	-21.1	7636178	699081	308
	PDI-SG-B309-BL1	-10.6	7634355	696256	309
	PDI-SG-B310-BL1	-14.9	7634402	696241	310
	PDI-SG-B311-BL1	-45.1	7634995	697138	311
	PDI-SG-B312-BL1	-33.6	7635199	697487	312
	PDI-SG-B313-BL1	-14.3	7636417	698725	313
	PDI-SG-B314-BL1	-3.9	7635609	697319	314
	PDI-SG-B315-BL1	-6.9	7636897	698745	315
	PDI-SG-B316-BL1	-25.1	7634928	695974	316
	PDI-SG-B317-BL1	-21.9	7635041	695874	317
	PDI-SG-B318-BL1	-45.3	7635739	696577	318
	PDI-SG-B319-BL1	-25.1	7635989	696999	319
	PDI-SG-B320-BL1	-22.5	7636122	696932	320
	PDI-SG-B321-BL1	-16.0	7635543	695787	321
	PDI-SG-B322-BL1	-16.8	7635680	695666	322
	PDI-SG-B323-BL1	-42.0	7636084	696134	323
	PDI-SG-B324-BL1	-25.4	7636625	696614	324
	PDI-SG-B325-BL1	-20.1	7635992	695430	325
	PDI-SG-B326-BL1	-14.1	7636724	696564	326
	PDI-SG-B327-BL1	-21.8	7636483	695369	327
	PDI-SG-B328-BL1	-32.3	7637014	696259	328
	PDI-SG-B329-BL1	-36.4	7636814	695564	329
	PDI-SG-B330-BL1	-74.0	7637158	695822	330
	PDI-SG-B331-BL1	-24.1	7637380	696139	331
	PDI-SG-B332-BL1	NA	7636670	694831	332
	PDI-SG-B333-BL1	NA	7636891	694755	333
	PDI-SG-B334-BL1	-41.2	7637422	695253	334
	PDI-SG-B335-BL1	-13.7	7637827	695913	335
	PDI-SG-B336-BL1	-34.3	7637847	695786	336
	PDI-SG-B337-BL1	-3.6	7637295	694326	337
	PDI-SG-B338-BL1	-13.8	7637443	694285	338
	PDI-SG-B339-BL1	NA	7638211	695705	339
	PDI-SG-B340-BL1	-39.9	7638287	695470	340
	PDI-SG-B341-BL1	NA	7638545	695546	341
	PDI-SG-B342-BL1	-32.5	7638030	694371	342
	PDI-SG-B343-BL1	-51.2	7638527	695195	343
	PDI-SG-B344-BL1	-30.4	7638152	694220	344

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Sample Type	Sample ID	Mudline Elevation (CRD - Feet) [a]	Proposed Location Coordinates (NAD 1983; Intl Feet) [b]		Sequential Station Count
			Easting	Northing	
Stratified random Site Samples	PDI-SG-B345-BL1	-30.2	7638665	695328	345
	PDI-SG-B346-BL1	-37.8	7638388	694508	346
	PDI-SG-B347-BL1	-4.2	7639021	695279	347
	PDI-SG-B348-BL1	-36.3	7638526	693899	348
	PDI-SG-B349-BL1	-37.2	7638615	693813	349
	PDI-SG-B350-BL1	-35.6	7639298	694908	350
	PDI-SG-B351-BL1	-18.3	7639611	694986	351
	PDI-SG-B352-BL1	-40.5	7639033	693807	352
	PDI-SG-B353-BL1	-36.5	7639871	694437	353
	PDI-SG-B354-BL1	-37.9	7639013	693466	354
	PDI-SG-B355-BL1	-21.5	7640151	694091	355
	PDI-SG-B356-BL1	-38.7	7639217	693269	356
	PDI-SG-B357-BL1	-41.3	7639356	693362	357
	PDI-SG-B358-BL1	-38.9	7639255	693228	358
	PDI-SG-B359-BL1	-37.9	7640160	693929	359
	PDI-SG-B360-BL1	-40.6	7640157	693685	360
	PDI-SG-B361-BL1	-34.6	7640370	693631	361
	PDI-SG-B362-BL1	-24.6	7639602	692854	362
	PDI-SG-B363-BL1	-22.1	7639731	692681	363
	PDI-SG-B364-BL1	-31.9	7640564	693260	364
	PDI-SG-B365-BL1	-34.3	7640672	693077	365
	PDI-SG-B366-BL1	-49.7	7640270	692769	366
	PDI-SG-B367-BL1	-27.5	7640048	692298	367
	PDI-SG-B368-BL1	-29.3	7640165	692146	368
	PDI-SG-B369-BL1	-34.5	7640977	692683	369
	PDI-SG-B370-BL1	-50.2	7640836	692188	370
	PDI-SG-B371-BL1	-22.1	7640433	691791	371
	PDI-SG-B372-BL1	-9.9	7641258	692381	372
	PDI-SG-B373-BL1	-9.6	7641436	692177	373
	PDI-SG-B374-BL1	-25.3	7640657	691549	374
	PDI-SG-B375-BL1	-37.8	7641487	691912	375
	PDI-SG-B376-BL1	-29.2	7641571	691924	376
	PDI-SG-B377-BL1	-27.9	7640953	691149	377
	PDI-SG-B378-BL1	-52.0	7641333	691382	378
	PDI-SG-B379-BL1	-25.2	7641874	691569	379
	PDI-SG-B380-BL1	NA	7640838	690487	380
	PDI-SG-B381-BL1	NA	7642057	691442	381
	PDI-SG-B382-BL1	NA	7641283	690634	382
	PDI-SG-B383-BL1	-11.5	7641555	690395	383
	PDI-SG-B384-BL1	-55.8	7641949	690485	384
	PDI-SG-B385-BL1	-6.0	7642430	690949	385
	PDI-SG-B386-BL1	-14.0	7642539	690766	386
	PDI-SG-B387-BL1	NA	7641767	690106	387

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			Easting	Northing	
Stratified random Site Samples	PDI-SG-B388-BL1	-43.4	7642465	690598	388
	PDI-SG-B389-BL1	-21.3	7642739	690508	389
	PDI-SG-B390-BL1	-9.8	7642022	689886	390
	PDI-SG-B391-BL1	-49.8	7642656	690280	391
	PDI-SG-B392-BL1	NA	7642895	690405	392
	PDI-SG-B393-BL1	-17.6	7642418	689508	393
	PDI-SG-B394-BL1	-34.0	7642543	689635	394
	PDI-SG-B395-BL1	-16.2	7642652	689308	395
	PDI-SG-B396-BL1	-15.1	7643325	689968	396
	PDI-SG-B397-BL1	-9.2	7642904	689061	397
	PDI-SG-B398-BL1	-24.2	7643596	689772	398
	PDI-SG-B399-BL1	-45.2	7643535	689456	399
	PDI-SG-B400-BL1	-31.3	7643852	689582	400
	PDI-SG-B401-BL1	-29.8	7643266	688913	401
	PDI-SG-B402-BL1	NA	7643133	688763	402
	PDI-SG-B403-BL1	NA	7643183	688734	403
	PDI-SG-B404-BL1	-41.8	7643915	689458	404
	PDI-SG-B405-BL1	-10.6	7644261	689277	405
	PDI-SG-B406-BL1	NA	7643497	688411	406
	PDI-SG-B407-BL1	-11.2	7643740	688216	407
	PDI-SG-B408-BL1	-49.2	7644499	688962	408
	PDI-SG-B409-BL1	-48.4	7644402	688802	409
	PDI-SG-B410-BL1	-44.7	7644669	688722	410
	PDI-SG-B411-BL1	NA	7644006	687988	411
	PDI-SG-B412-BL1	-32.6	7644268	687874	412
	PDI-SG-B413-BL1	NA	7644285	687670	413
	PDI-SG-B414-BL1	-24.1	7644917	688372	414
	PDI-SG-B415-BL1	-32.7	7645019	688145	415
	PDI-SG-B416-BL1	-37.0	7644534	687614	416
	PDI-SG-B417-BL1	-38.1	7644567	687621	417
	PDI-SG-B418-BL1	-39.1	7645168	687847	418
	PDI-SG-B419-BL1	-41.2	7644909	687601	419
	PDI-SG-B420-BL1	-40.1	7644993	687639	420
	PDI-SG-B421-BL1	-49.2	7644975	687415	421
	PDI-SG-B422-BL1	-41.7	7645169	687531	422
	PDI-SG-B423-BL1	-45.2	7645386	687495	423
	PDI-SG-B424-BL1	-50.4	7645151	687009	424
	PDI-SG-B425-BL1	-26.8	7645237	686724	425
	PDI-SG-B426-BL1	-36.8	7645725	687007	426
	PDI-SG-B427-BL1	-67.0	7645741	686809	427
	PDI-SG-B428-BL1	-68.1	7645737	686591	428

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Sample Type	Sample ID	Mudline Elevation (CRD - Feet) [a]	Proposed Location Coordinates (NAD 1983; Intl Feet) [b]		Sequential Station Count
			Easting	Northing	
Downtown/ Upriver Reach [c]	PDI-SG-B429	NA	7645273	686589	429
	PDI-SG-B430	NA	7645832	685810	430
	PDI-SG-B431	-38.2	7646115	685471	431
	PDI-SG-B432	-42.4	7647015	684804	432
	PDI-SG-B433	-12.2	7646781	683140	433
	PDI-SG-B434	-9.8	7646391	681722	434
	PDI-SG-B435	-19.7	7646274	681262	435
	PDI-SG-B436	NA	7645076	680645	436
	PDI-SG-B437	-23.2	7645220	680211	437
	PDI-SG-B438	-10.1	7645469	679267	438
	PDI-SG-B439	-13.9	7645702	678870	439
	PDI-SG-B440	-16.4	7646346	677122	440
	PDI-SG-B441	NA	7647802	675636	441
	PDI-SG-B442	NA	7648009	675443	442
	PDI-SG-B443	NA	7647600	674216	443
	PDI-SG-B444	NA	7648368	673605	444
	PDI-SG-B445	-6.9	7646779	673680	445
	PDI-SG-B446	-5.0	7646527	672880	446
	PDI-SG-B447	NA	7645540	672436	447
	PDI-SG-B448	NA	7649571	671647	448
	PDI-SG-B449	NA	7645174	671361	449
	PDI-SG-B450	-6.0	7646163	671113	450
	PDI-SG-B451	NA	7649897	671431	451
	PDI-SG-B452	NA	7646913	669176	452
	PDI-SG-B453	-8.8	7646045	667770	453
	PDI-SG-B454	NA	7645988	667628	454
	PDI-SG-B455	NA	7648051	667208	455
	PDI-SG-B456	-8.9	7647054	666157	456
	PDI-SG-B457	-5.7	7646780	665287	457
	PDI-SG-B458	NA	7646777	664307	458
	PDI-SG-B459	NA	7647413	662314	459
	PDI-SG-B460	NA	7647231	660249	460
	PDI-SG-B461	NA	7648042	660483	461
	PDI-SG-B462	NA	7648912	658355	462
	PDI-SG-B463	NA	7649429	657071	463
	PDI-SG-B464	NA	7649833	656401	464
	PDI-SG-B465	NA	7650446	655132	465
	PDI-SG-B466	NA	7651174	654197	466
	PDI-SG-B467	NA	7651565	653136	467
	PDI-SG-B468	NA	7651328	652982	468
	PDI-SG-B469	NA	7650105	651095	469
	PDI-SG-B470	NA	7650287	650584	470
	PDI-SG-B471	NA	7649452	649839	471
	PDI-SG-B472	NA	7648406	647388	472
	PDI-SG-B473	NA	7648576	646244	473
	PDI-SG-B474	NA	7655566	636887	474
	PDI-SG-B475	NA	7655850	634738	475
	PDI-SG-B476	NA	7655744	634467	476
	PDI-SG-B477	NA	7657537	629980	477
	PDI-SG-B478	NA	7658488	629128	478
	PDI-SG-B479	NA	7661008	625975	479
	PDI-SG-B480	NA	7661146	624885	480
	PDI-SG-B481	NA	7656722	620219	481
	PDI-SG-B482	NA	7656008	619968	482
	PDI-SG-B483	NA	7654430	619948	483
	PDI-SG-B484	NA	7653105	618181	484
	PDI-SG-B485	NA	7652475	618854	485
	PDI-SG-B486	NA	7650723	617481	486
	PDI-SG-B487	NA	7649518	616808	487
	PDI-SG-B488	NA	7649778	616099	488

Table 2. Station Location Coordinates, Target Depth, and Identification Scheme
Portland Harbor PDI Surface Sediment FSP, rev 2
Portland, OR

Sample Type	Sample ID	Mudline Elevation (CRD - Feet) [a]	Proposed Location Coordinates (NAD 1983; Intl Feet) [b]		Sequential Station Count
			Easting	Northing	
SMA Targeted Samples and Co-Located Grab at Core Location	PDI-SG-S001	NA	7617962	725157	001
	PDI-SG-S003	-8.8	7617774	724959	003
	PDI-SG-S004	-3.2	7617674	724707	004
	PDI-SG-S005	-33.3	7617585	724727	005
	PDI-SG-S006	-17.4	7617459	724368	006
	PDI-SG-S007	NA	7617494	724203	007
	PDI-SG-S008	-30.9	7617311	724217	008
	PDI-SG-S009	-36.1	7617132	723877	009
	PDI-SG-S010	-23.9	7617252	723774	010
	PDI-SG-S011	NA	7617185	723518	011
	PDI-SG-S012	-25.3	7617100	723514	012
	PDI-SG-S013	-3.7	7617105	723217	013
	PDI-SG-S015	-33	7616871	722876	015
	PDI-SG-S016	NA	7616992	722624	016
	PDI-SG-S017	NA	7617004	722340	017
	PDI-SG-S018	-34.7	7616718	721796	018
	PDI-SG-S019	-26.8	7616724	721582	019
	PDI-SG-S020	-30.7	7616779	721391	020
	PDI-SG-S021	-8.2	7615798	717953	021
	PDI-SG-S023	-48.7	7617276	717742	023
	PDI-SG-S024	-38.7	7618163	717154	024
	PDI-SG-S025	-38.9	7618228	717186	025
	PDI-SG-S026	-37.7	7618422	717115	026
	PDI-SG-S027	-38.5	7618724	717136	027
	PDI-SG-S028	-24.5	7619022	717183	028
	PDI-SG-S029	-30.8	7619197	717135	029
	PDI-SG-S030	-13.6	7619376	717044	030
	PDI-SG-S031	-22.4	7619579	717143	031
	PDI-SG-S032	-9.2	7619801	717236	032
	PDI-SG-S035	NA	7617909	717009	035
	PDI-SG-S037	NA	7616630	715972	037
	PDI-SG-S038	NA	7616671	715749	038
	PDI-SG-S039	NA	7616637	715829	039
	PDI-SG-S040	NA	7618253	716287	040
	PDI-SG-S041	NA	7618335	715997	041
	PDI-SG-S043	NA	7618408	715789	043
	PDI-SG-S044	NA	7618567	715423	044
	PDI-SG-S046	-12.7	7617310	714319	046
	PDI-SG-S047	-13.1	7617451	714126	047
	PDI-SG-S048	-32.6	7619270	714452	048
	PDI-SG-S049	-33.1	7619381	714641	049
	PDI-SG-S050	-26.2	7619590	714678	050
	PDI-SG-S051	-35.1	7619847	714517	051
	PDI-SG-S052	-32.5	7620324	714503	052
	PDI-SG-S053	NA	7617469	713720	053
	PDI-SG-S054	NA	7619578	713890	054
	PDI-SG-S055	-9.3	7619660	713672	055
	PDI-SG-S056	-43	7619277	713511	056
	PDI-SG-S057	-45.8	7619774	713421	057
	PDI-SG-S058	-48.1	7620077	713408	058
	PDI-SG-S059	-45.9	7620409	713319	059
	PDI-SG-S060	-37.3	7620262	713165	060
	PDI-SG-S062	-12.4	7618175	712583	062
	PDI-SG-S063	NA	7618239	712310	063
	PDI-SG-S065	NA	7618588	711680	065
	PDI-SG-S067	-55.1	7619937	710436	067
	PDI-SG-S068	-50.2	7620270	710342	068
	PDI-SG-S069	-47.6	7620058	710152	069
	PDI-SG-S070	-9.7	7619684	710015	070
	PDI-SG-S071	-47.2	7620330	710026	071
	PDI-SG-S072	NA	7620015	709541	072

Table 2. Station Location Coordinates, Target Depth, and Identification Scheme
Portland Harbor PDI Surface Sediment FSP, rev 2
Portland, OR

Sample Type	Sample ID	Mudline Elevation (CRD - Feet) [a]	Proposed Location Coordinates (NAD 1983; Intl Feet) [b]		Sequential Station Count
			Easting	Northing	
SMA Targeted Samples and Co-Located Grab at Core Location	PDI-SG-S073	-47.3	7620604	709561	073
	PDI-SG-S074	NA	7620318	709147	074
	PDI-SG-S075	-51.7	7620889	709461	075
	PDI-SG-S076	-51.5	7620959	709255	076
	PDI-SG-S077	-46.9	7620850	709046	077
	PDI-SG-S078	-12.4	7620681	708690	078
	PDI-SG-S079	-29.8	7621671	709095	079
	PDI-SG-S080	NA	7620966	708437	080
	PDI-SG-S081	-47	7621546	708370	081
	PDI-SG-S083	-50.6	7621575	708068	083
	PDI-SG-S084	-46.2	7621841	708208	084
	PDI-SG-S085	NA	7622302	708577	085
	PDI-SG-S086	-50.8	7621839	707823	086
	PDI-SG-S087	-47.4	7622061	708071	087
	PDI-SG-S088	-36.9	7622381	708288	088
	PDI-SG-S089	NA	7622526	708389	089
	PDI-SG-S090	-50.9	7622191	707840	090
	PDI-SG-S091	-50.7	7622058	707626	091
	PDI-SG-S092	NA	7622708	708150	092
	PDI-SG-S093	-4.5	7622856	708004	093
	PDI-SG-S094	-44.3	7622108	707245	094
	PDI-SG-S096	-44.5	7622449	706903	096
	PDI-SG-S097	NA	7623213	707638	097
	PDI-SG-S098	-45.6	7622652	706761	098
	PDI-SG-S099	NA	7623366	707450	099
	PDI-SG-S100	-36.4	7623469	707231	100
	PDI-SG-S101	-33.7	7622807	706534	101
	PDI-SG-S102	-13.3	7622987	706298	102
	PDI-SG-S103	-39.8	7623053	706372	103
	PDI-SG-S104	-17.8	7623732	707137	104
	PDI-SG-S106	-28.4	7623244	706171	106
	PDI-SG-S107	-48.9	7623633	706523	107
	PDI-SG-S108	-11.3	7623957	706996	108
	PDI-SG-S109	-44.6	7623821	706068	109
	PDI-SG-S110	-45	7623993	706160	110
	PDI-SG-S111	-7.8	7624552	706646	111
	PDI-SG-S113	-40.5	7624300	705633	113
	PDI-SG-S114	-6.4	7624971	706403	114
	PDI-SG-S115	NA	7625201	706313	115
	PDI-SG-S116	-44	7624706	705476	116
	PDI-SG-S118	-36.1	7624857	705236	118
	PDI-SG-S119	NA	7625423	706206	119
	PDI-SG-S120	NA	7625707	706104	120
	PDI-SG-S122	NA	7625993	706004	122
	PDI-SG-S123	-46.2	7625575	705190	123
	PDI-SG-S124	NA	7626287	705943	124
	PDI-SG-S125	-47.2	7625815	704973	125
	PDI-SG-S126	-37.3	7626498	705490	126
	PDI-SG-S128	-44.5	7626449	705210	128
	PDI-SG-S130	-19.7	7626998	705809	130
	PDI-SG-S131	-31.6	7626896	705602	131
	PDI-SG-S132	-44.5	7626776	704896	132

Table 2. Station Location Coordinates, Target Depth, and Identification Scheme
Portland Harbor PDI Surface Sediment FSP, rev 2
Portland, OR

Sample Type	Sample ID	Mudline Elevation (CRD - Feet) [a]	Proposed Location Coordinates (NAD 1983; Intl Feet) [b]		Sequential Station Count
			Easting	Northing	
SMA Targeted Samples and Co-Located Grab at Core Location	PDI-SG-S133	-12.5	7627283	705707	133
	PDI-SG-S134	-10.6	7627197	705454	134
	PDI-SG-S135	-11.1	7626327	704104	135
	PDI-SG-S136	NA	7626540	703725	136
	PDI-SG-S137	-30.7	7626783	703799	137
	PDI-SG-S138	NA	7626673	703543	138
	PDI-SG-S139	-7.4	7627058	703340	139
	PDI-SG-S141	-31.1	7627417	703217	141
	PDI-SG-S142	NA	7627256	702997	142
	PDI-SG-S143	NA	7628385	704100	143
	PDI-SG-S144	NA	7628759	704113	144
	PDI-SG-S145	-4.4	7628619	703925	145
	PDI-SG-S146	-16.4	7627591	702895	146
	PDI-SG-S147	NA	7628828	703729	147
	PDI-SG-S148	-32.4	7627852	702736	148
	PDI-SG-S149	NA	7629051	703558	149
	PDI-SG-S150	-21.9	7628009	702448	150
	PDI-SG-S151	-28.8	7628124	702358	151
	PDI-SG-S152	-5.5	7629314	703467	152
	PDI-SG-S153	-19.5	7628346	702019	153
	PDI-SG-S155	NA	7628616	701528	155
	PDI-SG-S156	NA	7628438	701361	156
	PDI-SG-S157	-37.9	7628992	700979	157
	PDI-SG-S158	-37.5	7629029	701024	158
	PDI-SG-S159	-35.7	7629045	700755	159
	PDI-SG-S160	-34.7	7628840	700428	160
	PDI-SG-S161	-43.8	7629277	700786	161
	PDI-SG-S162	-30	7629439	700574	162
	PDI-SG-S163	-25.8	7629268	700351	163
	PDI-SG-S164	NA	7630027	699987	164
	PDI-SG-S165	-22.3	7630320	699720	165
	PDI-SG-S166	NA	7630506	699311	166
	PDI-SG-S167	NA	7631607	700516	167
	PDI-SG-S168	-57.2	7631788	700712	168
	PDI-SG-S169	-35.7	7632329	701316	169
	PDI-SG-S170	-32.8	7632550	701508	170
	PDI-SG-S171	-38.2	7632034	700860	171
	PDI-SG-S172	-13.1	7633011	701894	172
	PDI-SG-S173	-35.8	7632837	701597	173
	PDI-SG-S174	-33.7	7632356	701007	174
	PDI-SG-S175	NA	7631874	700471	175
	PDI-SG-S176	-43.3	7632595	701150	176
	PDI-SG-S177	-27.1	7633185	701784	177
	PDI-SG-S178	-34.4	7632913	701344	178
	PDI-SG-S179	-41.5	7632407	700714	179
	PDI-SG-S180	-34.8	7633170	701487	180
	PDI-SG-S181	-43.9	7632004	699996	181
	PDI-SG-S182	-6.6	7632396	700483	182
	PDI-SG-S183	NA	7632704	700805	183
	PDI-SG-S184	-41.3	7632961	700962	184
	PDI-SG-S186	-24.4	7633614	701703	186
	PDI-SG-S187	NA	7633179	701189	187
	PDI-SG-S190	NA	7630934	698949	190
	PDI-SG-S191	-47.5	7632893	700639	191
	PDI-SG-S193	-26.3	7633802	701391	193
	PDI-SG-S194	-33.4	7633678	701116	194
	PDI-SG-S195	-19.1	7631432	698399	195
	PDI-SG-S196	NA	7631252	698149	196
	PDI-SG-S197	-25.3	7631721	698305	197
	PDI-SG-S198	-33.3	7633962	701062	198

Table 2. Station Location Coordinates, Target Depth, and Identification Scheme
Portland Harbor PDI Surface Sediment FSP, rev 2
Portland, OR

Sample Type	Sample ID	Mudline Elevation (CRD - Feet) [a]	Proposed Location Coordinates (NAD 1983; Intl Feet) [b]		Sequential Station Count
			Easting	Northing	
SMA Targeted Samples and Co-Located Grab at Core Location	PDI-SG-S199	-13.8	7634144	701259	199
	PDI-SG-S200	-30.6	7634163	700983	200
	PDI-SG-S201	-32.3	7633972	700775	201
	PDI-SG-S202	-25	7631941	698098	202
	PDI-SG-S203	-34.6	7634189	700562	203
	PDI-SG-S204	-17.6	7634615	700796	204
	PDI-SG-S205	-11.9	7632159	697892	205
	PDI-SG-S206	NA	7631956	697409	206
	PDI-SG-S207	-15.8	7632379	697684	207
	PDI-SG-S208	-31.8	7634586	700378	208
	PDI-SG-S209	-16.2	7632574	697493	209
	PDI-SG-S210	NA	7632397	697248	210
	PDI-SG-S211	-33	7634779	700167	211
	PDI-SG-S212	-18.4	7632756	697314	212
	PDI-SG-S213	-31.8	7634983	700092	213
	PDI-SG-S214	-4.1	7635223	700364	214
	PDI-SG-S215	-32.6	7635087	699825	215
	PDI-SG-S216	-27.1	7635297	699937	216
	PDI-SG-S217	-27.8	7633143	697043	217
	PDI-SG-S218	NA	7633085	696850	218
	PDI-SG-S220	-25.5	7635617	699935	220
	PDI-SG-S221	-28.8	7633359	696915	221
	PDI-SG-S222	-13.4	7633418	696809	222
	PDI-SG-S223	-23.8	7635704	699685	223
	PDI-SG-S224	-11.8	7635931	699879	224
	PDI-SG-S225	-22.4	7635739	699425	225
	PDI-SG-S226	NA	7633678	696608	226
	PDI-SG-S227	-16.2	7634098	696454	227
	PDI-SG-S228	-17.1	7635600	697286	228
	PDI-SG-S229	NA	7635857	699176	229
	PDI-SG-S230	-22.9	7636127	699519	230
	PDI-SG-S231	-22.2	7636042	699322	231
	PDI-SG-S233	-20.1	7636405	699406	233
	PDI-SG-S234	-18.8	7636304	698915	234
	PDI-SG-S235	-17.3	7636477	699071	235
	PDI-SG-S236	-15.4	7636643	699218	236
	PDI-SG-S237	-22.7	7634664	696105	237
	PDI-SG-S238	-14.1	7636449	698735	238
	PDI-SG-S239	-13.7	7636758	698960	239
	PDI-SG-S240	NA	7636937	699124	240
	PDI-SG-S241	-11	7636654	698746	241
	PDI-SG-S242	NA	7636706	698453	242
	PDI-SG-S243	-19.7	7635786	697155	243
	PDI-SG-S244	-17.3	7635278	695745	244
	PDI-SG-S246	-16.7	7635733	695498	246
	PDI-SG-S247	-19.5	7636119	695232	247
	PDI-SG-S248	-20.4	7636288	695193	248
	PDI-SG-S249	-18.3	7636390	695093	249
	PDI-SG-S250	-19.8	7636627	695075	250
	PDI-SG-S252	-19.4	7637602	696023	252
	PDI-SG-S253	-14.8	7637107	694683	253
	PDI-SG-S254	-23.4	7637333	694599	254
	PDI-SG-S255	NA	7637134	694050	255
	PDI-SG-S256	NA	7637282	694037	256
	PDI-SG-S257	-16.8	7637494	694351	257
	PDI-SG-S258	-28.7	7639814	694669	258

Table 2. Station Location Coordinates, Target Depth, and Identification Scheme
Portland Harbor PDI Surface Sediment FSP, rev 2
Portland, OR

Sample Type	Sample ID	Mudline Elevation (CRD - Feet) [a]	Proposed Location Coordinates (NAD 1983; Intl Feet) [b]		Sequential Station Count
			Easting	Northing	
SMA Targeted Samples and Co-Located Grab at Core Location	PDI-SG-S259	-35.7	7640001	694254	259
	PDI-SG-S261	-20.3	7639895	692464	261
	PDI-SG-S262	-2.6	7641772	691789	262
	PDI-SG-S263	NA	7642066	691478	263
	-- [d]				
	-- [d]				
	-- [d]				
	-- [d]				
	-- [d]				

General Notes:
1. All surface sediment samples have a target depth of 30 cm.
2. Conversion From CRD to NAVD88: Elevation (CRD) +5.38=NAVD88 (Geoid 12b)
3. NA = not available

Footnotes:
a) Vertical Datum: CRD (Columbia River Datum; Feet); based on 2009 NOAA bathymetry
b) Horizontal Projection: NAD 1983 (2011) State Plane Coordinate System (SPCC) Oregon North Zone (Intl Feet)
c) Upriver surface sediment samples target fine grain materials and locations were adjusted in June 2018 after completion of the soft sediment probing survey/field reconnaissance. Location may be further adjusted in field to reflect field conditions.
d) Five SMA Locations samples pulled from River Mile 11E area.

Table 3. Station Location Coordinates, Target Depth and Identification Scheme - Alternate 1 Locations
Portland Harbor PDI Surface Sediment FSP
Portland, OR

Sample Type	Sample ID (within the Site)	Mudline Elevation (CRD - Feet) [a]	Proposed Location Coordinates (NAD 1983; Intl Feet) [b]		Sequential Station Count
			Easting	Northing	
Stratified random Site Samples	PDI-SG-B001-BL1	-10.3	7616297	726267	001
	PDI-SG-B002-BL1	-46.4	7616849	725515	002
	PDI-SG-B003-BL1	-28.5	7617854	725354	003
	PDI-SG-B004-BL1	-43.6	7617500	725361	004
	PDI-SG-B005-BL1	-48.0	7616855	725268	005
	PDI-SG-B006-BL1	-40.3	7616564	725690	006
	PDI-SG-B007-BL1	-42.3	7617410	725033	007
	PDI-SG-B008-BL1	-6.3	7616042	725915	008
	PDI-SG-B009-BL1	-45.9	7617206	724940	009
	PDI-SG-B010-BL1	NA	7615768	725446	010
	PDI-SG-B011-BL1	-34.7	7616917	724557	011
	PDI-SG-B012-BL1	-10.9	7615769	725274	012
	PDI-SG-B013-BL1	-47.6	7616339	724499	013
	PDI-SG-B014-BL1	-36.2	7617096	724240	014
	PDI-SG-B015-BL1	-39.9	7616844	724826	015
	PDI-SG-B016-BL1	NA	7615513	724995	016
	PDI-SG-B017-BL1	-36.5	7617158	723920	017
	PDI-SG-B018-BL1	-40.5	7615801	724387	018
	PDI-SG-B019-BL1	-20.9	7615574	724183	019
	PDI-SG-B020-BL1	-35.9	7616628	724203	020
	PDI-SG-B021-BL1	NA	7617203	723607	021
	PDI-SG-B022-BL1	-45.7	7615908	723609	022
	PDI-SG-B023-BL1	NA	7615083	723488	023
	PDI-SG-B024-BL1	-35.4	7616641	723278	024
	PDI-SG-B025-BL1	-49.1	7615991	722711	025
	PDI-SG-B026-BL1	-40.1	7615653	722899	026
	PDI-SG-B027-BL1	NA	7615223	723118	027
	PDI-SG-B028-BL1	-20.2	7616991	723001	028
	PDI-SG-B029-BL1	-31.3	7615565	722963	029
	PDI-SG-B030-BL1	-26.7	7616896	722558	030
	PDI-SG-B031-BL1	-44.4	7616369	722248	031
	PDI-SG-B032-BL1	NA	7615149	722412	032
	PDI-SG-B033-BL1	-54.6	7615519	721926	033
	PDI-SG-B034-BL1	-22.0	7616786	722026	034
	PDI-SG-B035-BL1	-54.3	7615498	721914	035
	PDI-SG-B036-BL1	-45.1	7616426	721790	036
	PDI-SG-B037-BL1	-44.5	7616164	721899	037
	PDI-SG-B038-BL1	-38.9	7616389	721311	038
	PDI-SG-B039-BL1	-50.0	7615778	721836	039
	PDI-SG-B040-BL1	-12.9	7615334	721260	040
	PDI-SG-B041-BL1	-31.3	7615605	720898	041
	PDI-SG-B042-BL1	-33.9	7616749	721094	042
	PDI-SG-B043-BL1	-32.9	7615729	720572	043
	PDI-SG-B044-BL1	-28.2	7616782	720950	044
	PDI-SG-B045-BL1	-44.6	7616049	720423	045
	PDI-SG-B046-BL1	-42.3	7616308	720803	046
	PDI-SG-B047-BL1	-40.1	7616643	720540	047
	PDI-SG-B048-BL1	-35.0	7613984	720179	048
	PDI-SG-B049-BL1	NA	7612944	720100	049
	PDI-SG-B050-BL1	-29.9	7615695	720391	050
	PDI-SG-B051-BL1	-36.4	7616805	720117	051
	PDI-SG-B052-BL1	-50.5	7614482	720154	052
	PDI-SG-B053-BL1	-26.8	7615757	719873	053
	PDI-SG-B054-BL1	-33.5	7616869	719765	054
	PDI-SG-B055-BL1	-36.6	7615895	719504	055
	PDI-SG-B056-BL1	-44.6	7616611	719210	056

Table 3. Station Location Coordinates, Target Depth and Identification Scheme - Alternate 1 Locations
Portland Harbor PDI Surface Sediment FSP
Portland, OR

Sample Type	Sample ID (within the Site)	Mudline Elevation (CRD - Feet) [a]	Proposed Location Coordinates (NAD 1983; Intl Feet) [b]		Sequential Station Count
			Easting	Northing	
Stratified random Site Samples	PDI-SG-B057-BL1	-27.5	7615773	719033	057
	PDI-SG-B058-BL1	-43.4	7616149	719108	058
	PDI-SG-B059-BL1	NA	7616905	719613	059
	PDI-SG-B060-BL1	-37.7	7616009	719057	060
	PDI-SG-B061-BL1	-45.0	7616693	719148	061
	PDI-SG-B062-BL1	-44.8	7616823	719131	062
	PDI-SG-B063-BL1	NA	7617180	718876	063
	PDI-SG-B064-BL1	-36.9	7616141	718527	064
	PDI-SG-B065-BL1	-38.6	7616210	718363	065
	PDI-SG-B066-BL1	-45.4	7616248	719101	066
	PDI-SG-B067-BL1	-19.9	7617258	718458	067
	PDI-SG-B068-BL1	-25.5	7617352	718103	068
	PDI-SG-B069-BL1	-47.7	7616804	717715	069
	PDI-SG-B070-BL1	-14.6	7615880	717800	070
	PDI-SG-B071-BL1	-20.7	7616003	717525	071
	PDI-SG-B072-BL1	-49.0	7617228	717247	072
	PDI-SG-B073-BL1	-34.5	7617517	717639	073
	PDI-SG-B074-BL1	-34.7	7616374	717119	074
	PDI-SG-B075-BL1	-23.9	7617601	717531	075
	PDI-SG-B076-BL1	NA	7617992	717010	076
	PDI-SG-B077-BL1	-38.2	7618188	717198	077
	PDI-SG-B078-BL1	-17.9	7619632	717194	078
	PDI-SG-B079-BL1	-44.7	7616946	716482	079
	PDI-SG-B080-BL1	-21.2	7616325	716794	080
	PDI-SG-B081-BL1	NA	7616382	716517	081
	PDI-SG-B082-BL1	-30.1	7617812	716949	082
	PDI-SG-B083-BL1	NA	7616475	716231	083
	PDI-SG-B084-BL1	-30.8	7617942	716565	084
	PDI-SG-B085-BL1	-38.2	7617757	716683	085
	PDI-SG-B086-BL1	-47.4	7617775	716333	086
	PDI-SG-B087-BL1	-7.8	7618182	716263	087
	PDI-SG-B088-BL1	NA	7616579	715707	088
	PDI-SG-B089-BL1	NA	7618361	715905	089
	PDI-SG-B090-BL1	-26.2	7616944	715260	090
	PDI-SG-B091-BL1	NA	7616900	715151	091
	PDI-SG-B092-BL1	-50.8	7617662	715361	092
	PDI-SG-B093-BL1	-43.2	7617632	714649	093
	PDI-SG-B094-BL1	NA	7618392	715792	094
	PDI-SG-B095-BL1	-61.1	7618207	715285	095
	PDI-SG-B096-BL1	NA	7617072	714713	096
	PDI-SG-B097-BL1	-50.0	7618459	715355	097
	PDI-SG-B098-BL1	-22.5	7617239	714485	098
	PDI-SG-B099-BL1	-37.4	7618614	715082	099
	PDI-SG-B100-BL1	-36.5	7618823	714624	100
	PDI-SG-B101-BL1	-5.9	7619258	714741	101
	PDI-SG-B102-BL1	-27.7	7620345	714536	102
	PDI-SG-B103-BL1	-23.2	7617430	714230	103
	PDI-SG-B104-BL1	NA	7617413	713849	104
	PDI-SG-B105-BL1	-35.4	7618989	714477	105
	PDI-SG-B106-BL1	NA	7617598	713405	106
	PDI-SG-B107-BL1	-5.5	7619241	713959	107
	PDI-SG-B108-BL1	-29.9	7618952	714213	108
	PDI-SG-B109-BL1	-12.9	7619345	713819	109
	PDI-SG-B110-BL1	-7.7	7617870	713160	110
	PDI-SG-B111-BL1	-58.9	7618306	713544	111
	PDI-SG-B112-BL1	NA	7617964	712923	112
	PDI-SG-B113-BL1	-49.1	7618331	712890	113

Table 3. Station Location Coordinates, Target Depth and Identification Scheme - Alternate 1 Locations
Portland Harbor PDI Surface Sediment FSP
Portland, OR

Sample Type	Sample ID (within the Site)	Mudline Elevation (CRD - Feet) [a]	Proposed Location Coordinates (NAD 1983; Intl Feet) [b]		Sequential Station Count
			Easting	Northing	
Stratified random Site Samples	PDI-SG-B114-BL1	-17.5	7619484	713612	114
	PDI-SG-B115-BL1	NA	7618239	712351	115
	PDI-SG-B116-BL1	-18.2	7619621	713082	116
	PDI-SG-B117-BL1	NA	7619729	713067	117
	PDI-SG-B118-BL1	-73.1	7619108	712428	118
	PDI-SG-B119-BL1	NA	7618352	711986	119
	PDI-SG-B120-BL1	-23.9	7619662	712854	120
	PDI-SG-B121-BL1	-35.3	7619780	712470	121
	PDI-SG-B122-BL1	NA	7618596	711645	122
	PDI-SG-B123-BL1	-48.1	7619057	711845	123
	PDI-SG-B124-BL1	-68.7	7619610	711692	124
	PDI-SG-B125-BL1	-41.0	7619834	712319	125
	PDI-SG-B126-BL1	NA	7618590	711555	126
	PDI-SG-B127-BL1	-40.5	7620027	711904	127
	PDI-SG-B128-BL1	-34.7	7618988	711177	128
	PDI-SG-B129-BL1	-20.0	7619094	710898	129
	PDI-SG-B130-BL1	-14.4	7620397	711471	130
	PDI-SG-B131-BL1	NA	7620581	711191	131
	PDI-SG-B132-BL1	-76.8	7619912	710893	132
	PDI-SG-B133-BL1	-28.7	7619339	710563	133
	PDI-SG-B134-BL1	NA	7620638	711113	134
	PDI-SG-B135-BL1	NA	7619455	710193	135
	PDI-SG-B136-BL1	-51.2	7619662	710795	136
	PDI-SG-B137-BL1	-7.7	7619640	710054	137
	PDI-SG-B138-BL1	NA	7620693	710782	138
	PDI-SG-B139-BL1	NA	7619884	709724	139
	PDI-SG-B140-BL1	-47.8	7620072	710169	140
	PDI-SG-B141-BL1	-24.5	7620915	710479	141
	PDI-SG-B142-BL1	-24.4	7621116	710132	142
	PDI-SG-B143-BL1	-49.0	7620341	710250	143
	PDI-SG-B144-BL1	-4.2	7620065	709524	144
	PDI-SG-B145-BL1	-23.6	7621355	709674	145
	PDI-SG-B146-BL1	-47.4	7620841	708955	146
	PDI-SG-B147-BL1	-35.7	7620436	709164	147
	PDI-SG-B148-BL1	-4.5	7621552	709475	148
	PDI-SG-B149-BL1	-31.5	7620543	708978	149
	PDI-SG-B150-BL1	-47.5	7621459	709214	150
	PDI-SG-B151-BL1	-28.4	7621699	709070	151
	PDI-SG-B152-BL1	-12.2	7620749	708600	152
	PDI-SG-B153-BL1	-24.8	7621047	708379	153
	PDI-SG-B154-BL1	-29.2	7621778	708985	154
	PDI-SG-B155-BL1	NA	7622181	708862	155
	PDI-SG-B156-BL1	-45.4	7621857	708529	156
	PDI-SG-B157-BL1	-4.6	7621364	707873	157
	PDI-SG-B158-BL1	-38.4	7621546	707903	158
	PDI-SG-B159-BL1	-40.3	7622261	708387	159
	PDI-SG-B160-BL1	NA	7621588	707642	160
	PDI-SG-B161-BL1	-16.9	7621810	707492	161
	PDI-SG-B162-BL1	-41.7	7622443	708192	162
	PDI-SG-B163-BL1	-37.3	7622415	708247	163
	PDI-SG-B164-BL1	-41.0	7622702	707915	164
	PDI-SG-B165-BL1	NA	7621907	707222	165
	PDI-SG-B166-BL1	-46.1	7622416	706944	166
	PDI-SG-B167-BL1	-23.4	7622900	707843	167
	PDI-SG-B168-BL1	-51.1	7622108	707771	168
	PDI-SG-B169-BL1	-46.1	7623217	707262	169
	PDI-SG-B170-BL1	-39.6	7622580	706752	170

Table 3. Station Location Coordinates, Target Depth and Identification Scheme - Alternate 1 Locations
Portland Harbor PDI Surface Sediment FSP
Portland, OR

Sample Type	Sample ID (within the Site)	Mudline Elevation (CRD - Feet) [a]	Proposed Location Coordinates (NAD 1983; Intl Feet) [b]		Sequential Station Count
			Easting	Northing	
Stratified random Site Samples	PDI-SG-B171-BL1	-10.6	7623606	707241	171
	PDI-SG-B172-BL1	-13.5	7622825	706383	172
	PDI-SG-B173-BL1	-45.6	7623002	707130	173
	PDI-SG-B174-BL1	-5.3	7623077	706156	174
	PDI-SG-B175-BL1	-49.8	7623630	706892	175
	PDI-SG-B176-BL1	-44.0	7622839	706948	176
	PDI-SG-B177-BL1	-55.5	7623732	706793	177
	PDI-SG-B178-BL1	-34.7	7623572	705975	178
	PDI-SG-B179-BL1	-4.9	7623691	705841	179
	PDI-SG-B180-BL1	NA	7624389	706839	180
	PDI-SG-B181-BL1	-43.1	7623982	706093	181
	PDI-SG-B182-BL1	-27.2	7624168	705606	182
	PDI-SG-B183-BL1	-45.6	7624072	706158	183
	PDI-SG-B184-BL1	-43.9	7624353	706532	184
	PDI-SG-B185-BL1	-4.0	7625025	706396	185
	PDI-SG-B186-BL1	NA	7624314	705468	186
	PDI-SG-B187-BL1	-46.3	7624640	705682	187
	PDI-SG-B188-BL1	-43.5	7625117	705548	188
	PDI-SG-B189-BL1	-5.8	7624686	705247	189
	PDI-SG-B190-BL1	-44.2	7625131	705881	190
	PDI-SG-B191-BL1	-43.1	7625377	705715	191
	PDI-SG-B192-BL1	-24.5	7624990	705117	192
	PDI-SG-B193-BL1	-30.8	7625333	704949	193
	PDI-SG-B194-BL1	-44.8	7625760	705235	194
	PDI-SG-B195-BL1	-44.8	7625710	705668	195
	PDI-SG-B196-BL1	-46.3	7625417	705068	196
	PDI-SG-B197-BL1	-14.0	7626325	705804	197
	PDI-SG-B198-BL1	-5.3	7625635	704682	198
	PDI-SG-B199-BL1	-9.5	7625896	704516	199
	PDI-SG-B200-BL1	-43.0	7626435	705410	200
	PDI-SG-B201-BL1	-30.2	7626226	704387	201
	PDI-SG-B202-BL1	-46.2	7626994	704306	202
	PDI-SG-B203-BL1	-29.1	7626977	705695	203
	PDI-SG-B204-BL1	-17.3	7626976	705342	204
	PDI-SG-B205-BL1	-23.4	7626327	704208	205
	PDI-SG-B206-BL1	-41.6	7626733	704114	206
	PDI-SG-B207-BL1	-18.6	7626468	703985	207
	PDI-SG-B208-BL1	-43.1	7627000	704700	208
	PDI-SG-B209-BL1	NA	7626606	703549	209
	PDI-SG-B210-BL1	-52.2	7627753	703694	210
	PDI-SG-B211-BL1	-47.0	7627475	704409	211
	PDI-SG-B212-BL1	-39.4	7626959	703821	212
	PDI-SG-B213-BL1	NA	7626792	703404	213
	PDI-SG-B214-BL1	NA	7628078	704707	214
	PDI-SG-B215-BL1	NA	7628407	704300	215
	PDI-SG-B216-BL1	NA	7627226	703070	216
	PDI-SG-B217-BL1	-51.5	7628326	703631	217
	PDI-SG-B218-BL1	-10.3	7627383	703060	218
	PDI-SG-B219-BL1	-6.2	7627587	702830	219
	PDI-SG-B220-BL1	-44.6	7627773	703424	220
	PDI-SG-B221-BL1	-29.7	7628763	703619	221
	PDI-SG-B222-BL1	-39.0	7628152	702712	222
	PDI-SG-B223-BL1	-25.3	7628035	702442	223
	PDI-SG-B224-BL1	-61.1	7628776	703100	224
	PDI-SG-B225-BL1	-27.8	7628279	702194	225
	PDI-SG-B226-BL1	-7.2	7629520	703375	226
	PDI-SG-B227-BL1	-37.0	7628284	702469	227

Table 3. Station Location Coordinates, Target Depth and Identification Scheme - Alternate 1 Locations
Portland Harbor PDI Surface Sediment FSP
Portland, OR

Sample Type	Sample ID (within the Site)	Mudline Elevation (CRD - Feet) [a]	Proposed Location Coordinates (NAD 1983; Intl Feet) [b]		Sequential Station Count
			Easting	Northing	
Stratified random Site Samples	PDI-SG-B228-BL1	-57.3	7629000	702637	228
	PDI-SG-B229-BL1	-33.1	7629531	702755	229
	PDI-SG-B230-BL1	NA	7628304	701974	230
	PDI-SG-B231-BL1	-34.4	7629661	702720	231
	PDI-SG-B232-BL1	NA	7628429	701346	232
	PDI-SG-B233-BL1	-25.3	7629954	702547	233
	PDI-SG-B234-BL1	-49.1	7629457	701751	234
	PDI-SG-B235-BL1	-47.4	7629516	701505	235
	PDI-SG-B236-BL1	-23.5	7628541	700944	236
	PDI-SG-B237-BL1	-24.6	7628738	700917	237
	PDI-SG-B238-BL1	-15.9	7630359	702347	238
	PDI-SG-B239-BL1	-35.7	7628900	700699	239
	PDI-SG-B240-BL1	-17.4	7630541	702134	240
	PDI-SG-B241-BL1	-34.3	7629336	700607	241
	PDI-SG-B242-BL1	-38.0	7630159	700525	242
	PDI-SG-B243-BL1	-26.2	7630908	701873	243
	PDI-SG-B244-BL1	-9.0	7631206	701808	244
	PDI-SG-B245-BL1	-21.1	7629543	700307	245
	PDI-SG-B246-BL1	-12.7	7629834	700147	246
	PDI-SG-B247-BL1	-48.4	7630880	701414	247
	PDI-SG-B248-BL1	NA	7631610	701664	248
	PDI-SG-B249-BL1	-29.3	7631876	701548	249
	PDI-SG-B250-BL1	-25.7	7630763	699446	250
	PDI-SG-B251-BL1	NA	7629940	699941	251
	PDI-SG-B252-BL1	-37.3	7632150	701358	252
	PDI-SG-B253-BL1	NA	7630290	699608	253
	PDI-SG-B254-BL1	-32.4	7632951	701295	254
	PDI-SG-B255-BL1	-44.8	7632388	700928	255
	PDI-SG-B256-BL1	-38.0	7631768	701156	256
	PDI-SG-B257-BL1	-8.0	7630585	699330	257
	PDI-SG-B258-BL1	-45.9	7631731	700332	258
	PDI-SG-B259-BL1	-37.6	7631959	700949	259
	PDI-SG-B260-BL1	-35.0	7632393	701502	260
	PDI-SG-B261-BL1	-44.1	7632015	700028	261
	PDI-SG-B262-BL1	-21.3	7630945	699100	262
	PDI-SG-B263-BL1	-17.2	7633045	701877	263
	PDI-SG-B264-BL1	-58.6	7632205	700345	264
	PDI-SG-B265-BL1	NA	7633557	701820	265
	PDI-SG-B266-BL1	-41.1	7632090	699990	266
	PDI-SG-B267-BL1	-26.4	7631047	699283	267
	PDI-SG-B268-BL1	-6.7	7630958	699011	268
	PDI-SG-B269-BL1	-21.2	7631350	698694	269
	PDI-SG-B270-BL1	-45.5	7631586	699514	270
	PDI-SG-B271-BL1	-33.0	7633621	701157	271
	PDI-SG-B272-BL1	-39.9	7632271	699844	272
	PDI-SG-B273-BL1	-31.2	7633878	701184	273
	PDI-SG-B274-BL1	-43.3	7632672	699435	274
	PDI-SG-B275-BL1	-9.8	7631463	698121	275
	PDI-SG-B276-BL1	-46.0	7632734	699318	276
	PDI-SG-B277-BL1	NA	7631596	697685	277
	PDI-SG-B278-BL1	-46.0	7632938	699177	278
	PDI-SG-B279-BL1	NA	7634314	701174	279
	PDI-SG-B280-BL1	-32.6	7634403	700661	280
	PDI-SG-B281-BL1	-46.1	7633118	699047	281
	PDI-SG-B282-BL1	-24.1	7632036	698080	282
	PDI-SG-B283-BL1	-11.0	7632022	697636	283
	PDI-SG-B284-BL1	NA	7634982	700544	284

Table 3. Station Location Coordinates, Target Depth and Identification Scheme - Alternate 1 Locations
Portland Harbor PDI Surface Sediment FSP
Portland, OR

Sample Type	Sample ID (within the Site)	Mudline Elevation (CRD - Feet) [a]	Proposed Location Coordinates (NAD 1983; Intl Feet) [b]		Sequential Station Count
			Easting	Northing	
Stratified random Site Samples	PDI-SG-B285-BL1	-44.6	7633382	698841	285
	PDI-SG-B286-BL1	-11.0	7632508	697411	286
	PDI-SG-B287-BL1	-36.2	7633437	697821	287
	PDI-SG-B288-BL1	-28.7	7635021	700393	288
	PDI-SG-B289-BL1	-37.1	7633703	698653	289
	PDI-SG-B290-BL1	-17.0	7632670	697417	290
	PDI-SG-B291-BL1	NA	7632925	696983	291
	PDI-SG-B292-BL1	-33.6	7633135	697398	292
	PDI-SG-B293-BL1	-34.2	7633945	698507	293
	PDI-SG-B294-BL1	-28.6	7635134	700095	294
	PDI-SG-B295-BL1	-41.2	7633858	697734	295
	PDI-SG-B296-BL1	-25.1	7635598	699716	296
	PDI-SG-B297-BL1	-13.9	7634164	698435	297
	PDI-SG-B298-BL1	NA	7633207	696721	298
	PDI-SG-B299-BL1	NA	7633542	696706	299
	PDI-SG-B300-BL1	-27.8	7633726	696955	300
	PDI-SG-B301-BL1	-35.7	7634416	698095	301
	PDI-SG-B302-BL1	-22.7	7635743	699438	302
	PDI-SG-B303-BL1	-22.0	7636058	699290	303
	PDI-SG-B304-BL1	-5.0	7634762	697981	304
	PDI-SG-B305-BL1	-5.4	7633851	696555	305
	PDI-SG-B306-BL1	-35.7	7634777	696880	306
	PDI-SG-B307-BL1	-8.5	7634976	697807	307
	PDI-SG-B308-BL1	-20.8	7636221	699076	308
	PDI-SG-B309-BL1	-15.6	7634299	696336	309
	PDI-SG-B310-BL1	NA	7634510	696095	310
	PDI-SG-B311-BL1	-38.9	7635111	696739	311
	PDI-SG-B312-BL1	-23.2	7635472	697356	312
	PDI-SG-B313-BL1	-17.6	7636540	699215	313
	PDI-SG-B314-BL1	-21.9	7635730	697181	314
	PDI-SG-B315-BL1	NA	7636601	698507	315
	PDI-SG-B316-BL1	-22.6	7634997	695902	316
	PDI-SG-B317-BL1	-14.0	7635241	695748	317
	PDI-SG-B318-BL1	-70.3	7636337	696318	318
	PDI-SG-B319-BL1	-22.6	7635871	697086	319
	PDI-SG-B320-BL1	-37.7	7636109	696825	320
	PDI-SG-B321-BL1	-15.1	7635585	695777	321
	PDI-SG-B322-BL1	-13.2	7635804	695680	322
	PDI-SG-B323-BL1	-12.4	7635602	695878	323
	PDI-SG-B324-BL1	-15.1	7636514	696737	324
	PDI-SG-B325-BL1	-17.0	7636089	695415	325
	PDI-SG-B326-BL1	-11.4	7636802	696510	326
	PDI-SG-B327-BL1	-13.2	7636423	695328	327
	PDI-SG-B328-BL1	-26.5	7637025	696303	328
	PDI-SG-B329-BL1	-26.1	7636525	695511	329
	PDI-SG-B330-BL1	-59.4	7636655	695903	330
	PDI-SG-B331-BL1	-6.3	7637493	696154	331
	PDI-SG-B332-BL1	-14.9	7636709	695129	332
	PDI-SG-B333-BL1	-16.2	7637109	694796	333
	PDI-SG-B334-BL1	-41.5	7637917	694962	334
	PDI-SG-B335-BL1	-22.0	7637560	696045	335
	PDI-SG-B336-BL1	-5.9	7638008	695794	336
	PDI-SG-B337-BL1	NA	7637308	694265	337
	PDI-SG-B338-BL1	NA	7637218	694036	338
	PDI-SG-B339-BL1	-21.2	7638292	695567	339
	PDI-SG-B340-BL1	-73.0	7637468	695561	340
	PDI-SG-B341-BL1	NA	7638752	695596	341

Table 3. Station Location Coordinates, Target Depth and Identification Scheme - Alternate 1 Locations
Portland Harbor PDI Surface Sediment FSP
Portland, OR

Sample Type	Sample ID (within the Site)	Mudline Elevation (CRD - Feet) [a]	Proposed Location Coordinates (NAD 1983; Intl Feet) [b]		Sequential Station Count
			Easting	Northing	
Stratified random Site Samples	PDI-SG-B342-BL1	-32.6	7638052	694352	342
	PDI-SG-B343-BL1	-42.0	7638870	695039	343
	PDI-SG-B344-BL1	-31.4	7638100	694279	344
	PDI-SG-B345-BL1	NA	7638943	695432	345
	PDI-SG-B346-BL1	-44.2	7638921	694425	346
	PDI-SG-B347-BL1	-30.4	7639287	695013	347
	PDI-SG-B348-BL1	-36.2	7638526	693890	348
	PDI-SG-B349-BL1	-37.7	7638628	693823	349
	PDI-SG-B350-BL1	-57.0	7639115	694609	350
	PDI-SG-B351-BL1	-33.5	7639680	694816	351
	PDI-SG-B352-BL1	-40.9	7639002	694041	352
	PDI-SG-B353-BL1	-34.7	7639893	694463	353
	PDI-SG-B354-BL1	-37.0	7638959	693511	354
	PDI-SG-B355-BL1	-36.4	7639967	694273	355
	PDI-SG-B356-BL1	-38.8	7639166	693320	356
	PDI-SG-B357-BL1	-34.8	7639616	692934	357
	PDI-SG-B358-BL1	-38.0	7639347	693110	358
	PDI-SG-B359-BL1	-7.9	7640381	693730	359
	PDI-SG-B360-BL1	-46.4	7640298	692876	360
	PDI-SG-B361-BL1	-34.9	7640344	693661	361
	PDI-SG-B362-BL1	-39.6	7639499	692970	362
	PDI-SG-B363-BL1	-22.9	7639728	692697	363
	PDI-SG-B364-BL1	-19.0	7640580	693294	364
	PDI-SG-B365-BL1	-27.6	7640746	692986	365
	PDI-SG-B366-BL1	-47.7	7640467	692523	366
	PDI-SG-B367-BL1	-26.8	7640030	692318	367
	PDI-SG-B368-BL1	-30.6	7640300	691987	368
	PDI-SG-B369-BL1	-21.9	7640908	692807	369
	PDI-SG-B370-BL1	-46.9	7640387	692795	370
	PDI-SG-B371-BL1	-27.0	7640543	691695	371
	PDI-SG-B372-BL1	-15.7	7641138	692546	372
	PDI-SG-B373-BL1	-10.8	7641473	692143	373
	PDI-SG-B374-BL1	-21.6	7640545	691657	374
	PDI-SG-B375-BL1	-38.4	7641472	691917	375
	PDI-SG-B376-BL1	-29.1	7641615	691868	376
	PDI-SG-B377-BL1	-24.8	7640912	691177	377
	PDI-SG-B378-BL1	-49.9	7641355	691109	378
	PDI-SG-B379-BL1	-16.2	7641936	691546	379
	PDI-SG-B380-BL1	-23.4	7640960	690922	380
	PDI-SG-B381-BL1	-24.9	7642148	691227	381
	PDI-SG-B382-BL1	-21.7	7641386	690629	382
	PDI-SG-B383-BL1	-14.5	7641450	690513	383
	PDI-SG-B384-BL1	-56.4	7641737	690887	384
	PDI-SG-B385-BL1	-6.6	7642296	691122	385
	PDI-SG-B386-BL1	-20.4	7642481	690816	386
	PDI-SG-B387-BL1	-19.3	7641763	690228	387
	PDI-SG-B388-BL1	-38.5	7642076	691180	388
	PDI-SG-B389-BL1	-26.8	7642749	690473	389
	PDI-SG-B390-BL1	-29.6	7641963	690046	390
	PDI-SG-B391-BL1	-50.2	7642934	689975	391
	PDI-SG-B392-BL1	-38.4	7642997	690188	392
	PDI-SG-B393-BL1	-10.6	7642177	689706	393
	PDI-SG-B394-BL1	-42.4	7642887	689481	394
	PDI-SG-B395-BL1	-13.8	7642676	689276	395
	PDI-SG-B396-BL1	-21.2	7643226	690031	396
	PDI-SG-B397-BL1	-6.6	7642709	689208	397
	PDI-SG-B398-BL1	-26.6	7643598	689760	398

Table 3. Station Location Coordinates, Target Depth and Identification Scheme - Alternate 1 Locations
Portland Harbor PDI Surface Sediment FSP
Portland, OR

Sample Type	Sample ID (within the Site)	Mudline Elevation (CRD - Feet) [a]	Proposed Location Coordinates (NAD 1983; Intl Feet) [b]		Sequential Station Count
			Easting	Northing	
Stratified random Site Samples	PDI-SG-B399-BL1	-45.9	7643700	689216	399
	PDI-SG-B400-BL1	-15.7	7643673	689754	400
	PDI-SG-B401-BL1	-36.3	7642871	689372	401
	PDI-SG-B402-BL1	NA	7643154	688757	402
	PDI-SG-B403-BL1	NA	7643347	688553	403
	PDI-SG-B404-BL1	-43.6	7643898	689427	404
	PDI-SG-B405-BL1	-32.4	7644273	689174	405
	PDI-SG-B406-BL1	NA	7643524	688419	406
	PDI-SG-B407-BL1	-9.7	7643961	688075	407
	PDI-SG-B408-BL1	-33.4	7644503	689106	408
	PDI-SG-B409-BL1	-43.5	7643868	688917	409
	PDI-SG-B410-BL1	-39.5	7644733	688742	410
	PDI-SG-B411-BL1	NA	7643958	687997	411
	PDI-SG-B412-BL1	-34.1	7644261	687971	412
	PDI-SG-B413-BL1	-21.3	7644266	687765	413
	PDI-SG-B414-BL1	-26.4	7644908	688391	414
	PDI-SG-B415-BL1	-46.5	7644666	688185	415
	PDI-SG-B416-BL1	-38.4	7644654	687490	416
	PDI-SG-B417-BL1	-36.7	7644446	687771	417
	PDI-SG-B418-BL1	-29.1	7645044	688139	418
	PDI-SG-B419-BL1	-41.9	7644913	687516	419
	PDI-SG-B420-BL1	-42.0	7644990	687592	420
	PDI-SG-B421-BL1	-30.2	7644753	687247	421
	PDI-SG-B422-BL1	-41.1	7645212	687531	422
	PDI-SG-B423-BL1	-53.0	7645302	687205	423
	PDI-SG-B424-BL1	-47.2	7644960	687135	424
	PDI-SG-B425-BL1	NA	7645158	686736	425
	PDI-SG-B426-BL1	-57.1	7645413	687129	426
	PDI-SG-B427-BL1	-66.3	7645825	686742	427
	PDI-SG-B428-BL1	-36.6	7645498	686477	428

General Notes:
1. All surface sediment samples have a target depth of 30 cm.
2. Conversion From CRD to NAVD88: Elevation(CRD)+5.38=NAVD88
3. NA = not available

Footnotes:
a) Vertical Datum: CRD (Columbia River Datum; Feet); based on 2009 NOAA bathymetry
b) Horizontal Projection: NAD 1983 (2011) Oregon State Plane North (Intl Feet)

Table 4. Station Location Coordinates, Target Depth and Identification Scheme - Alternate 2 Locations
Portland Harbor PDI Surface Sediment FSP, rev 2
Portland, OR

Sample Type	Sample ID (within the Site)	Mudline Elevation (CRD - Feet) [a]	Proposed Location Coordinates (NAD 1983; Intl Feet) [b]		Sequential Station Count
			Easting	Northing	
Stratified random Site Samples	PDI-SG-B001-BL1	-20.0	7616393	726093	001
	PDI-SG-B002-BL1	-42.7	7616958	725972	002
	PDI-SG-B003-BL1	-20.0	7617849	725169	003
	PDI-SG-B004-BL1	-40.3	7617494	725280	004
	PDI-SG-B005-BL1	-47.4	7617149	725468	005
	PDI-SG-B006-BL1	-17.7	7616286	726052	006
	PDI-SG-B007-BL1	-41.7	7617641	724936	007
	PDI-SG-B008-BL1	-32.6	7616236	725649	008
	PDI-SG-B009-BL1	-49.5	7617531	724840	009
	PDI-SG-B010-BL1	NA	7615752	725651	010
	PDI-SG-B011-BL1	NA	7617627	724562	011
	PDI-SG-B012-BL1	-19.5	7615855	724958	012
	PDI-SG-B013-BL1	-52.2	7616093	724420	013
	PDI-SG-B014-BL1	-26.8	7617362	724178	014
	PDI-SG-B015-BL1	-45.7	7616635	724843	015
	PDI-SG-B016-BL1	-14.8	7615593	724654	016
	PDI-SG-B017-BL1	-34.2	7616816	724054	017
	PDI-SG-B018-BL1	NA	7615414	724419	018
	PDI-SG-B019-BL1	-5.4	7615398	724055	019
	PDI-SG-B020-BL1	-39.1	7616393	723698	020
	PDI-SG-B021-BL1	NA	7617238	723614	021
	PDI-SG-B022-BL1	-47.9	7616264	724342	022
	PDI-SG-B023-BL1	NA	7615236	723825	023
	PDI-SG-B024-BL1	-34.1	7616734	723279	024
	PDI-SG-B025-BL1	-42.8	7616279	723294	025
	PDI-SG-B026-BL1	-41.3	7615716	723294	026
	PDI-SG-B027-BL1	-37.5	7615639	723260	027
	PDI-SG-B028-BL1	-37.5	7616743	722966	028
	PDI-SG-B029-BL1	-26.9	7615461	722964	029
	PDI-SG-B030-BL1	-41.5	7616495	722719	030
	PDI-SG-B031-BL1	-11.4	7616925	722289	031
	PDI-SG-B032-BL1	-30.5	7615378	722564	032
	PDI-SG-B033-BL1	-53.4	7615490	721935	033
	PDI-SG-B034-BL1	-40.6	7616472	721925	034
	PDI-SG-B035-BL1	-55.8	7615519	721836	035
	PDI-SG-B036-BL1	-45.0	7616329	721765	036
	PDI-SG-B037-BL1	-47.8	7615931	721816	037
	PDI-SG-B038-BL1	-40.2	7616463	721572	038
	PDI-SG-B039-BL1	-48.8	7615872	721825	039
	PDI-SG-B040-BL1	NA	7615075	721350	040
	PDI-SG-B041-BL1	-13.0	7615401	721065	041
	PDI-SG-B042-BL1	-37.4	7616435	721094	042
	PDI-SG-B043-BL1	-5.5	7615106	720667	043
	PDI-SG-B044-BL1	-38.9	7616692	720947	044
	PDI-SG-B045-BL1	-44.3	7616000	721224	045
	PDI-SG-B046-BL1	-43.2	7616169	720601	046
	PDI-SG-B047-BL1	NA	7616896	720498	047
	PDI-SG-B048-BL1	-29.5	7613540	720414	048
	PDI-SG-B049-BL1	-35.8	7612791	720638	049
	PDI-SG-B050-BL1	-19.0	7615216	720119	050
	PDI-SG-B051-BL1	NA	7616852	720077	051
	PDI-SG-B052-BL1	-56.0	7614386	720299	052
	PDI-SG-B053-BL1	-21.1	7615584	719958	053
	PDI-SG-B054-BL1	-39.1	7616807	719821	054

Table 4. Station Location Coordinates, Target Depth and Identification Scheme - Alternate 2 Locations
Portland Harbor PDI Surface Sediment FSP, rev 2
Portland, OR

Sample Type	Sample ID (within the Site)	Mudline Elevation (CRD - Feet) [a]	Proposed Location Coordinates (NAD 1983; Intl Feet) [b]		Sequential Station Count
			Easting	Northing	
Stratified random Site Samples	PDI-SG-B055-BL1	-19.0	7615679	719410	055
	PDI-SG-B056-BL1	-46.9	7616656	719705	056
	PDI-SG-B057-BL1	-19.4	7615760	719334	057
	PDI-SG-B058-BL1	-45.6	7616310	719144	058
	PDI-SG-B059-BL1	-39.2	7616846	719593	059
	PDI-SG-B060-BL1	-27.4	7615752	718985	060
	PDI-SG-B061-BL1	-46.1	7616813	718410	061
	PDI-SG-B062-BL1	-30.5	7616940	719236	062
	PDI-SG-B063-BL1	-26.6	7617157	718606	063
	PDI-SG-B064-BL1	-24.9	7615713	718371	064
	PDI-SG-B065-BL1	-29.3	7615775	718202	065
	PDI-SG-B066-BL1	-46.5	7616427	718544	066
	PDI-SG-B067-BL1	-4.3	7617299	718491	067
	PDI-SG-B068-BL1	-25.2	7617377	718051	068
	PDI-SG-B069-BL1	-47.1	7616783	717645	069
	PDI-SG-B070-BL1	-35.1	7616039	717835	070
	PDI-SG-B071-BL1	-31.3	7616111	717452	071
	PDI-SG-B072-BL1	-50.8	7617139	717235	072
	PDI-SG-B073-BL1	-43.9	7617314	717860	073
	PDI-SG-B074-BL1	-35.6	7616408	717156	074
	PDI-SG-B075-BL1	NA	7617726	717638	075
	PDI-SG-B076-BL1	-36.7	7617753	716995	076
	PDI-SG-B077-BL1	-17.4	7618784	717244	077
	PDI-SG-B078-BL1	-1.7	7619077	717293	078
	PDI-SG-B079-BL1	-52.7	7617010	716724	079
	PDI-SG-B080-BL1	-22.6	7616276	716928	080
	PDI-SG-B081-BL1	-30.5	7616499	716614	081
	PDI-SG-B082-BL1	-30.7	7617854	716866	082
	PDI-SG-B083-BL1	-28.9	7616636	716174	083
	PDI-SG-B084-BL1	-30.4	7617938	716575	084
	PDI-SG-B085-BL1	-39.8	7617830	716440	085
	PDI-SG-B086-BL1	-40.1	7617962	716031	086
	PDI-SG-B087-BL1	-25.0	7618121	716310	087
	PDI-SG-B088-BL1	NA	7616664	715760	088
	PDI-SG-B089-BL1	NA	7618331	716114	089
	PDI-SG-B090-BL1	NA	7616799	715124	090
	PDI-SG-B091-BL1	-32.7	7617114	714941	091
	PDI-SG-B092-BL1	-43.0	7617113	715814	092
	PDI-SG-B093-BL1	-42.5	7617590	714729	093
	PDI-SG-B094-BL1	-18.4	7618474	715560	094
	PDI-SG-B095-BL1	-64.6	7618358	714912	095
	PDI-SG-B096-BL1	NA	7617127	714517	096
	PDI-SG-B097-BL1	-16.7	7618506	715500	097
	PDI-SG-B098-BL1	-25.9	7617286	714447	098
	PDI-SG-B099-BL1	NA	7618704	714974	099
	PDI-SG-B100-BL1	-28.5	7618823	714734	100
	PDI-SG-B101-BL1	-32.6	7619063	714612	101
	PDI-SG-B102-BL1	-13.1	7619718	714722	102
	PDI-SG-B103-BL1	NA	7617360	713935	103
	PDI-SG-B104-BL1	NA	7617556	713646	104
	PDI-SG-B105-BL1	-35.5	7618991	714491	105
	PDI-SG-B106-BL1	NA	7617585	713432	106
	PDI-SG-B107-BL1	-27.7	7619039	714070	107
	PDI-SG-B108-BL1	-49.1	7618833	714065	108
	PDI-SG-B109-BL1	-12.1	7619379	713783	109

Table 4. Station Location Coordinates, Target Depth and Identification Scheme - Alternate 2 Locations
Portland Harbor PDI Surface Sediment FSP, rev 2
Portland, OR

Sample Type	Sample ID (within the Site)	Mudline Elevation (CRD - Feet) [a]	Proposed Location Coordinates (NAD 1983; Intl Feet) [b]		Sequential Station Count
			Easting	Northing	
Stratified random Site Samples	PDI-SG-B110-BL1	NA	7617770	713229	110
	PDI-SG-B111-BL1	-24.7	7617618	713893	111
	PDI-SG-B112-BL1	NA	7617953	712906	112
	PDI-SG-B113-BL1	-52.4	7618328	712996	113
	PDI-SG-B114-BL1	-38.8	7619382	713579	114
	PDI-SG-B115-BL1	NA	7618134	712558	115
	PDI-SG-B116-BL1	-39.0	7619534	712939	116
	PDI-SG-B117-BL1	-30.6	7620315	713074	117
	PDI-SG-B118-BL1	-73.1	7619083	712733	118
	PDI-SG-B119-BL1	-10.0	7618414	712141	119
	PDI-SG-B120-BL1	-11.3	7619700	712891	120
	PDI-SG-B121-BL1	-40.5	7619822	712335	121
	PDI-SG-B122-BL1	NA	7618439	711814	122
	PDI-SG-B123-BL1	-42.3	7618925	711697	123
	PDI-SG-B124-BL1	-68.0	7619461	712181	124
	PDI-SG-B125-BL1	-38.5	7619970	712082	125
	PDI-SG-B126-BL1	NA	7618713	711321	126
	PDI-SG-B127-BL1	-39.3	7620050	711943	127
	PDI-SG-B128-BL1	-29.0	7619022	711082	128
	PDI-SG-B129-BL1	-21.8	7619179	710756	129
	PDI-SG-B130-BL1	-42.1	7620166	711620	130
	PDI-SG-B131-BL1	-33.8	7620358	711376	131
	PDI-SG-B132-BL1	-67.8	7620117	710516	132
	PDI-SG-B133-BL1	-32.2	7619400	710531	133
	PDI-SG-B134-BL1	-32.0	7620614	710910	134
	PDI-SG-B135-BL1	-32.5	7619549	710301	135
	PDI-SG-B136-BL1	-61.8	7619750	710764	136
	PDI-SG-B137-BL1	-28.6	7619739	710071	137
	PDI-SG-B138-BL1	-7.2	7620906	710636	138
	PDI-SG-B139-BL1	-24.2	7619907	709839	139
	PDI-SG-B140-BL1	-39.6	7619942	709917	140
	PDI-SG-B141-BL1	-14.5	7620963	710442	141
	PDI-SG-B142-BL1	-3.7	7621180	710159	142
	PDI-SG-B143-BL1	-53.6	7620258	710458	143
	PDI-SG-B144-BL1	-6.8	7620058	709541	144
	PDI-SG-B145-BL1	NA	7621290	709918	145
	PDI-SG-B146-BL1	-46.4	7620568	709380	146
	PDI-SG-B147-BL1	-4.9	7620294	709211	147
	PDI-SG-B148-BL1	-27.5	7621434	709479	148
	PDI-SG-B149-BL1	-34.8	7620579	708988	149
	PDI-SG-B150-BL1	-52.3	7620946	709606	150
	PDI-SG-B151-BL1	-27.5	7621597	709199	151
	PDI-SG-B152-BL1	-16.8	7620858	708502	152
	PDI-SG-B153-BL1	NA	7620950	708390	153
	PDI-SG-B154-BL1	NA	7622111	708967	154
	PDI-SG-B155-BL1	NA	7622168	708844	155
	PDI-SG-B156-BL1	-46.4	7622021	708149	156
	PDI-SG-B157-BL1	-12.3	7621352	707960	157
	PDI-SG-B158-BL1	-47.5	7621932	707876	158
	PDI-SG-B159-BL1	-34.5	7622285	708387	159
	PDI-SG-B160-BL1	-16.9	7621625	707637	160
	PDI-SG-B161-BL1	-11.0	7621868	707378	161
	PDI-SG-B162-BL1	-46.3	7622434	708017	162
	PDI-SG-B163-BL1	NA	7622564	708338	163
	PDI-SG-B164-BL1	-7.9	7622715	708041	164

Table 4. Station Location Coordinates, Target Depth and Identification Scheme - Alternate 2 Locations
Portland Harbor PDI Surface Sediment FSP, rev 2
Portland, OR

Sample Type	Sample ID (within the Site)	Mudline Elevation (CRD - Feet) [a]	Proposed Location Coordinates (NAD 1983; Intl Feet) [b]		Sequential Station Count
			Easting	Northing	
Stratified random Site Samples	PDI-SG-B165-BL1	NA	7622020	707083	165
	PDI-SG-B166-BL1	-20.9	7622157	707085	166
	PDI-SG-B167-BL1	-44.7	7622952	707487	167
	PDI-SG-B168-BL1	-51.9	7621949	707605	168
	PDI-SG-B169-BL1	-46.7	7623201	707263	169
	PDI-SG-B170-BL1	NA	7622398	706382	170
	PDI-SG-B171-BL1	-7.2	7623662	707208	171
	PDI-SG-B172-BL1	-9.5	7622757	706368	172
	PDI-SG-B173-BL1	-48.4	7623280	706950	173
	PDI-SG-B174-BL1	-41.3	7623071	706372	174
	PDI-SG-B175-BL1	-25.8	7623735	707089	175
	PDI-SG-B176-BL1	-46.4	7622621	706920	176
	PDI-SG-B177-BL1	-55.3	7623871	706586	177
	PDI-SG-B178-BL1	NA	7623248	706010	178
	PDI-SG-B179-BL1	-15.4	7623645	705878	179
	PDI-SG-B180-BL1	-37.1	7624278	706599	180
	PDI-SG-B181-BL1	-43.5	7623899	706134	181
	PDI-SG-B182-BL1	NA	7623946	705617	182
	PDI-SG-B183-BL1	-46.5	7623993	706273	183
	PDI-SG-B184-BL1	-44.3	7624445	706442	184
	PDI-SG-B185-BL1	-29.5	7624957	706236	185
	PDI-SG-B186-BL1	NA	7624285	705420	186
	PDI-SG-B187-BL1	-44.4	7625150	705334	187
	PDI-SG-B188-BL1	-49.3	7624808	705693	188
	PDI-SG-B189-BL1	NA	7624660	705215	189
	PDI-SG-B190-BL1	-43.9	7625199	705963	190
	PDI-SG-B191-BL1	-43.5	7625238	705826	191
	PDI-SG-B192-BL1	-15.9	7625056	705064	192
	PDI-SG-B193-BL1	NA	7625257	704874	193
	PDI-SG-B194-BL1	-44.3	7625844	705181	194
	PDI-SG-B195-BL1	-14.8	7625796	705956	195
	PDI-SG-B196-BL1	-42.5	7625627	704832	196
	PDI-SG-B197-BL1	-9.2	7626131	705902	197
	PDI-SG-B198-BL1	-19.8	7625484	704821	198
	PDI-SG-B199-BL1	-9.3	7625714	704653	199
	PDI-SG-B200-BL1	-43.4	7626254	705152	200
	PDI-SG-B201-BL1	NA	7626168	704204	201
	PDI-SG-B202-BL1	-44.1	7626873	704404	202
	PDI-SG-B203-BL1	-44.4	7626680	705118	203
	PDI-SG-B204-BL1	-18.0	7626924	705163	204
	PDI-SG-B205-BL1	-31.3	7626415	704223	205
	PDI-SG-B206-BL1	-45.5	7626205	704677	206
	PDI-SG-B207-BL1	NA	7626513	703795	207
	PDI-SG-B208-BL1	-48.0	7627055	704571	208
	PDI-SG-B209-BL1	-32.9	7626909	703713	209
	PDI-SG-B210-BL1	-43.1	7627253	704260	210
	PDI-SG-B211-BL1	NA	7627734	704557	211
	PDI-SG-B212-BL1	-43.6	7627208	703746	212
	PDI-SG-B213-BL1	NA	7626777	703469	213
	PDI-SG-B214-BL1	NA	7628016	704317	214
	PDI-SG-B215-BL1	NA	7628132	704268	215
	PDI-SG-B216-BL1	NA	7627213	703041	216
	PDI-SG-B217-BL1	-26.9	7628340	704015	217
	PDI-SG-B218-BL1	-11.3	7627473	702990	218
	PDI-SG-B219-BL1	-8.6	7627787	702611	219

Table 4. Station Location Coordinates, Target Depth and Identification Scheme - Alternate 2 Locations
Portland Harbor PDI Surface Sediment FSP, rev 2
Portland, OR

Sample Type	Sample ID (within the Site)	Mudline Elevation (CRD - Feet) [a]	Proposed Location Coordinates (NAD 1983; Intl Feet) [b]		Sequential Station Count
			Easting	Northing	
Stratified random Site Samples	PDI-SG-B220-BL1	-45.1	7627775	703450	220
	PDI-SG-B221-BL1	-22.1	7628718	703698	221
	PDI-SG-B222-BL1	-38.6	7627623	703223	222
	PDI-SG-B223-BL1	-17.7	7627854	702602	223
	PDI-SG-B224-BL1	-43.9	7628869	703324	224
	PDI-SG-B225-BL1	-21.0	7628162	702268	225
	PDI-SG-B226-BL1	-35.6	7629249	703009	226
	PDI-SG-B227-BL1	-36.3	7628500	702175	227
	PDI-SG-B228-BL1	-52.3	7628664	702736	228
	PDI-SG-B229-BL1	-10.6	7629589	703244	229
	PDI-SG-B230-BL1	-3.7	7628356	701920	230
	PDI-SG-B231-BL1	-45.2	7629473	702532	231
	PDI-SG-B232-BL1	NA	7628523	701514	232
	PDI-SG-B233-BL1	-27.0	7630149	702350	233
	PDI-SG-B234-BL1	-32.3	7630378	701973	234
	PDI-SG-B235-BL1	-36.3	7629165	701428	235
	PDI-SG-B236-BL1	-12.1	7628476	701097	236
	PDI-SG-B237-BL1	-28.1	7629035	701159	237
	PDI-SG-B238-BL1	-26.9	7630298	702219	238
	PDI-SG-B239-BL1	-18.7	7628652	700564	239
	PDI-SG-B240-BL1	-3.5	7630536	702213	240
	PDI-SG-B241-BL1	-16.2	7629003	700194	241
	PDI-SG-B242-BL1	-41.1	7629789	701025	242
	PDI-SG-B243-BL1	-28.0	7630913	701860	243
	PDI-SG-B244-BL1	-22.2	7631239	701768	244
	PDI-SG-B245-BL1	-5.5	7629550	700191	245
	PDI-SG-B246-BL1	-20.2	7629782	700260	246
	PDI-SG-B247-BL1	-53.3	7630449	701067	247
	PDI-SG-B248-BL1	-9.5	7631655	701632	248
	PDI-SG-B249-BL1	-33.9	7631710	701524	249
	PDI-SG-B250-BL1	-27.6	7630686	699564	250
	PDI-SG-B251-BL1	-35.3	7630198	699947	251
	PDI-SG-B252-BL1	-36.0	7632260	701502	252
	PDI-SG-B253-BL1	-8.3	7630244	699718	253
	PDI-SG-B254-BL1	NA	7632949	701252	254
	PDI-SG-B255-BL1	-40.1	7632044	701166	255
	PDI-SG-B256-BL1	-45.1	7631392	700490	256
	PDI-SG-B257-BL1	-22.9	7630728	699335	257
	PDI-SG-B258-BL1	NA	7631640	700458	258
	PDI-SG-B259-BL1	-33.5	7632352	700387	259
	PDI-SG-B260-BL1	-32.3	7632474	701523	260
	PDI-SG-B261-BL1	-44.8	7631860	700240	261
	PDI-SG-B262-BL1	NA	7630675	699094	262
	PDI-SG-B263-BL1	-24.3	7632706	701778	263
	PDI-SG-B264-BL1	-55.5	7631733	700786	264
	PDI-SG-B265-BL1	-33.3	7633428	701364	265
	PDI-SG-B266-BL1	-43.2	7632200	699801	266
	PDI-SG-B267-BL1	-39.1	7631690	699230	267
	PDI-SG-B268-BL1	-22.4	7631014	699063	268
	PDI-SG-B269-BL1	-15.6	7631412	698501	269
	PDI-SG-B270-BL1	-48.5	7632026	699461	270
	PDI-SG-B271-BL1	-32.6	7633524	701343	271
	PDI-SG-B272-BL1	-40.1	7632441	699682	272
	PDI-SG-B273-BL1	NA	7634074	701263	273
	PDI-SG-B274-BL1	-35.0	7632816	699447	274

Table 4. Station Location Coordinates, Target Depth and Identification Scheme - Alternate 2 Locations
Portland Harbor PDI Surface Sediment FSP, rev 2
Portland, OR

Sample Type	Sample ID (within the Site)	Mudline Elevation (CRD - Feet) [a]	Proposed Location Coordinates (NAD 1983; Intl Feet) [b]		Sequential Station Count
			Easting	Northing	
Stratified random Site Samples	PDI-SG-B275-BL1	NA	7631311	698076	275
	PDI-SG-B276-BL1	-49.1	7632351	699366	276
	PDI-SG-B277-BL1	-13.3	7631738	697899	277
	PDI-SG-B278-BL1	-40.8	7633039	699194	278
	PDI-SG-B279-BL1	-6.1	7634481	701069	279
	PDI-SG-B280-BL1	-33.1	7634384	700410	280
	PDI-SG-B281-BL1	-38.3	7633208	699060	281
	PDI-SG-B282-BL1	-30.4	7631807	698301	282
	PDI-SG-B283-BL1	-7.6	7632200	697783	283
	PDI-SG-B284-BL1	-30.9	7634658	700451	284
	PDI-SG-B285-BL1	-40.8	7633453	698815	285
	PDI-SG-B286-BL1	-9.2	7632326	697580	286
	PDI-SG-B287-BL1	-47.8	7633532	698270	287
	PDI-SG-B288-BL1	-32.6	7634842	700114	288
	PDI-SG-B289-BL1	-38.8	7633659	698628	289
	PDI-SG-B290-BL1	NA	7632717	697030	290
	PDI-SG-B291-BL1	NA	7632932	696925	291
	PDI-SG-B292-BL1	-31.1	7633244	697119	292
	PDI-SG-B293-BL1	NA	7634015	698638	293
	PDI-SG-B294-BL1	NA	7635288	700313	294
	PDI-SG-B295-BL1	-49.2	7634507	697452	295
	PDI-SG-B296-BL1	-25.1	7635591	699723	296
	PDI-SG-B297-BL1	-34.0	7634291	698205	297
	PDI-SG-B298-BL1	-21.2	7633251	696939	298
	PDI-SG-B299-BL1	-22.6	7633608	696750	299
	PDI-SG-B300-BL1	-31.1	7633405	697204	300
	PDI-SG-B301-BL1	-32.8	7634417	698114	301
	PDI-SG-B302-BL1	-24.2	7635782	699821	302
	PDI-SG-B303-BL1	NA	7635688	699249	303
	PDI-SG-B304-BL1	-6.0	7634752	697982	304
	PDI-SG-B305-BL1	NA	7633942	696493	305
	PDI-SG-B306-BL1	-23.7	7634239	696537	306
	PDI-SG-B307-BL1	-35.0	7634936	697664	307
	PDI-SG-B308-BL1	-19.6	7636454	699266	308
	PDI-SG-B309-BL1	NA	7634329	696257	309
	PDI-SG-B310-BL1	-15.1	7634623	696086	310
	PDI-SG-B311-BL1	-40.9	7635302	696652	311
	PDI-SG-B312-BL1	-30.0	7635253	697475	312
	PDI-SG-B313-BL1	-17.7	7636531	699207	313
	PDI-SG-B314-BL1	-16.2	7635601	697288	314
	PDI-SG-B315-BL1	-10.2	7636760	698790	315
	PDI-SG-B316-BL1	-15.5	7634732	696025	316
	PDI-SG-B317-BL1	-17.9	7635258	695794	317
	PDI-SG-B318-BL1	-43.1	7635636	696818	318
	PDI-SG-B319-BL1	-13.0	7636029	697019	319
	PDI-SG-B320-BL1	-29.6	7636093	696907	320
	PDI-SG-B321-BL1	-19.9	7635559	695682	321
	PDI-SG-B322-BL1	-18.3	7635654	695549	322
	PDI-SG-B323-BL1	-39.6	7636001	696158	323
	PDI-SG-B324-BL1	-22.1	7636501	696714	324
	PDI-SG-B325-BL1	-11.9	7636124	695544	325
	PDI-SG-B326-BL1	-18.0	7636772	696505	326
	PDI-SG-B327-BL1	-20.5	7636310	695196	327
	PDI-SG-B328-BL1	-18.3	7637089	696319	328
	PDI-SG-B329-BL1	-50.0	7636742	695749	329

Table 4. Station Location Coordinates, Target Depth and Identification Scheme - Alternate 2 Locations
Portland Harbor PDI Surface Sediment FSP, rev 2
Portland, OR

Sample Type	Sample ID (within the Site)	Mudline Elevation (CRD - Feet) [a]	Proposed Location Coordinates (NAD 1983; Intl Feet) [b]		Sequential Station Count
			Easting	Northing	
Stratified random Site Samples	PDI-SG-B330-BL1	-70.5	7636696	696088	330
	PDI-SG-B331-BL1	NA	7637486	696210	331
	PDI-SG-B332-BL1	-19.2	7636541	694991	332
	PDI-SG-B333-BL1	NA	7636812	694819	333
	PDI-SG-B334-BL1	-28.3	7637070	695182	334
	PDI-SG-B335-BL1	-13.2	7637584	696070	335
	PDI-SG-B336-BL1	-15.5	7638090	695717	336
	PDI-SG-B337-BL1	-31.5	7637319	694867	337
	PDI-SG-B338-BL1	NA	7637215	694056	338
	PDI-SG-B339-BL1	-29.2	7638096	695644	339
	PDI-SG-B340-BL1	-53.2	7637729	695216	340
	PDI-SG-B341-BL1	-15.9	7638400	695530	341
	PDI-SG-B342-BL1	-31.5	7637995	694376	342
	PDI-SG-B343-BL1	-51.1	7638558	695108	343
	PDI-SG-B344-BL1	-31.8	7638307	694119	344
	PDI-SG-B345-BL1	NA	7639012	695324	345
	PDI-SG-B346-BL1	-43.2	7638599	694587	346
	PDI-SG-B347-BL1	NA	7639076	695349	347
	PDI-SG-B348-BL1	-31.4	7638422	693998	348
	PDI-SG-B349-BL1	-36.9	7638769	693686	349
	PDI-SG-B350-BL1	-43.8	7639594	694250	350
	PDI-SG-B351-BL1	-15.5	7639483	694989	351
	PDI-SG-B352-BL1	-41.8	7639119	694121	352
	PDI-SG-B353-BL1	-34.9	7639909	694442	353
	PDI-SG-B354-BL1	-36.2	7638932	693532	354
	PDI-SG-B355-BL1	-36.3	7639968	694274	355
	PDI-SG-B356-BL1	-36.7	7639059	693395	356
	PDI-SG-B357-BL1	-46.3	7639935	693048	357
	PDI-SG-B358-BL1	-39.0	7639279	693206	358
	PDI-SG-B359-BL1	-39.8	7640305	693667	359
	PDI-SG-B360-BL1	-37.7	7640212	693485	360
	PDI-SG-B361-BL1	-37.9	7640320	693662	361
	PDI-SG-B362-BL1	-12.2	7639526	692895	362
	PDI-SG-B363-BL1	-19.7	7639865	692510	363
	PDI-SG-B364-BL1	-10.4	7640699	693133	364
	PDI-SG-B365-BL1	-18.8	7640815	692942	365
	PDI-SG-B366-BL1	-51.5	7640457	692042	366
	PDI-SG-B367-BL1	-31.2	7639968	692419	367
	PDI-SG-B368-BL1	-32.6	7640274	692031	368
	PDI-SG-B369-BL1	-14.1	7641083	692641	369
	PDI-SG-B370-BL1	-45.1	7640950	692177	370
	PDI-SG-B371-BL1	-24.7	7640398	691857	371
	PDI-SG-B372-BL1	-26.7	7641108	692537	372
	PDI-SG-B373-BL1	-12.9	7641456	692104	373
	PDI-SG-B374-BL1	-23.9	7640666	691525	374
	PDI-SG-B375-BL1	-43.6	7641339	691940	375
	PDI-SG-B376-BL1	-26.7	7641724	691751	376
	PDI-SG-B377-BL1	-27.5	7640955	691134	377
	PDI-SG-B378-BL1	-31.2	7641021	691122	378
	PDI-SG-B379-BL1	NA	7641985	691534	379
	PDI-SG-B380-BL1	-21.6	7640924	690930	380
	PDI-SG-B381-BL1	-28.7	7642136	691219	381
	PDI-SG-B382-BL1	-24.7	7641411	690661	382
	PDI-SG-B383-BL1	-10.5	7641541	690409	383
	PDI-SG-B384-BL1	-51.7	7641806	690583	384

Table 4. Station Location Coordinates, Target Depth and Identification Scheme - Alternate 2 Locations
Portland Harbor PDI Surface Sediment FSP, rev 2
Portland, OR

Sample Type	Sample ID (within the Site)	Mudline Elevation (CRD - Feet) [a]	Proposed Location Coordinates (NAD 1983; Intl Feet) [b]		Sequential Station Count
			Easting	Northing	
Stratified random Site Samples	PDI-SG-B385-BL1	-33.2	7642280	691012	385
	PDI-SG-B386-BL1	-14.3	7642604	690698	386
	PDI-SG-B387-BL1	-23.0	7641736	690296	387
	PDI-SG-B388-BL1	-62.2	7642294	690636	388
	PDI-SG-B389-BL1	-11.2	7642698	690605	389
	PDI-SG-B390-BL1	-23.2	7642036	689922	390
	PDI-SG-B391-BL1	-51.6	7642876	690014	391
	PDI-SG-B392-BL1	-27.0	7642874	690354	392
	PDI-SG-B393-BL1	-38.6	7642224	689753	393
	PDI-SG-B394-BL1	-49.1	7642188	689930	394
	PDI-SG-B395-BL1	NA	7642522	689338	395
	PDI-SG-B396-BL1	NA	7643208	690167	396
	PDI-SG-B397-BL1	-5.0	7642833	689090	397
	PDI-SG-B398-BL1	-28.3	7643415	689860	398
	PDI-SG-B399-BL1	-43.7	7643692	689024	399
	PDI-SG-B400-BL1	-31.1	7643786	689620	400
	PDI-SG-B401-BL1	-15.1	7643433	688614	401
	PDI-SG-B402-BL1	-9.9	7643096	688895	402
	PDI-SG-B403-BL1	-7.4	7643236	688749	403
	PDI-SG-B404-BL1	NA	7644092	689412	404
	PDI-SG-B405-BL1	-38.0	7644363	689086	405
	PDI-SG-B406-BL1	NA	7643493	688423	406
	PDI-SG-B407-BL1	-9.7	7643753	688202	407
	PDI-SG-B408-BL1	-46.9	7644462	688993	408
	PDI-SG-B409-BL1	-55.0	7644503	688431	409
	PDI-SG-B410-BL1	NA	7644760	688764	410
	PDI-SG-B411-BL1	-20.3	7644203	687837	411
	PDI-SG-B412-BL1	-34.9	7643775	688482	412
	PDI-SG-B413-BL1	-28.5	7644387	687655	413
	PDI-SG-B414-BL1	-14.2	7644953	688359	414
	PDI-SG-B415-BL1	-34.8	7645056	687778	415
	PDI-SG-B416-BL1	-40.5	7644719	687538	416
	PDI-SG-B417-BL1	-38.3	7644556	687830	417
	PDI-SG-B418-BL1	-27.7	7645213	687928	418
	PDI-SG-B419-BL1	-44.6	7644991	687480	419
	PDI-SG-B420-BL1	-38.1	7645085	687612	420
	PDI-SG-B421-BL1	-38.9	7644871	687438	421
	PDI-SG-B422-BL1	-14.2	7645402	687636	422
	PDI-SG-B423-BL1	-26.9	7645416	687559	423
	PDI-SG-B424-BL1	-48.5	7645027	687198	424
	PDI-SG-B425-BL1	-59.9	7645406	686934	425
	PDI-SG-B426-BL1	-63.8	7645553	687001	426
	PDI-SG-B427-BL1	-43.8	7645931	686773	427
	PDI-SG-B428-BL1	-63.1	7645602	686606	428

General Notes:
1. All surface sediment samples have a target depth of 30 cm.
2. Conversion From CRD to NAVD88: Elevation(CRD)+5.38=NAVD88
3. NA = not available

Footnotes:
a) Vertical Datum: CRD (Columbia River Datum; Feet); based on 2009 NOAA bathymetry
b) Horizontal Projection: NAD 1983 (2011) Oregon State Plane North (Intl Feet)

Table 5. Field Quality Control Sample Requirements
Portland Harbor PDI Surface Sediment FSP
Portland, OR

QA/QC Sample Type	Frequency
Temperature Blanks	1 per cooler
Field Duplicates	5 percent
Field Equipment Rinsate Blanks	5 percent or 1 per week per equipment

Acronyms:
QA/QC = quality assurance/quality control

Table 6. Summary of Estimated Field Quality Control Samples
Portland Harbor PDI Surface Sediment FSP
Portland, OR

Surface Sediment Sample Type	Number of Project Samples	Estimated # of Field Weeks	Field Duplicates	Field Equipment Rinsate Blanks
Stratified Random Site Samples	428	8.6	22	86
SMA Targeted Site Samples	178	3.6	9	36
Co-located Grabs at In-water Core Stations	60	1.2	3	12
Downtown/Upriver Reaches	60	2.2	3	20
Total Count	**726**	**15.5**	**37**	**153**

General Notes:
1. Estimated # of field weeks assumes 2 vessels in the field.

Table 7. Analyte List
Portland Harbor PDI Surface Sediment FSP
Portland, OR

Media	Location Count	Analyte List	
		Parameter	Method
Surface Sediment Stratified Random	428 - within Site; 60 - D/U Reach	Aldrin	8081B
		Arsenic	6020B
		Atterberg Limits	ASTM D4318
		BEHP	8270C
		Cadmium	6020B
		Chlordanes	8081B
		Copper	6020B
		DDx	8081B
		DDD	8081B
		DDE	8081B
		DDT	8081B
		Dieldrin	8081B
		Lindane	8081B
		Lead	6020B
		Mercury	7471A
		PCB congeners	1668
		PAHs	8270D SIM
		cPAHs (BaP eq)	8270D SIM
		1,2,3,4,7,8-HxCDF	1613B
		1,2,3,7,8-PeCDD	1613B
		2,3,4,7,8-PeCDF	1613B
		2,3,7,8-TCDF	1613B
		2,3,7,8-TCDD	1613B
		PCDD/Fs	1613B
		TPH-Diesel	NWTPH-Dx
		Tributyltin	OrganoTin
		Zinc	6020B
		TOC	Plumb 1981/ EPA 9060
		Grain Size	ASTM D7928 / D6913
Additional Surface Sediment - SMA	178 - within Site	DDx	8081B
		PCB congeners	1668
		PAHs	8270D SIM
		PCDD/Fs	1613B
		TOC	Plumb 1981/ EPA 9060
		Grain Size	ASTM D7928 / D6913
Additional Surface Sediment - In-water Core Location Grab	60 - within Site	DDx	8081B
		PCB congeners	1668
		PAHs	8270D SIM
		PCDD/Fs	1613B
		TOC	Plumb 1981/ EPA 9060
		Grain Size	ASTM D7928 / D6913

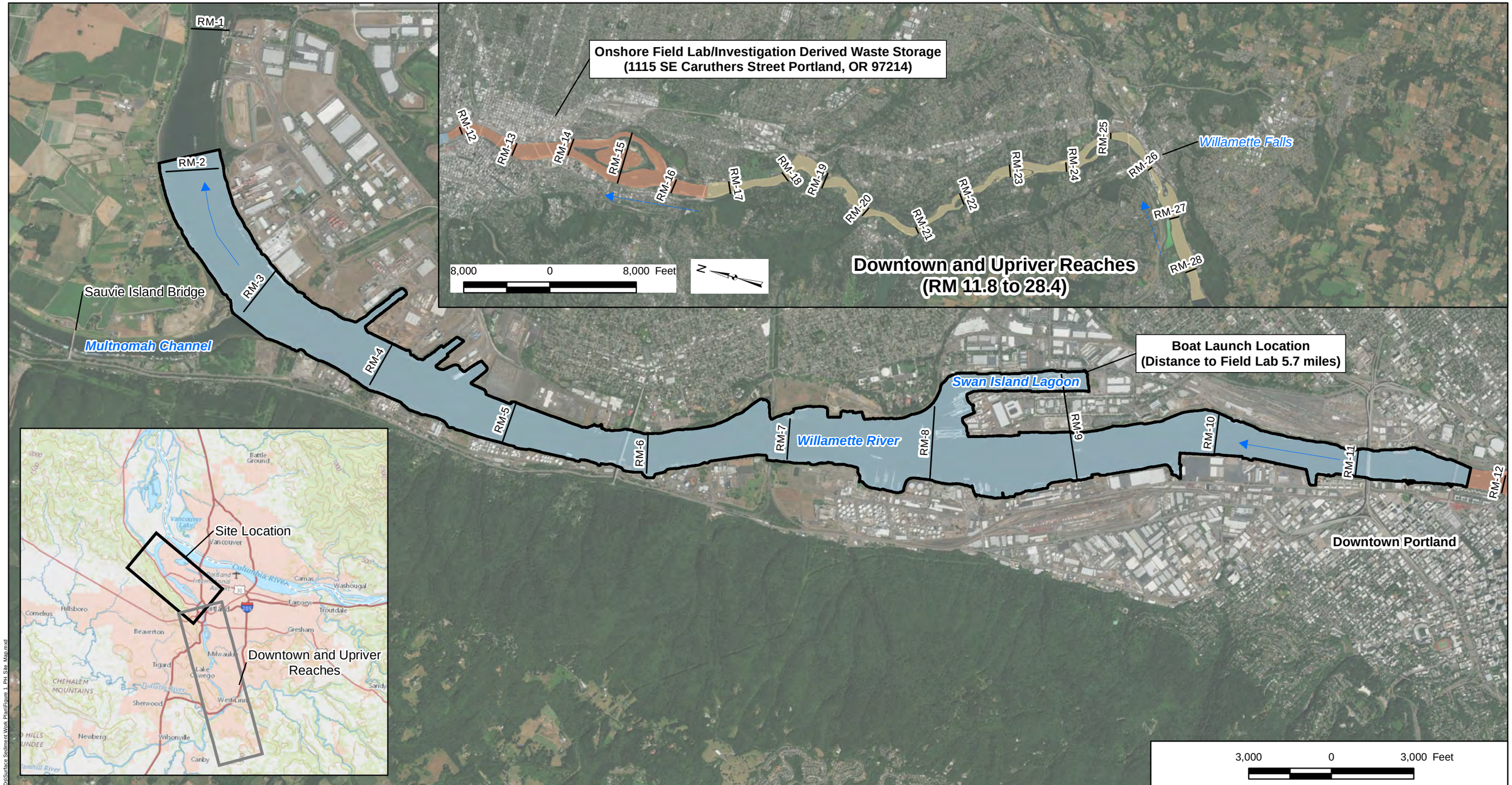
Abbreviations:
BL - baseline; DDx - sum of dichlorodiphenyltrichloroethane and its derivatives; PAHs - polycyclic aromatic hydrocarbon; PCBs - polychlorinated biphenyls; PCDD/Fs - polychlorinated dibenzo-p-dioxins and furans; PDI - Pre-remedial Design Investigation. PSEP - Puget Sound Estuary Protocol; TOC - total organic carbon; D/U – Downtown/Upriver Reach; SS - surface grab

Table 8. Sample Containers, Preservation, Holding Times, and Sample Volume
Portland Harbor PDI Surface Sediment FSP
Portland, OR

Sediment Analysis	Container		Preservation	Holding Time	Minimum Sample Size (wet weight grams)
	Type	Size			
PCBs	WMG	8 oz	Refrigerate, 0 to 6ºC Deep Frozen (-20ºC)	1 year, 1 year	100
PCDD/PCDFs	WMG	8 oz	Refrigerate, 0 to 6ºC Deep Frozen (-20ºC)	1 year, 1 year [a]	100
Pesticides	WMG	8 oz	Refrigerate, 0 to 6ºC Deep Frozen (-20ºC)	14 days, 1 year	100
SVOCs	WMG	8 oz	Refrigerate, 0 to 6ºC Deep Frozen (-20ºC)	14 days, 1 year	100
VOCs	G (no headspace)	8 oz	Refrigerate, 4 ± 2ºC	14 days	50
Herbicides	WMG	8 oz	Refrigerate, 0 to 6ºC Deep Frozen (-20ºC)	14 days, 1 year	100
Metals	G or P	8 oz	Refrigerate, 0 to 6ºC Deep Frozen (-20ºC)	6 months, 2 years	50
Mercury	WMG	8 oz	Refrigerate, 0 to 6ºC Deep Frozen (-20ºC)	28 days, 28 days	50
Tributyltin	WMG	8 oz	Refrigerate, 0 to 6ºC Deep Frozen (-20ºC)	14 days, 1 year	100
Grain size	G or P	16 oz	Refrigerate, 4 ± 2ºC	6 months	100 to 150
Total organic carbon	WMG	8 oz	Refrigerate, 0 to 6ºC Deep Frozen (-20ºC)	14 days, 1 year	25
Total solids	G or P	8 oz	Refrigerate, 0 to 6ºC Deep Frozen (-20ºC)	14 days, 6 months	50

General Notes:
1. Refrigerate preservation times consistent with PSEP protocols for Washington State.
2. Frozen preservation times provided from PSEP 1996.
3. Method detection limits presented in the project QAPP.
Footnotes:
a) stored in darkness
G - glass; P - plastic; WMG - wide mouth glass

FIGURES



3,000 0 3,000 Feet

Legend

- Flow Direction
- River Mile Marker
- Superfund Site Boundary (RM 1.9 to 11.8)

Study Area

- Site Area (RM 1.9 to 11.8)
- Downtown Reach (RM 11.8 to 16.6)
- Upriver Reach (RM 16.6 to 28.4)

N

Note:
1. Aerial Imagery provided by ESRI Basemaps 2016

Portland Harbor Site Map

Portland Harbor Superfund Site
PDI Surface Sediment FSP

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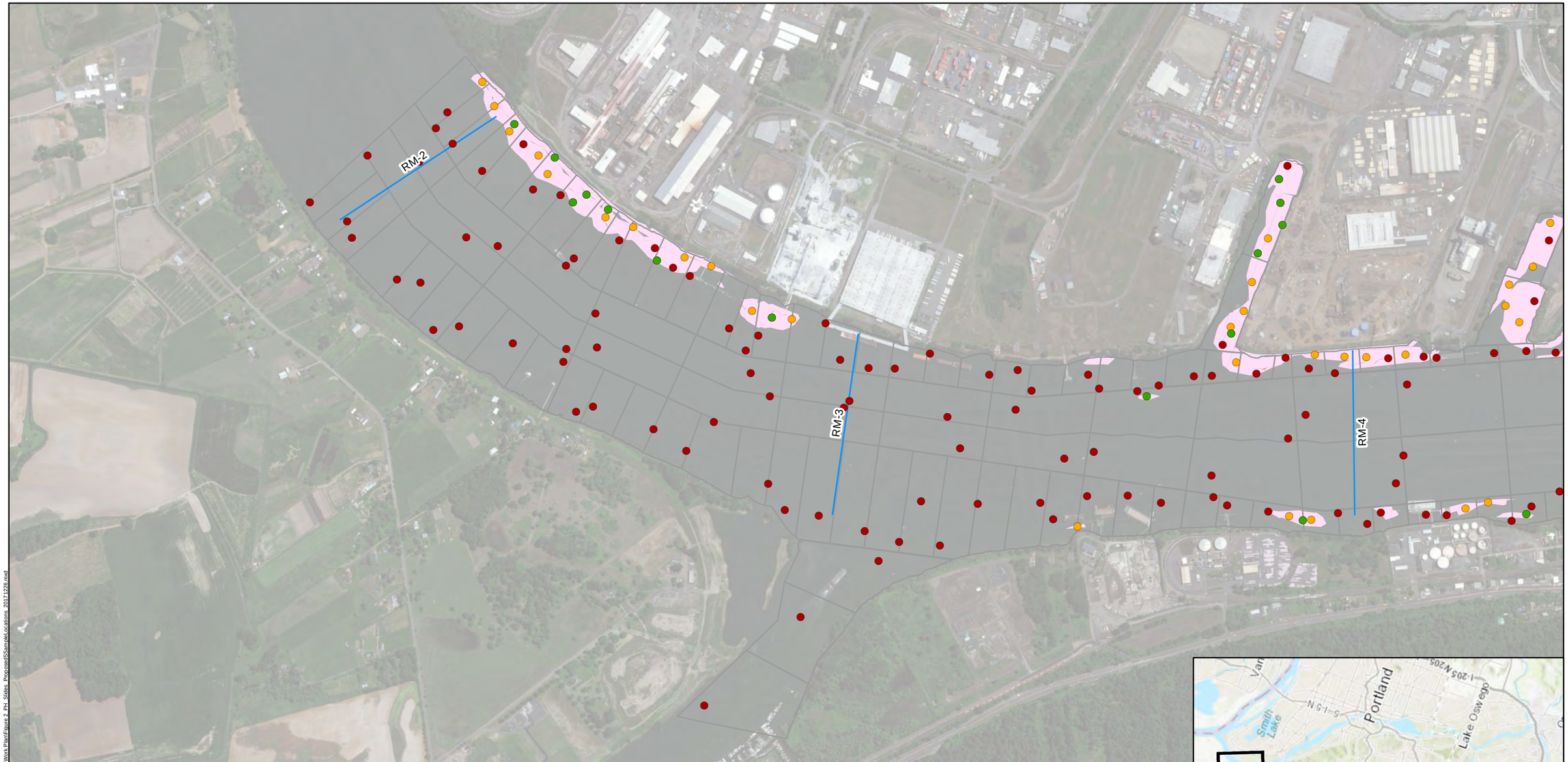
Figure 1

Path: P:\Projects\Portland Pre-Design PN\0767A\900\GIS and CAD\MXDs\Surface Sediment Work Plan\Figure 1_PH_Site_Map.mxd



Legend

- Stratified Random Samples (n = 428)
- Additional SMA Samples (n = 178)
- Surface Grab at Co-located Core Location (n = 60)
- River Mile Marker
- Randomized Sample Grid Cells
- Capped Area (Existing)
- Alternative F Mod SMA Footprint

N

1,000 500 0 1,000 2,000 Feet

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Surface sediment samples are defined as the 0-30 cm depth.
3. 5 grabs were removed from the RM 11E vicinity and will be redistributed in the site (TBD).
4. n - sample count, RM - river mile. SMA - Sediment Management Area.
5. SMA surface sediment grab samples may need to be revisited based on redistribution of cores to optimize coverage in the SMAs.

Proposed Surface Sediment Sampling Locations - RM 1.9 to 4

Portland Harbor Superfund Site
PDI Surface Sediment FSP

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Figure **2a**

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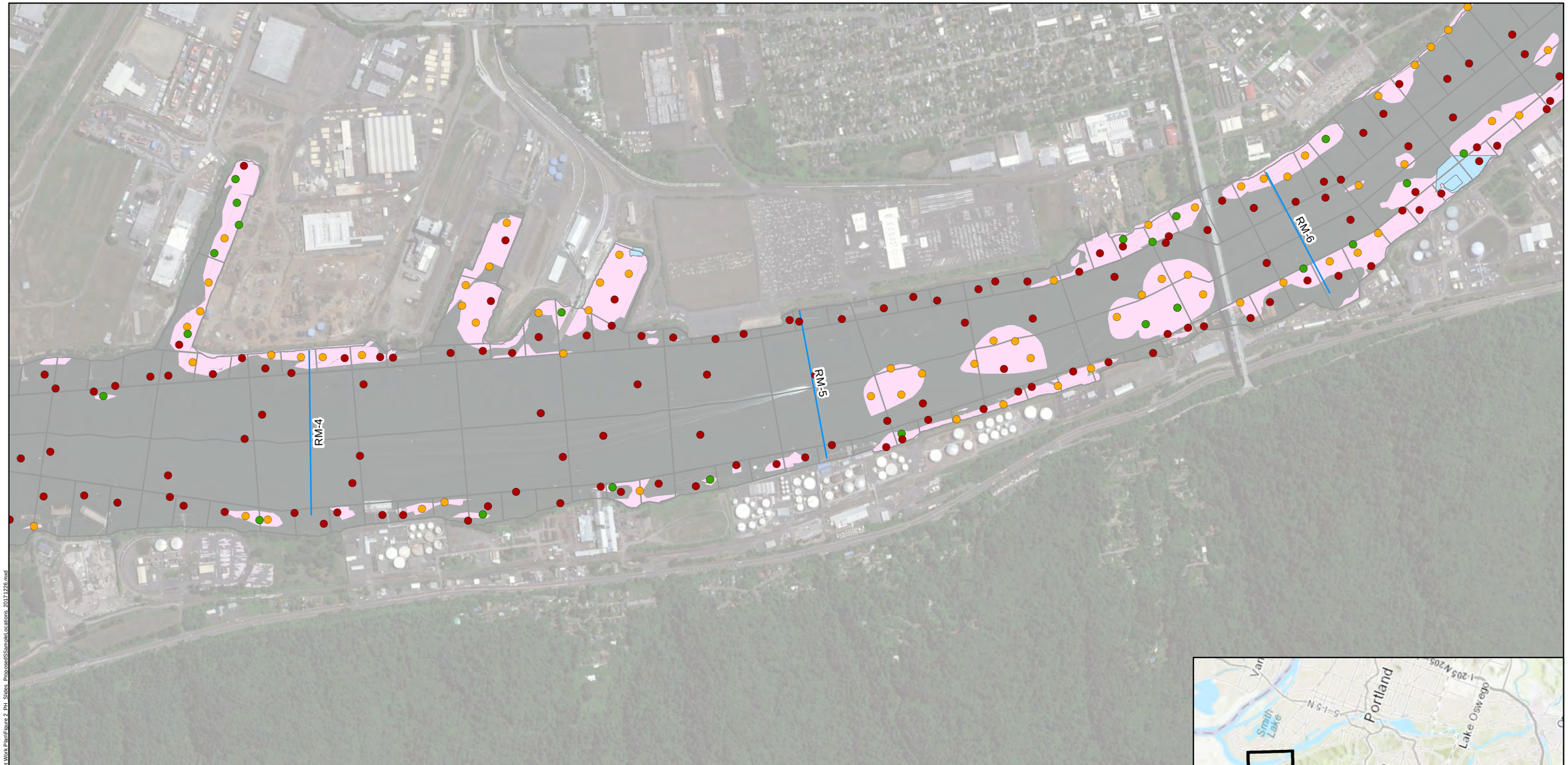
Path: P:\Projects\Portland Pre-Design PN\60707A\900 GIS and CAD\MXDs\Surface Sediment Work Plan\Figure 2_PH_Slides_ProposedSSampleLocations_20171226.mxd



Legend

- Stratified Random Samples (n = 428)
- Additional SMA Samples (n = 178)
- Surface Grab at Co-located Core Location (n = 60)
- River Mile Marker
- Randomized Sample Grid Cells
- Capped Area (Existing)
- Alternative F Mod SMA Footprint

N

1,000 500 0 1,000 2,000 Feet

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Surface sediment samples are defined as the 0-30 cm depth.
3. 5 grabs were removed from the RM 11E vicinity and will be redistributed in the site (TBD).
4. n - sample count, RM - river mile. SMA - Sediment Management Area.
5. SMA surface sediment grab samples may need to be revisited based on redistribution of cores to optimize coverage in the SMAs.

Proposed Surface Sediment Sampling Locations - RM 4 to 6

Portland Harbor Superfund Site
PDI Surface Sediment FSP

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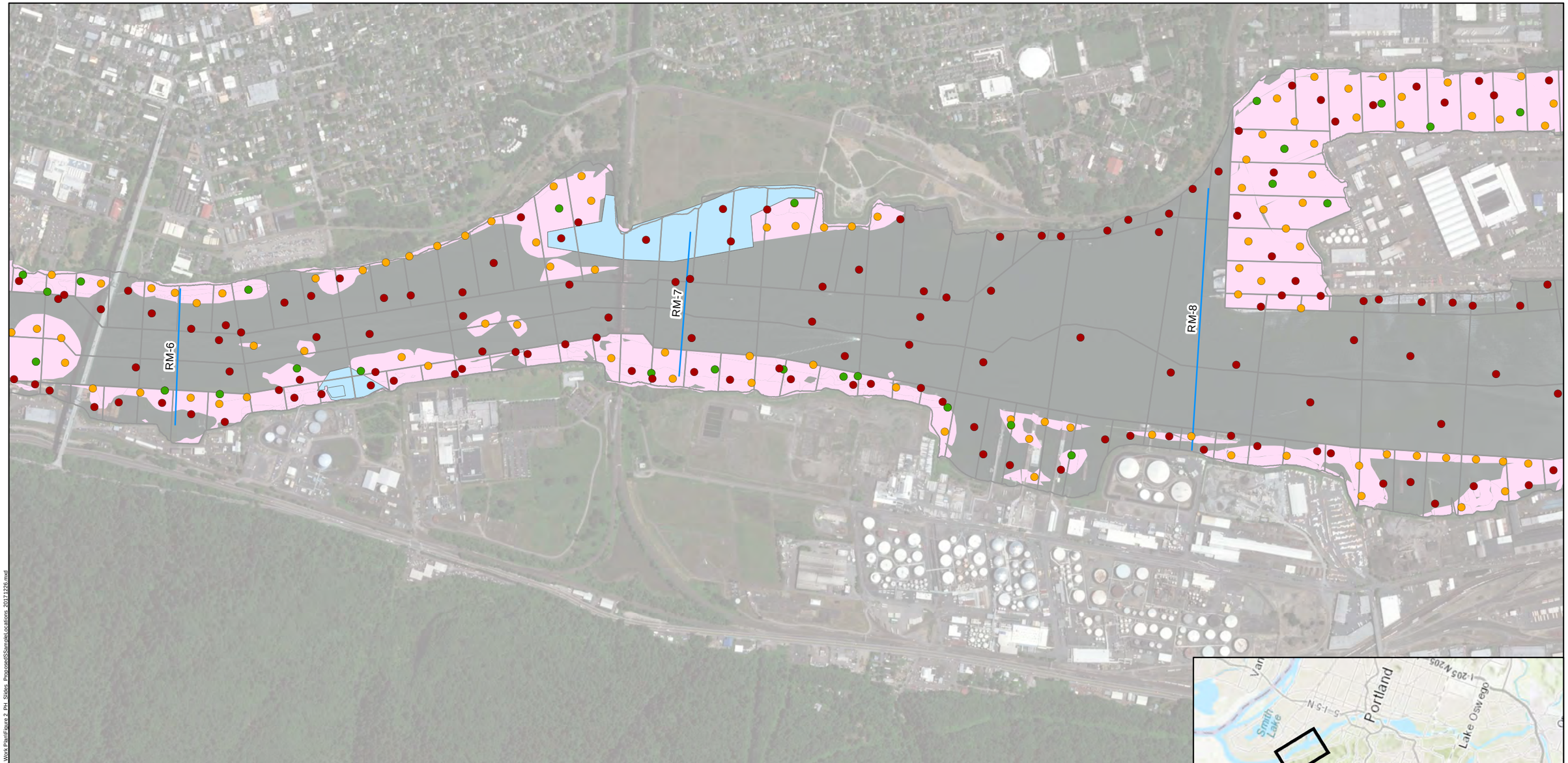
Figure **2b**

MI/SEA | March 23, 2018

Path: P:\Projects\Portland Pre-Design PN\G0767A\900\GIS and CAD\MXDs\Surface Sediment Work Plan\Figure 2_PH_Slides_ProposedSSSampleLocations_20171226.mxd



Legend

- Stratified Random Samples (n = 428)
- Additional SMA Samples (n = 178)
- Surface Grab at Co-located Core Location (n = 60)
- River Mile Marker
- Randomized Sample Grid Cells
- Capped Area (Existing)
- Alternative F Mod SMA Footprint

N

1,000 500 0 1,000 2,000 Feet

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Surface sediment samples are defined as the 0-30 cm depth.
3. 5 grabs were removed from the RM 11E vicinity and will be redistributed in the site (TBD).
4. n - sample count, RM - river mile. SMA - Sediment Management Area.
5. SMA surface sediment grab samples may need to be revisited based on redistribution of cores to optimize coverage in the SMAs.

Proposed Surface Sediment Sampling Locations - RM 6 to 8

Portland Harbor Superfund Site
PDI Surface Sediment FSP

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Figure **2c**

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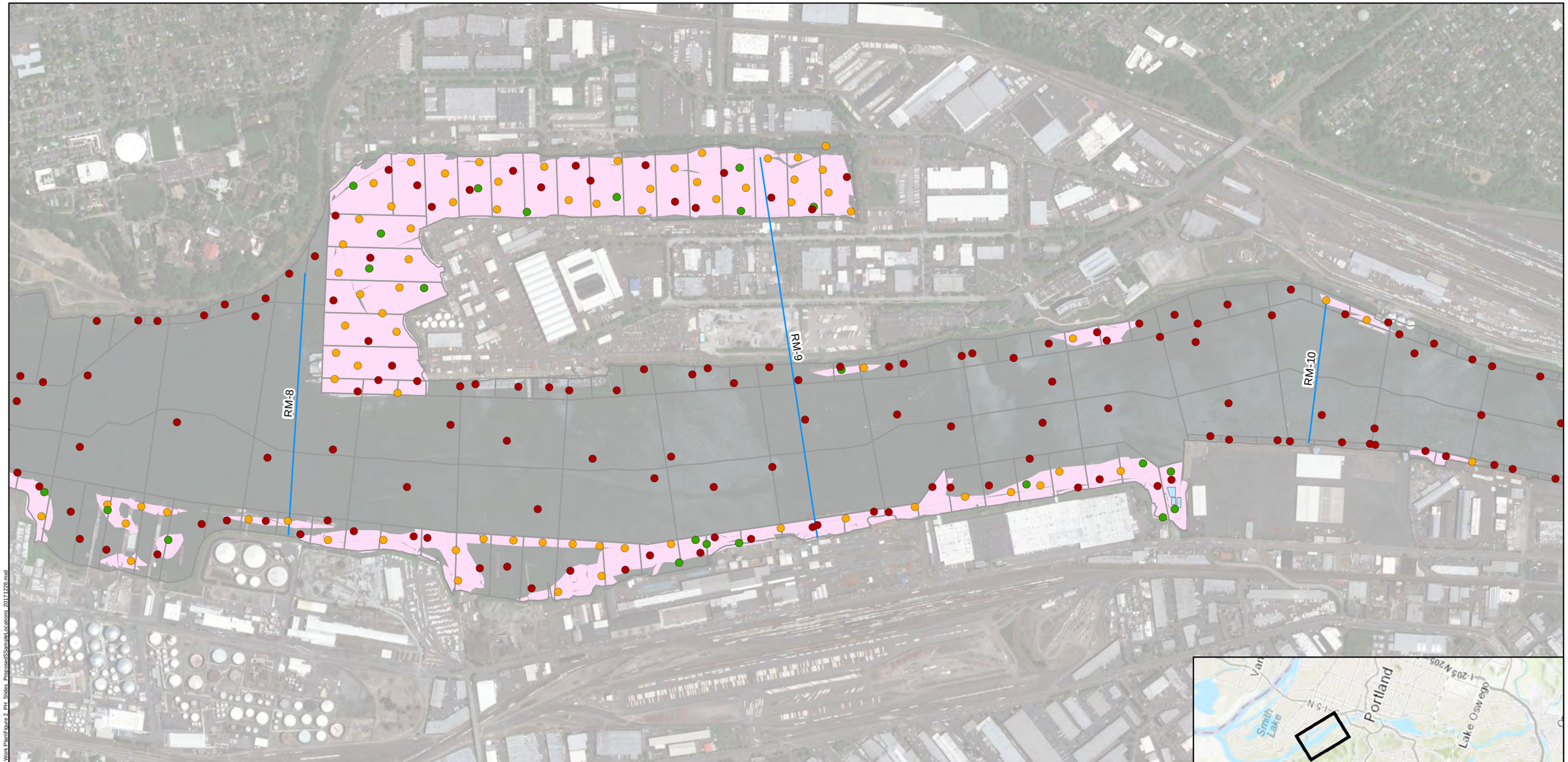

Legend

- Stratified Random Samples (n = 428)
- Additional SMA Samples (n = 178)
- Surface Grab at Co-located Core Location (n = 60)
- River Mile Marker
- Randomized Sample Grid Cells
- Capped Area (Existing)
- Alternative F Mod SMA Footprint

N

1,000 500 0 1,000 2,000 Feet

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Surface sediment samples are defined as the 0-30 cm depth.
3. 5 grabs were removed from the RM 11E vicinity and will be redistributed in the site (TBD).
4. n - sample count, RM - river mile. SMA - Sediment Management Area.
5. SMA surface sediment grab samples may need to be revisited based on redistribution of cores to optimize coverage in the SMAs.

Proposed Surface Sediment Sampling Locations - RM 8 to 10

Portland Harbor Superfund Site
PDI Surface Sediment FSP

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Figure 2d

MI/SEA | March 23, 2018

Path: P:\Projects\Portland Pre-Design PNG0767A\900 GIS and CAD\MXDs\Surface Sediment Work Plan\Figure 2_PH_Slides_ProposedSSampleLocations_20171226.mxd

Legend

- Stratified Random Samples (n = 428)
- Additional SMA Samples (n = 178)
- Surface Grab at Co-located Core Location (n = 60)
- River Mile Marker
- Randomized Sample Grid Cells
- Capped Area (Existing)
- Alternative F Mod SMA Footprint

N

1,000 500 0 1,000 2,000 Feet

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Surface sediment samples are defined as the 0-30 cm depth.
3. 5 grabs were removed from the RM 11E vicinity and will be redistributed in the site (TBD).
4. n - sample count, RM - river mile. SMA - Sediment Management Area.
5. SMA surface sediment grab samples may need to be revisited based on redistribution of cores to optimize coverage in the SMAs.

Proposed Surface Sediment Sampling Locations - RM 10 to 11.8

Portland Harbor Superfund Site
PDI Surface Sediment FSP

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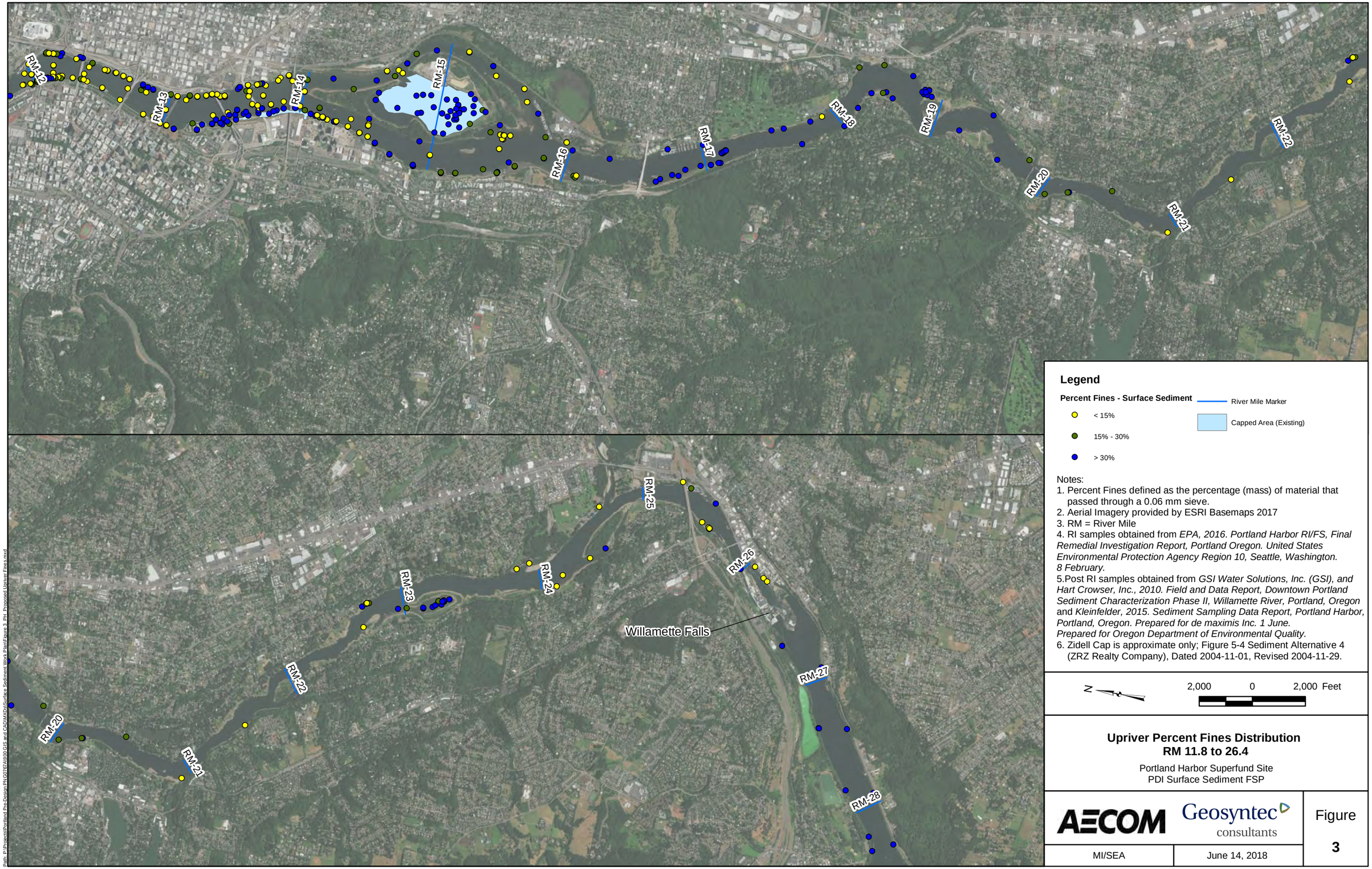
MI/SEA	March 23, 2018	Figure 2e

Path: P:\Projects\Portland Pre-Design\PN\G0767A\900\GIS and CAD\MXDs\Surface Sediment Work Plan\Figure 2_PH_Slides_ProposedSSampleLocations_20171226.mxd



Notes:
1. Percent Fines defined as the percentage (mass) of material that passed through a 0.06 mm sieve.
2. Aerial Imagery provided by ESRI Basemaps 2017
3. RM = River Mile
4. RI samples obtained from *EPA, 2016. Portland Harbor RI/FS, Final Remedial Investigation Report, Portland Oregon. United States Environmental Protection Agency Region 10, Seattle, Washington. 8 February.*
5.Post RI samples obtained from *GSI Water Solutions, Inc. (GSI), and Hart Crowser, Inc., 2010. Field and Data Report, Downtown Portland Sediment Characterization Phase II, Willamette River, Portland, Oregon* and *Kleinfelder, 2015. Sediment Sampling Data Report, Portland Harbor, Portland, Oregon. Prepared for de maximis Inc. 1 June. Prepared for Oregon Department of Environmental Quality.*
6. Zidell Cap is approximate only; Figure 5-4 Sediment Alternative 4 (ZRZ Realty Company), Dated 2004-11-01, Revised 2004-11-29.

Upriver Percent Fines Distribution
RM 11.8 to 26.4

Portland Harbor Superfund Site
PDI Surface Sediment FSP

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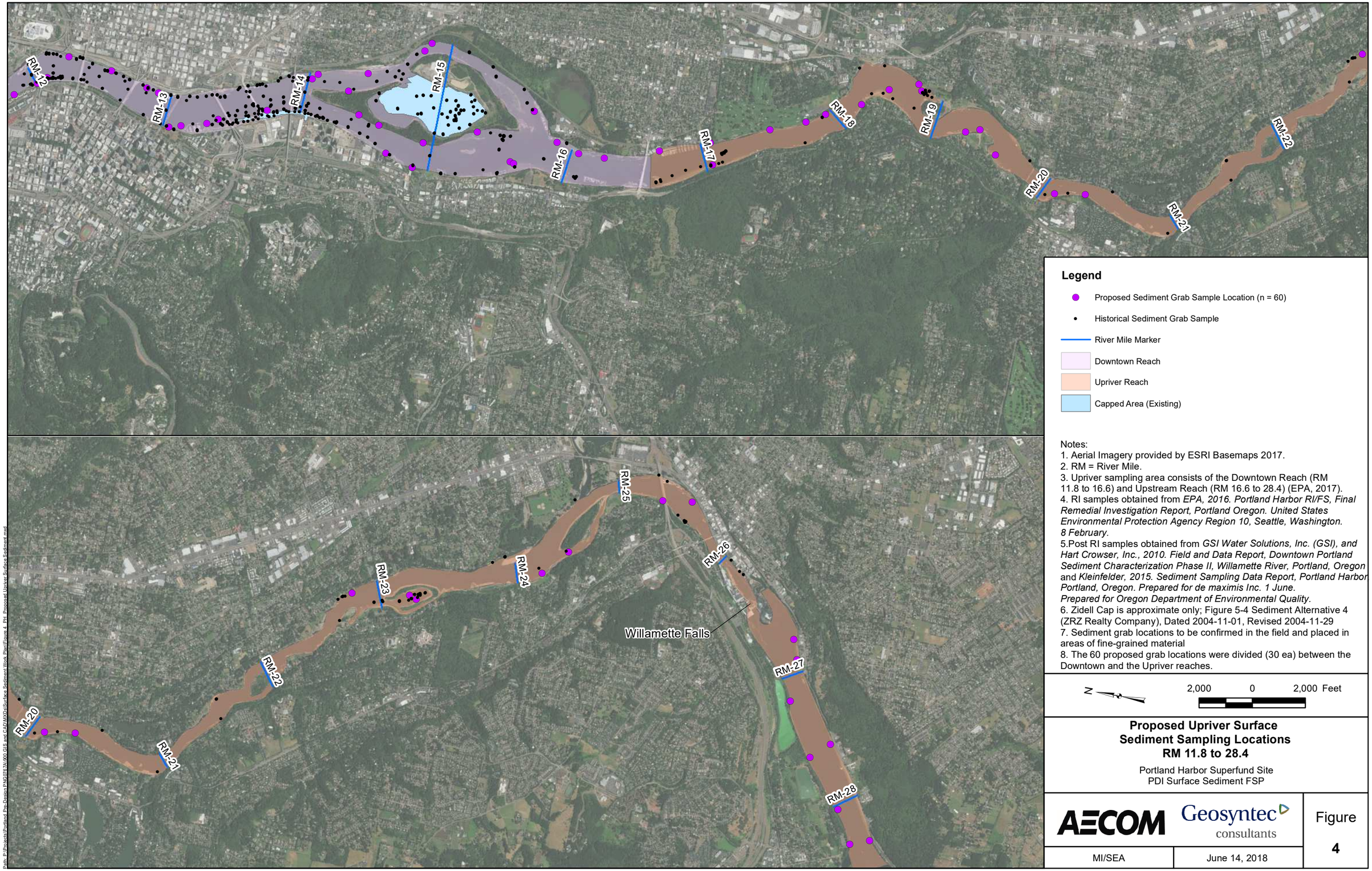
MI/SEA	June 14, 2018	Figure 3

Path: P:\Projects\Portland Pre-Design PN\60767A\900 GIS and CAD\MXDs\Surface Sediment Work Plan\Figure 3_PH_Proposed Upriver Fines.mxd



Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. RM = River Mile.
3. Upriver sampling area consists of the Downtown Reach (RM 11.8 to 16.6) and Upstream Reach (RM 16.6 to 28.4) (EPA, 2017).
4. RI samples obtained from *EPA, 2016. Portland Harbor RI/FS, Final Remedial Investigation Report, Portland Oregon. United States Environmental Protection Agency Region 10, Seattle, Washington. 8 February.*
5.Post RI samples obtained from *GSI Water Solutions, Inc. (GSI), and Hart Crowser, Inc., 2010. Field and Data Report, Downtown Portland Sediment Characterization Phase II, Willamette River, Portland, Oregon* and *Kleinfelder, 2015. Sediment Sampling Data Report, Portland Harbor Portland, Oregon. Prepared for de maximis Inc. 1 June. Prepared for Oregon Department of Environmental Quality.*
6. Zidell Cap is approximate only; Figure 5-4 Sediment Alternative 4 (ZRZ Realty Company), Dated 2004-11-01, Revised 2004-11-29
7. Sediment grab locations to be confirmed in the field and placed in areas of fine-grained material
8. The 60 proposed grab locations were divided (30 ea) between the Downtown and the Upriver reaches.

Proposed Upriver Surface Sediment Sampling Locations RM 11.8 to 28.4

Portland Harbor Superfund Site
PDI Surface Sediment FSP

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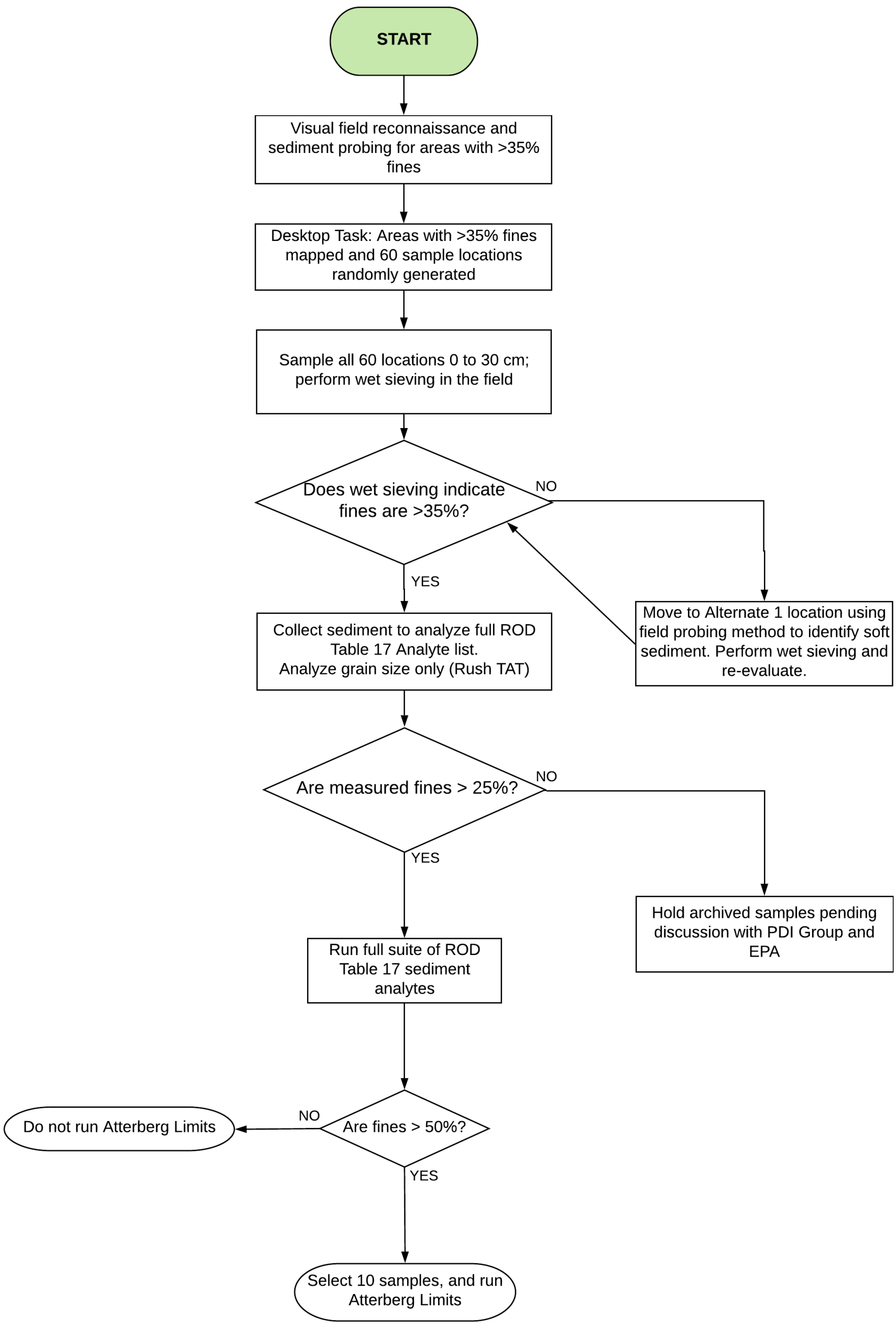
Figure 4

MI/SEA | June 14, 2018

Path: P:\Projects\Portland_Pre-Design PNG0767A\900 GIS and CAD\MXDs\Surface Sediment Work Plan\Figure 4_PH_Proposed Upriver Surface Sediment.mxd



Downtown/Upstream Reaches Sediment Sampling Decision Flow Chart

Portland Harbor Superfund Site
PDI Surface Sediment FSP

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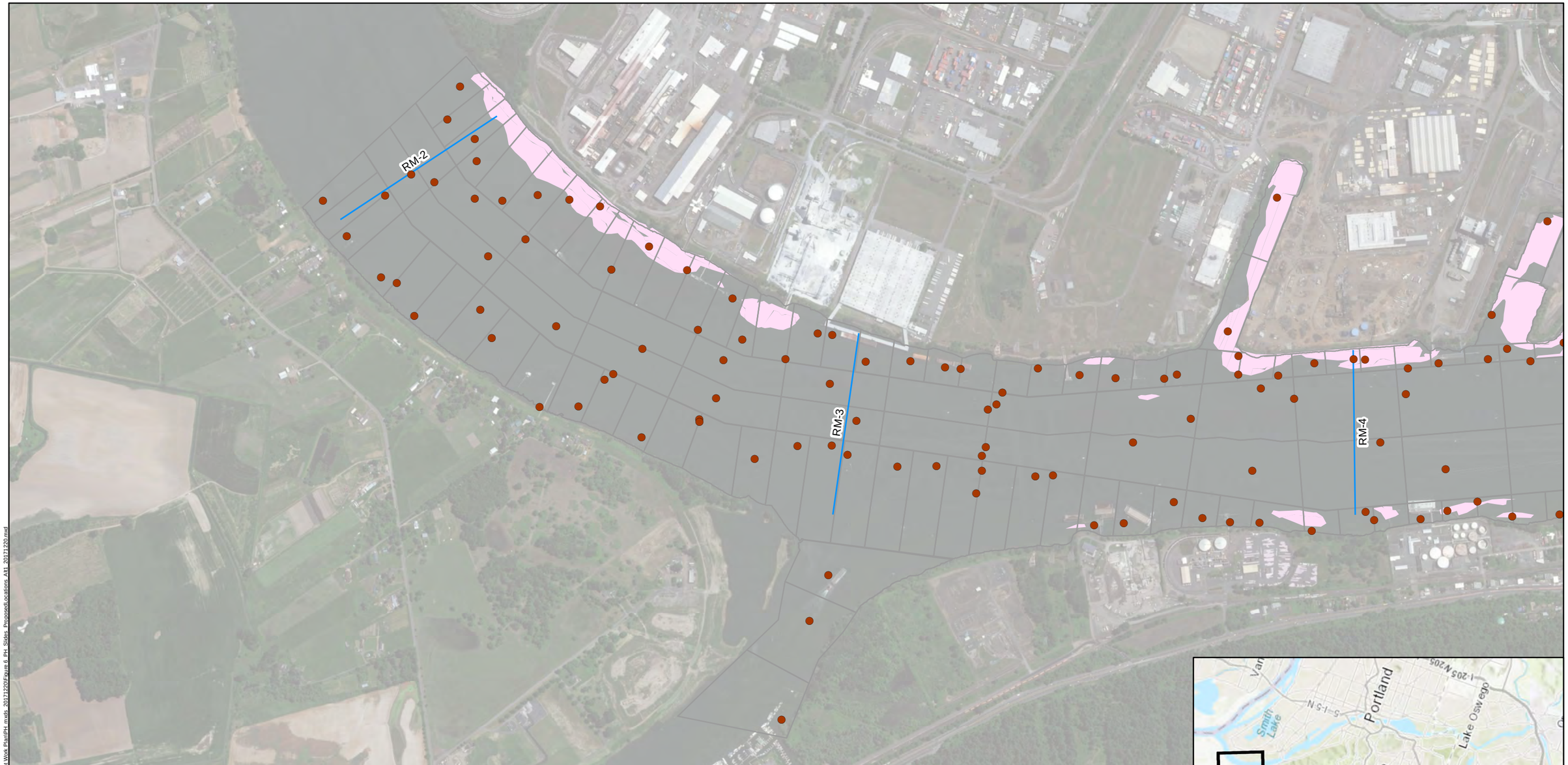
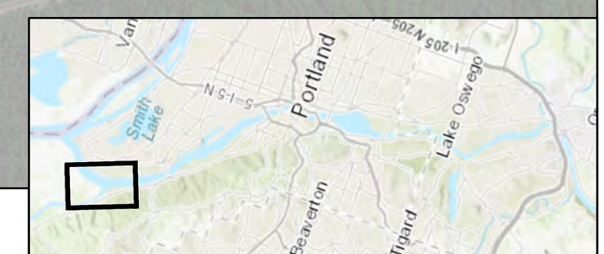
Figure 5

MI/SEA | March 23, 2018

Path: P:\Projects\Portland Pre-Design PNG0767A\900 GIS and CAD\MXDs\Surface Sediment Work Plan\Figure 5_PH_Decision Flow Chart.mxd





Legend

- Stratified Random Samples (n = 428)
- River Mile Marker
- Randomized Sample Grid Cells
- Capped Area (Existing)
- Alternative F Mod SMA Footprint

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Surface sediment samples are defined as the 0-30 cm depth.
3. n - sample count, RM - river mile, SMA - Sediment Management Area.

N

1,000 500 0 1,000 2,000 Feet

Proposed Stratified Random Site Sample Locations (Alternate 1) RM 1.9 to 4

Portland Harbor Superfund Site
PDI Surface Sediment FSP

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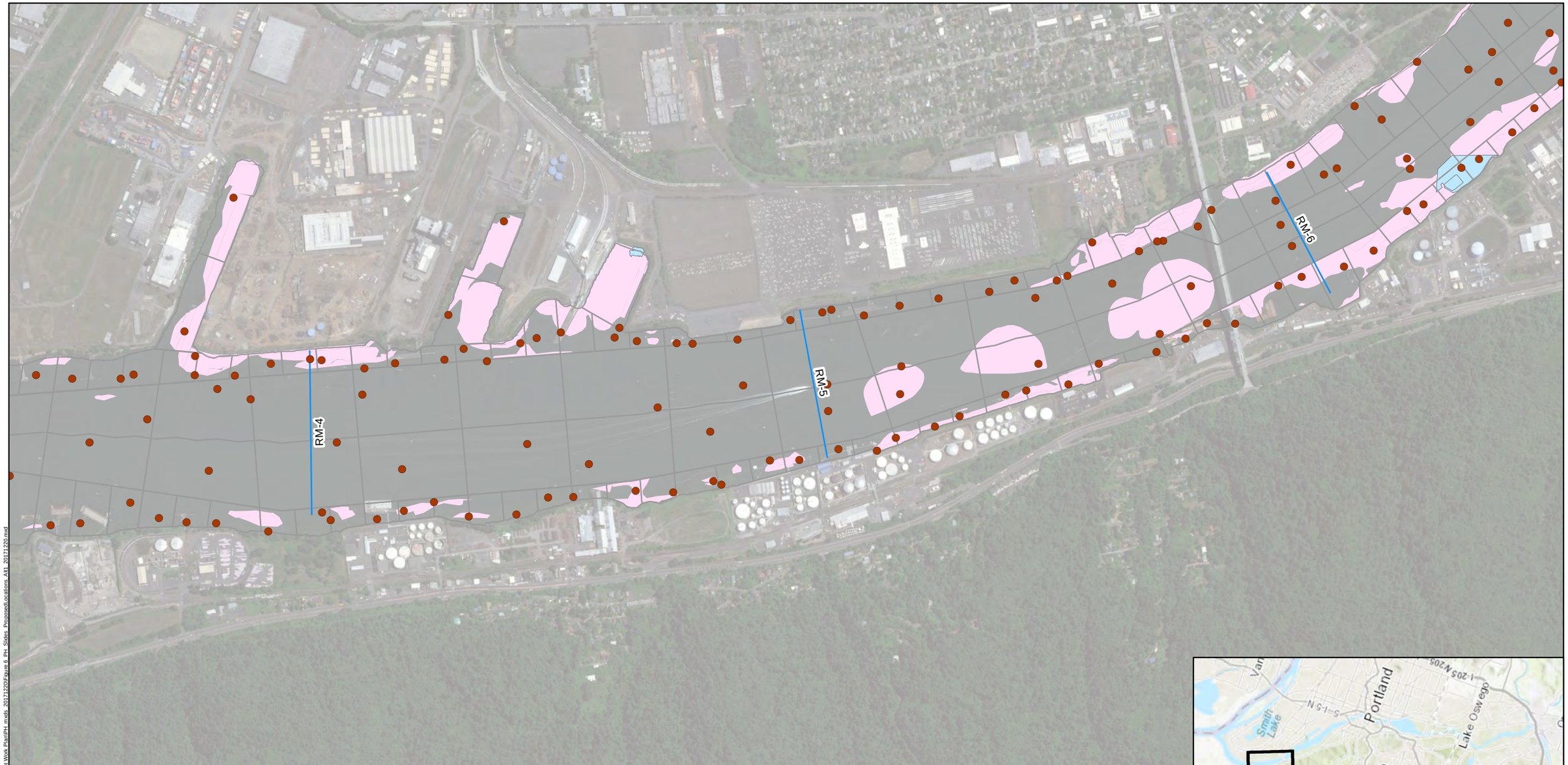
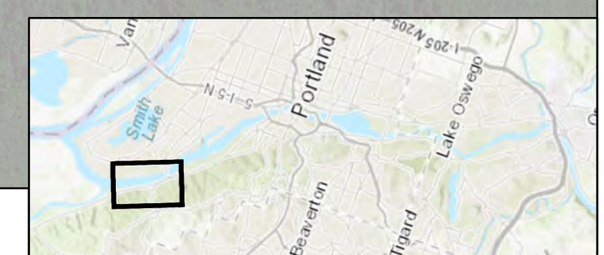
Figure **6a**

MI/SEA | March 23, 2018

Path: P:\Projects\Portland Pre-Design\PN\G076\EA\900\GIS and CAD\MXDs\Surface Sediment Work Plan\PH_mxds_20171220\Figure 6_PH_Slides_ProposedLocations_Alt1_20171220.mxd





Legend

- Stratified Random Samples (n = 428)
- River Mile Marker
- Randomized Sample Grid Cells
- Capped Area (Existing)
- Alternative F Mod SMA Footprint

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Surface sediment samples are defined as the 0-30 cm depth.
3. n - sample count, RM - river mile, SMA - Sediment Management Area.

N

1,000 500 0 1,000 2,000 Feet

Proposed Stratified Random Site Sample Locations (Alternate 1) RM 4 to 6

Portland Harbor Superfund Site
PDI Surface Sediment FSP

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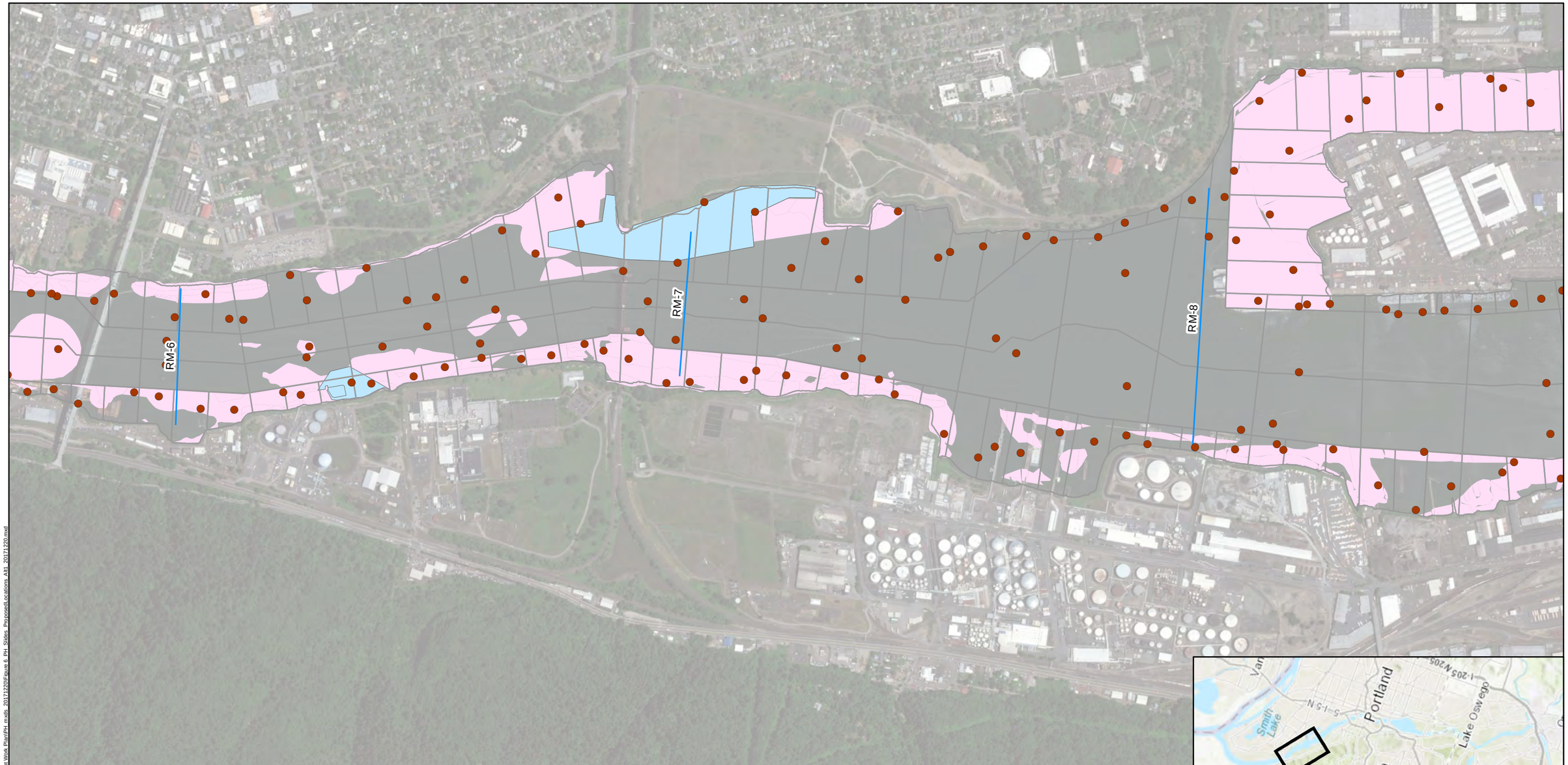
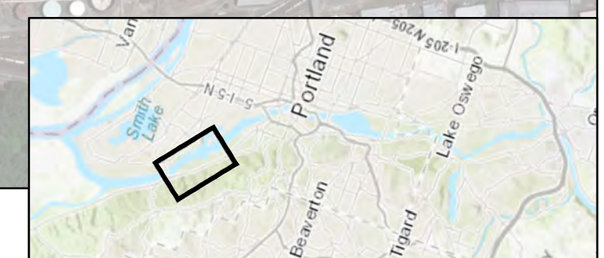
Figure 6b

Path: P:\Projects\Portland Pre-Design\PN\G0767A\9\90\GIS and CAD\MXDs\Surface Sediment Work Plan\PH_mxds_20171220\Figure 6_PH_Slides_ProposedLocations_Alt1_20171220.mxd





Legend

- Stratified Random Samples (n = 428)
- River Mile Marker
- Randomized Sample Grid Cells
- Capped Area (Existing)
- Alternative F Mod SMA Footprint

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Surface sediment samples are defined as the 0-30 cm depth.
3. n - sample count, RM - river mile, SMA - Sediment Management Area.

N

1,000 500 0 1,000 2,000 Feet

Proposed Stratified Random Site Sample Locations (Alternate 1) RM 6 to 8

Portland Harbor Superfund Site
PDI Surface Sediment FSP

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Figure 6c

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Path: P:\Projects\Portland Pre-Design\PN\G076\A\900\GIS and CAD\MXDs\Surface Sediment Work Plan\PH_mxds_20171220\Figure 6_PH_Slides_ProposedLocations_Alt1_20171220.mxd

Legend

- Stratified Random Samples (n = 428)
- River Mile Marker
- Randomized Sample Grid Cells
- Capped Area (Existing)
- Alternative F Mod SMA Footprint

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Surface sediment samples are defined as the 0-30 cm depth.
3. n - sample count, RM - river mile, SMA - Sediment Management Area.

N

1,000 500 0 1,000 2,000 Feet

Proposed Stratified Random Site Sample Locations (Alternate 1) RM 8 to 10

Portland Harbor Superfund Site
PDI Surface Sediment FSP

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Figure **6d**

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Path: P:\Projects\Portland Pre-Design\PN\G0767A\900\GIS and CAD\MXDs\Surface Sediment Work Plan\PH_mxds_20171220\Figure 6_PH_Slides_ProposedLocations_Alt1_20171220.mxd

Legend

- Stratified Random Samples (n = 428)
- River Mile Marker
- Randomized Sample Grid Cells
- Capped Area (Existing)
- Alternative F Mod SMA Footprint

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Surface sediment samples are defined as the 0-30 cm depth.
3. n - sample count, RM - river mile, SMA - Sediment Management Area.

N

1,000 500 0 1,000 2,000 Feet

Proposed Stratified Random Site Sample Locations (Alternate 1) RM 10 to 11.8

Portland Harbor Superfund Site
PDI Surface Sediment FSP

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Figure 6e

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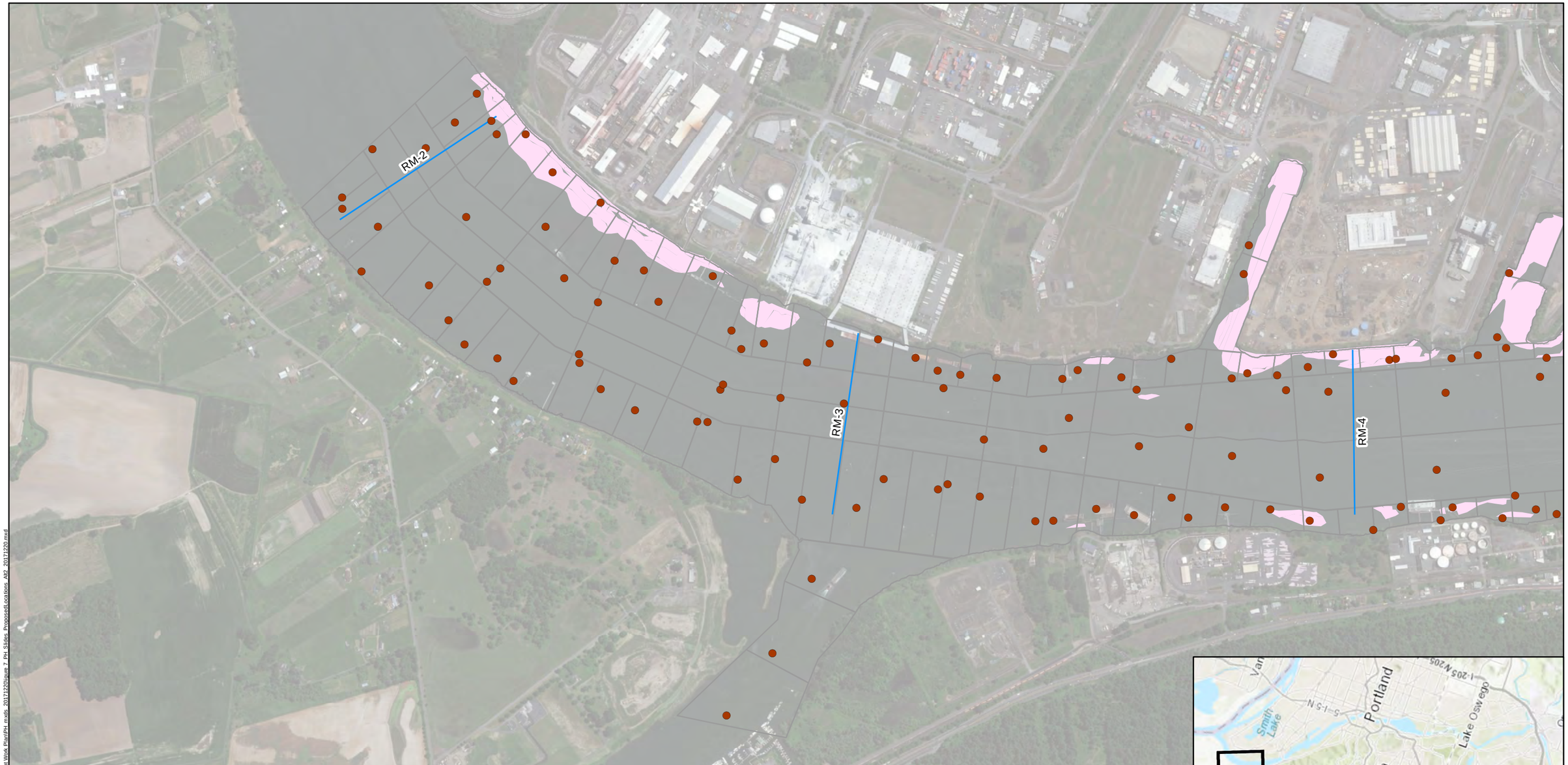

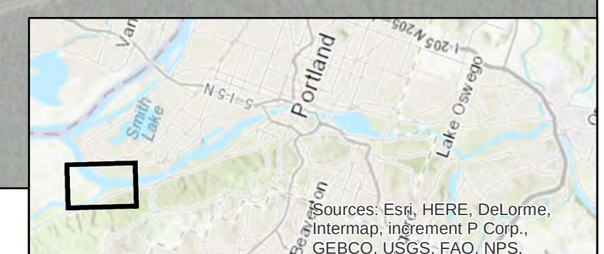

Legend

- Stratified Random Samples (n = 428)
- River Mile Marker
- Randomized Sample Grid Cells
- Capped Area (Existing)
- Alternative F Mod SMA Footprint

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Surface sediment samples are defined as the 0-30 cm depth.
3. n - sample count, RM - river mile, SMA - Sediment Management Area.

N

1,000 500 0 1,000 2,000 Feet

Proposed Stratified Random Site Sample Locations (Alternate 2) RM 1.9 to 4

Portland Harbor Superfund Site
PDI Surface Sediment FSP

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Figure 7a

Path: P:\Projects\Portland Pre-Design\PNG076\A9\00\GIS and CAD\MXDs\Surface Sediment Work Plan\PH_mxds_20171220\figure 7_PH_Slides_ProposedLocations_A82_20171220.mxd

Legend

- Stratified Random Samples (n = 428)
- River Mile Marker
- Randomized Sample Grid Cells
- Capped Area (Existing)
- Alternative F Mod SMA Footprint

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Surface sediment samples are defined as the 0-30 cm depth.
3. n - sample count, RM - river mile, SMA - Sediment Management Area.

N

1,000 500 0 1,000 2,000 Feet

Proposed Stratified Random Site Sample Locations (Alternate 2) RM 4 to 6

Portland Harbor Superfund Site
PDI Surface Sediment FSP

AECOM Geosyntec consultants

Figure 7b

MI/SEA | March 23, 2018

Path: P:\Projects\Portland Pre-Design PNG0767A\900 GIS and CAD\MXDs\Surface Sediment Work Plan\PH_mxds_20171220\figure 7_PH_Slides_ProposedLocations_Alt2_20171220.mxd

Legend

- Stratified Random Samples (n = 428)
- River Mile Marker
- Randomized Sample Grid Cells
- Capped Area (Existing)
- Alternative F Mod SMA Footprint

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Surface sediment samples are defined as the 0-30 cm depth.
3. n - sample count, RM - river mile, SMA - Sediment Management Area.

N

1,000 500 0 1,000 2,000 Feet

Proposed Stratified Random Site Sample Locations (Alternate 2) RM 6 to 8

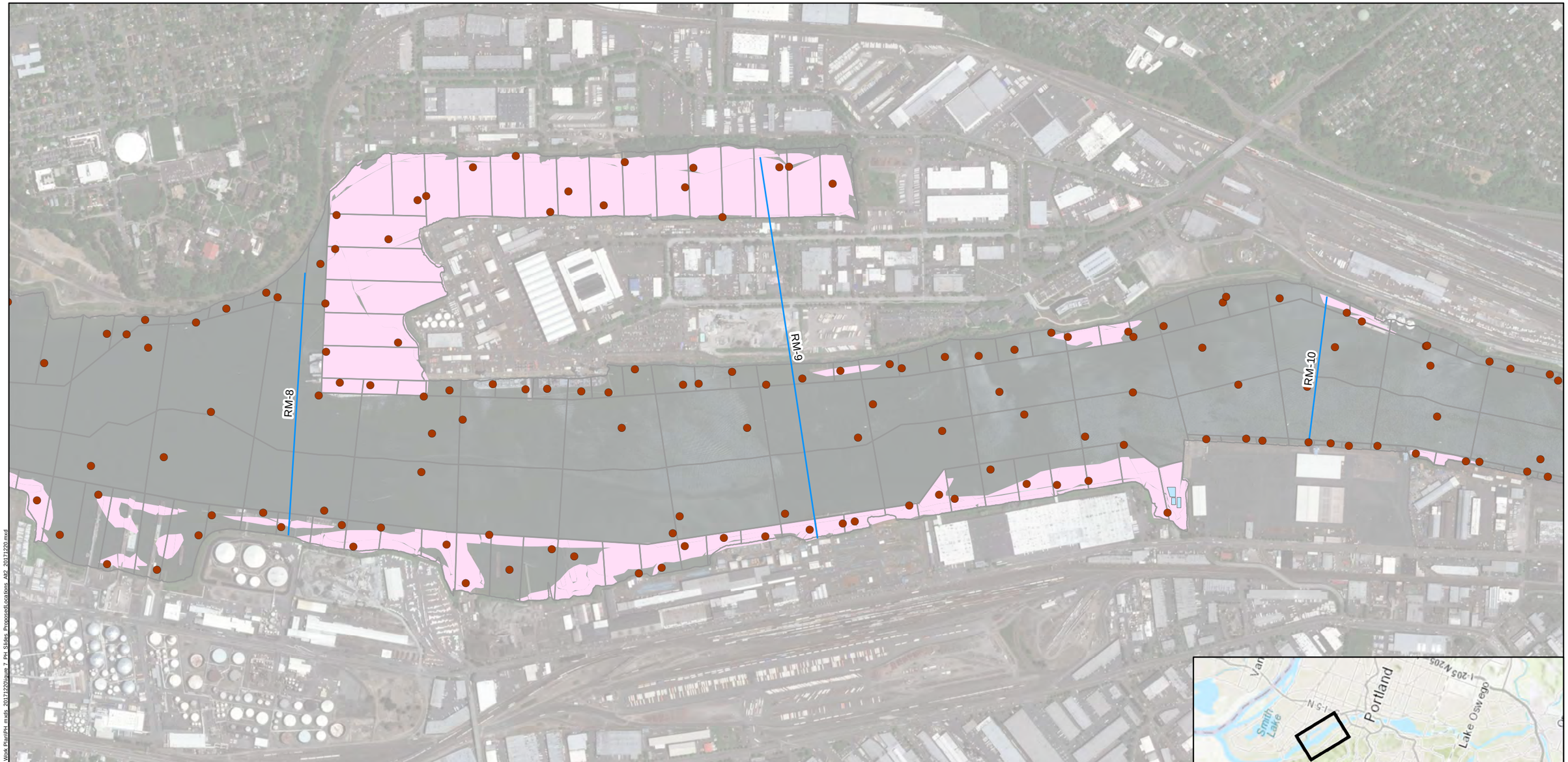
Portland Harbor Superfund Site
PDI Surface Sediment FSP

AECOM Geosyntec consultants

Figure 7c

MI/SEA | March 23, 2018

Path: P:\Projects\Portland Pre-Design\PN\G0767A\90\GIS and CAD\MXDs\Surface Sediment Work Plan\PH_mxds_20171220\figure 7_PH_Slides_ProposedLocations_A82_20171220.mxd



Legend

- Stratified Random Samples (n = 428)
- River Mile Marker
- Randomized Sample Grid Cells
- Capped Area (Existing)
- Alternative F Mod SMA Footprint

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Surface sediment samples are defined as the 0-30 cm depth.
3. n - sample count, RM - river mile, SMA - Sediment Management Area.

N

1,000 500 0 1,000 2,000 Feet

Proposed Stratified Random Site Sample Locations (Alternate 2) RM 8 to 10

Portland Harbor Superfund Site
PDI Surface Sediment FSP

AECOM Geosyntec consultants

Figure 7d

MI/SEA | March 23, 2018

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Legend

- Stratified Random Samples (n = 428)
- River Mile Marker
- Randomized Sample Grid Cells
- Capped Area (Existing)
- Alternative F Mod SMA Footprint

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Surface sediment samples are defined as the 0-30 cm depth.
3. n - sample count, RM - river mile, SMA - Sediment Management Area.

N

1,000 500 0 1,000 2,000 Feet

Proposed Stratified Random Site Sample Locations (Alternate 2) RM 10 to 11.8

Portland Harbor Superfund Site
PDI Surface Sediment FSP

AECOM Geosyntec consultants

MI/SEA | March 23, 2018

Figure 7e

Path: P:\Projects\Portland Pre-Design PN\0767A\900 GIS and CAD\MXDs\Surface Sediment Work Plan\PH_mxds_20171220\Figure 7_PH_SMAs_ProposedLocations_A82_20171220.mxd

APPENDIX A – Sediment Logging Keys, Equipment Checklist, and Field Forms

A-1. Summary of the ASTM Visual-Soil Classification Method and Sediment Sample Logging Key

A-2. Equipment Checklist

A-3. Field Forms

Appendix A-1 Summary of the ASTM Visual-Soil Classification Method and Sediment Sampling Logging Key

MAJOR DIVISION			GROUP SYMBOL	LETTER SYMBOL	GROUP NAME
COARSE GRAINED SOILS CONTAINS MORE THAN 50% FINES	**GRAVEL AND GRAVELLY SOILS** MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVEL WITH 5% FINES		GW	Well-graded GRAVEL
				GP	Poorly graded GRAVEL
		GRAVEL WITH BETWEEN 5% AND 15% FINES		GW-GM	Well-graded GRAVEL with silt
				GW-GC	Well-graded GRAVEL with clay
				GP-GM	Poorly graded GRAVEL with silt
				GP-GC	Poorly graded GRAVEL with clay
		GRAVEL WITH ≥ 15% FINES		GM	Silty GRAVEL
				GC	Clayey GRAVEL
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SAND WITH 5% FINES		SW	Well-graded SAND
				SP	Poorly graded SAND
		SAND WITH BETWEEN 5% AND 15% FINES		SW-SM	Well-graded SAND with silt
				SW-SC	Well-graded SAND with clay
				SP-SM	Poorly graded SAND with silt
				SP-SC	Poorly graded SAND with clay
		SAND WITH ≥ 15% FINES		SM	Silty SAND
				SC	Clayey SAND
FINE GRAINED SOILS CONTAINS MORE THAN 50% FINES	SILT AND CLAY	LIQUID LIMIT LESS THAN 50		ML	Inorganic SILT with low plasticity
				CL	Lean inorganic CLAY with low plasticity
				OL	Organic SILT with low plasticity
		LIQUID LIMIT GREATER THAN 50		MH	Elastic inorganic SILT with moderate to high plasticity
				CH	Fat inorganic CLAY with moderate to high plasticity
				OH	Organic SILT or CLAY with moderate to high plasticity
HIGHLY ORGANIC SOILS				PT	PEAT soils with high organic contents

Notes

1. Sample descriptions are based on visual field and laboratory observations using classification methods of ASTM D2488. Where laboratory data are available, classifications are in accordance with ASTM D2487.
2. Same percentage distribution and group name method applies to fine-grained soils and % of sand and gravel it contains.
3. Fines are material passing the U.S. Std. #200 Sieve.

AECOM Geosyntec consultants

PDI Portland Harbor Superfund Site Pre-Remedial Design and Baseline Sampling Portland, OR

Appendix A-1: Summary of the ASTM Visual-Soil Classification Method

Appendix A-1
Portland Harbor PDI Sediment
Sample Logging Key

Visual Sediment Descriptions consist of the following:

- Moisture content
- Density/consistency (estimated based on visual observation)
- Color (Munsell Number)
- Major/Minor Contituents
- Amount and shape of minor constituents and major constituent structure
- Sheen and odor
- Redox potential discontinuity

Example: wet, soft, olive green (GLEY 1, 5/10Y) clayey SILT, little sand, moderate shell fragments, and trace twigs and rootlets. Silt texture is uniform, slightly compressible, massive, blocky, and of low plasticity. Slight odor and trace sheen. RPD 1 cm.

Sediment Description Terminology: Estimated based on visual observations

Moisture Content

Dry	Little perceptible moisture
Damp	Some perceptible moisture, probably below optimum
Moist	Probably near optimum moisture content, no visible water
Wet	Visible free water, probably above optimum

Density: Visual Core Drive Penetration

SAND or GRAVEL		SILT or CLAY
Density	**Visual**	**Consistency**
Very loose	freefall	Very soft
Loose	easy penentration	Soft
Medium dense	moderate penentration	Medium stiff
Dense	hard penentration	Stiff
Very dense	refusal	Very Stiff/Hard

Color descriptions in Munsell Charts

MAJOR and Minor Constituent % (by weight)

Core Logs	Percent	Field Logs
Trace (clay, silt, etc.)	0–5	not identified
Few (clay, silt, etc.)	5-15	Slightly (clayey, silty, etc.)
Little (clay, silt, etc.)	15-30	Clayey, silty, sandy, gravelly
Clayey, silty, sandy, gravelly	30-50	Very (clayey, silty, sandy, etc.)
GROUP NAME	> 50	GROUP NAME

Other Minor Constituents: % (by volume)

(i.e., shells, wood, organics, plastic, non-native debris)

Trace	0-5
Scattered	5-10
Moderate	10-30
Substantial	30-50
GROUP NAME	> 50

Structure

Stratified	Alternating layers of varied material/color at least 1/4" thick
Laminated	Alternating layers of varied material/color at least 1/4 mm thick
Blocky	Cohesive soil that can be broken down into smaller lumps
Spongy	Organic and compressible nature
Lensed	Inclusion of thin discontinuous layers of different sediment
Homogenous/Massive	Same color and appearance throughout
Fibrous	Stringy or rope like structure
Seam	1/16 to 1/2" thick
Layer	greater than 1/2" thick
Interbedded	Multiple beds within a unit
Rolls Easily	Play-dough like (plasticity observation)
Angular	Sharp edges
Subangular	Rounded edges
Subrounded	Well-rounded edges
Rounded	Smoothed, no edges

Odor Descriptions

none
trace
slight
moderate
strong

Sheen Test- % coverage

S.T. = Sheen test visual analysis	
none, trace	<2
slight sheen	2-15
moderate sheen	15-40
moderate to heavy	40-70
heavy	>70

Sheen Test- Visual Description

rainbow	multicolored
metallic	metallic gray-colored
florets	semi-circular and multicolored
streaks	long and flowing shape

Other Sediment Descriptions Used

Agglomerate	Fused-appearance, often vesicular
Clast/inclusion	Non-fused appearance
Xenoclasts	Clasts that have been moved
Fresh	No visible sign of decomposition or discoloration
Winnowed	Loss of fines
Slumped	Settled but intact
Pockets/balls	Semicircular to circular inclusion/deposit
Chunky	Mass of unidentified material

Sediment Core Log Guidelines

----------	color or minor change
————	major sediment change
━━━━	depositional change

Core Acceptance Guidelines

1. Desired drive/penetration depth is reached.
2. Core recovery is greater than 70%.
3. Core tube appears intact (no signs of blocking, bending).
4. Minimal sediment loss out the top or bottom (minimal winnowing).

Grab Acceptance Guidelines

1. No or minimal excess water leaking from the jaws of the sampler.
2. No excessive turbidity in the overlaying water of the sampler.
3. Sampler did not over-penetrate.
4. Sediment surface appears to be intact with minimal disturbance.
5. Program-specific penetration (30 centimeters) has been achieved.

NOTES:

*Classification of sediment on core logs is based on visual field observations.
Classification notes should not be construed to imply laboratory testing unless presented herein. Unified Soil Classification System ASTM D-2487 and Visual-manual classification method ASTM D-2488 for the description and identification of soils were used as an identification guide.

Appendix A-2 Portland Harbor PDI
Sediment Sampling Equipment List

Safety Equipment
GPS
Cell phones (fully charged) or Satellite phone (if no cell coverage)
VHF radios
Rescue rope in throw bag
Air horns and/or whistles
Waterproof flashlight
Secondary "kicker" motor or alternative propulsion
Bailer or bilge pump/emergency pump
Length of rope for securing boat
US Coast Guard approved Type III or V PFD or life jacket
Type 4 throwable ring or cushion
Type BC fire extinguisher (10 pound) if extra fuel is carried in portable containers.
Anchor with appropriate length of line
First-Aid Kit and AED
Oil booms
PID
Bottled water
Snacks
Float plan

PPE
Boots, waterproof, steel-toed
Gloves, nitrile, heavy outer
Gloves, nitrile, thin inner
Hard hats
Hearing protection
Rain slicks
Safety glasses/goggles
Butcher apron or Tyvek for decon
Warm/dry clothes

Sample Handling
Vibracore sampler, core and tubes [1]
Hydraulic power grab sampler [2]
Bowls, large, stainless
Spoons, small, stainless
Spoons, large, stainless
Bottleware, sample analyses specific
Sample labels
core caps [1]
core catchers [1]

Plans
Field Sampling Plan [3]
Maps
Health and Safety Plan
Quality Assurance Program Plan

Tools
Hacksaw and Circular saw [1]
Extension cord and power strip [1]
Drywall blade, 6"
Ruler (12 inch/30 cm)
Measuring tape (with 1/10 inch increments) [1]
Rubber mallet [1]
Screwdrivers (Phillips, flat)
Siphon tubes [2]
Utility knife
Lead line (if not on vessel)

Supplies
Handheld GPS, fully charged
Camera
Gas for boat, if applicable
Keys for boat, if applicable
White board, white board markers
Bags, plastic zip, gallon-size
Bags, plastic zip, quart-size
Duct tape, electrical tape, and packing tape
Plastic sheeting
Ice
Logs, field [3]
Field books
Paper towels
Pens, ballpoint, permanent [3]
Sharpies, small and large
Trash bags
Zip ties
4" pipe clamps
Core carrying box

Decon Equipment
Brushes, long-handled
Brushes, short-handled
Detergent, laboratory (e.g., Alconox)
Methanol/hexane in dispensing bottle (optional)
Nitric acid, 10% in dispensing bottle (optional)
5 gallon buckets, or similar
Aluminum foil
Water, distilled in dispensing bottle

Notes:
1: Subsurface Coring specific equipment
2: Surface grab sampling specific
3: Write-in-Rain waterproof paper/pens are recommended

Portland Harbor PDI Surface Sediment Sampling Log

Location ID: _____

Sample Date: ____ / ____ / _____

Page: 1 of ____

Vessel (circle one):	Tieton Cayuse
Weather Conditions:	
Depth Sounding Method:	*AirMar Echo Sounder (Bow Mounted)*
Gauge Source (circle one):	NOAA PRT03 USGS 14211720
Gauge Height and Datum:	ft PRD, Measurement Time:
Horizontal Coordinate Datum	*NAD 1983 Oregon State Plane North (Intl ft)*
Proposed Coordinates:	Easting: Northing:

Sampling Personnel:	Notes: Sampler:
Subcontractor Personnel:	Captain: Deckhand:
Sampling Equipment	*Powergrab, Stainless Steel Bowls & Spoons*
General River Location:	

Sample Type (circle one):	Baseline/BL	SMA / Co-Located with Core	Downtown/Upriver
Analytical Suite (circle one):	Full ROD Table 17	Four Focused COCs	

EPA Oversight During Sample Collection? No Yes If Yes, name of person: _____

(Definitions: Rec. = recovery; JC = jaws closed; OLW = overlying water; In 3-PT? = sediment used in 3-Point composite)

Attempt Summary

Attempt #	Radius (ft)	Time	Coordinates Easting:	Coordinates Northing:	Water Depth (ft)	Rec. Depth (cm)	JC? ✓	OLW? ✓	Accepted ✓	Photo? ✓	Additional Comments	Sample Interval (cm)	In 3-PT? ✓
1													
2													
3													
4													
5													
6													
7													

Homogenized 3-Point Composite Sample Description

3 x Attempt #s:	Color, Minor/Major Constituent %, Density:

Sample Information

Sample ID	Sample Time	Sample Type (Primary, Duplicate, MS/MSD, EPA Split)	# of Containers
		Primary	

Additional Comments (weight adjustments/per attempt; substrate bin type; access issues; probing results)

Portland Harbor PDI Surface Sediment Sampling Log

Location ID: _____

Sample Date: ____ / ____ / _____

Page: ____ of ____

Sediment Description	
Attempt #:	Redox Potential Discontinuity (RPD): cm
Structure:	
Density, Color, Minor/Major Constituent %:	
Odor/Sheen:	
Organics, Biota, or Other:	

Sediment Description	
Attempt #:	Redox Potential Discontinuity (RPD): cm
Structure:	
Density, Color, Minor/Major Constituent %:	
Odor/Sheen:	
Organics, Biota, or Other:	

Sediment Description	
Attempt #:	Redox Potential Discontinuity (RPD): cm
Structure:	
Density, Color, Minor/Major Constituent %:	
Odor/Sheen:	
Organics, Biota, or Other:	

APPENDIX B – Standard Operating Procedures

B-1. Horizontal and Vertical Station Control

B-2. Surface Sediment Sampling (Integral 2004)

B-3. Management of IDW

B-4. Field Wet Sieving for Grain Size

STANDARD OPERATING PROCEDURE
HORIZONTAL AND VERTICAL SURVEY CONTROL

Introduction

This Standard Operating Procedure (SOP) has been developed for the Pre-Remedial Design Sampling and Baseline Investigations (PDI) at the Portland Harbor Superfund Site located in Portland, Oregon to confirm accurate positioning of vessels and samples during sample collection activities. The survey control requirements described in this SOP are specifically for environmental sample collection and will generally comply with map-grade precision and accuracy in contrast to the geodetic-grade precision and accuracy performed for the Bathymetric Survey conducted by David Evans and Associates (DEA). However, the same survey control points and geodetic parameters will be used in both surveys for consistency, and a portion of the quality assurance/quality control (QA/QC) process will involve consultation with DEA Oregon Professional Land Surveyor (PLS) staff to review the map-grade data collected for the environmental sample collection.

The organization of this SOP is as follows:

- Methodology Overview
- Project Geodetic Parameters
- Survey Accuracy, Precision, and Control
- Primary Equipment
- Hand-Held GPS Operation
- Vessel Navigation and Equipment Operation
- Data Processing and QA/QC Procedures

Tables, figures, and attachments are presented at the end of the SOP.

Methodology Overview

Horizontal (Map) Data Collection

A combination of vessel-mounted and hand-held GPS receivers will be used to navigate to sampling locations and to collect map location coordinates (Northings, Eastings) for those sampling locations. The vessel-mounted GPS receivers will be the primary tool used for navigation to the pre-planned sampling locations in a GIS file, which will be pre-loaded into the vessel navigational system. The hand-held GPS devices will be used as a backup and confirmation of vessel position only if there are problems with the vessel GPS navigation system or if there is no specific vessel navigation system (i.e., smaller boats). Since the inception of field work, the vessel GPS coordinates have been consistently verified and deemed to be sufficient to meet position and accuracy requirements for the project. The hand-held GPS devices will primarily be used for studies involving small vessels. These devices will also have the pre-loaded basemap content depicting planned sampling locations.

The vessel GPS will operate in two modes, collecting both a separate continuous data stream of positional information (line file) and recording GPS soundings (target file) when a sample is specifically

collected. The sample location target file will be recorded when the sampling device is in position for the grab (e.g., when sampler is on the river bottom). The specific Location ID associated with the sample will also be recorded in the GPS device log. Field personnel will be required to write that same Location ID on their field data collection forms at the same time. Both the continuous and episodic dataset will be timestamped to allow comparison of the two types of data. This data will be recorded and maintained on the vessel, and will also be exported from the vessel navigation system and archived to project servers on a daily basis.

The hand-held GPS devices will be operated independently of the vessel's systems and will be used to record a location sounding wherever a sample is collected only for studies unable to use the vessel GPS navigation system. The sample location sounding will be recorded approximately at the same time as when the vessel GPS measurement is collected (e.g., when sampler is in position). The specific Location ID associated with the sample will also be recorded on the GPS device. Field personnel will write this Location ID on the field forms only if the vessel measurement described earlier cannot be collected for some reason (e.g., equipment failure). These measurements will also be timestamped. The data from the hand-held GPS devices will be wirelessly synchronized to a "cloud" web service in near real-time; the data from the "cloud" will also downloaded and saved to project servers daily.

Vertical Data Collection

Vertical (elevation) data is also required for water levels, sample collection depth below surface water, and bottom (mudline) depth location for some types of sample locations. For increased precision and accuracy, it is proposed that bottom (mudline) depth locations (e.g., for sediment cores) be calculated from the bathymetric surface to be developed by the hydrographic survey performed by DEA (since the data will be collected within a few months of each other). The NAVD88 elevation will be calculated from the intersection of the surface map location coordinates collected as described earlier, projected vertically down to the bathymetric surface (United States Army Corps of Engineers [USACE], 2004). The elevation from the intersection of the bathymetric surface will be used as the final or "best" elevation for the sample.

In contrast, for depth measurements that require less precision (e.g., water levels, depth to samples below water surface), the onboard vessel sonar will be used to record depth and then subsequently calculate elevation. All depths will be recorded relative to the water surface and time tagged to correct with time tagged gauge data for obtaining riverbed elevations. The elevation will be calculated to NAVD88 datum. To correct elevations, gauge data from the Northwest River Forecast Center will be downloaded for gauge PRT03, which is representative of the former Morrison gauge which has been moved. This gauge does not report NAVD88 elevations but rather reports a value that is 0.3 feet above Columbia River Datum (CRD). Corrections from CRD to NAVD88 differ moving down the river from the gauge due to the fact that NAVD88 is a reference normal to gravity (water does not flow if the elevation is unchanging), and CRD is a gradient datum that follows the lower water surface. In Portland Harbor, the difference between CRD and NAVD88 (Geoid12b) ranges from 0.00 feet CRD = -5.16 feet NAVD88 (Geoid12b) at Willamette River river mile (RM) 2.0, to 0.00 feet CRD = -5.41 feet NAVD88 (Geoid12b) at Willamette River RM 12.8 (approximate location of PRT03 Gauge). Accordingly, a correction to the Willamette Gauge in Portland would be -5.41+0.3 or -5.11 feet at RM 12.8. An approximation would be to subtract 5 feet from the gauge reading for the full length of the

study area, but precision will vary depending on tides and river gradient.

For sample locations requiring vertical information, depth will be recorded by field staff on their data collection forms relative to the water surface, and these values will be loaded to the project database as described in the Data Quality Management Plan (DQMP). Final calculated NAVD88 elevation data (feet) will also be entered into a separate data field in the project database after completion of spatial analysis, calculations, and QA/QC. DEA will provide support during the QA/QC process to verify proper calculation of NAVD88 elevation data.

Location Position Recording in Project Database

Discrete Samples

When discrete samples are collected, the Location ID and the location coordinates (Northing/Easting) will be recorded on the GPS device(s) and the field data collection form(s). The location coordinates will be based on the vessel GPS instantaneous target measurement. This target measurement will be the location coordinate pair loaded initially to the project database. After the field event is completed, the target measurement will be compared to the line file (vessel continuous GPS measurement) to confirm that the coordinate pair loaded to the project database is appropriate. If analysis reveals precision or accuracy issues, the loaded location coordinate pair in the project database may be updated and edited with a better value derived from the line file. In general, the hand-held GPS devices will be used as a backup and confirmation of vessel position only if there are problems with the vessel GPS navigation system or an independent navigation system is not available on the vessel. These coordinates will be loaded to the project database only if there is a significant problem with the vessel GPS (e.g., equipment failure) or if there is no vessel GPS.

Composite Samples

When composite samples are collected, location coordinates will also be recorded as both target measurements and continuous measurements using the vessel GPS. The continuous GPS measurements will be recorded during the entire compositing event, and instantaneous target measurements will be collected when the sampler is in position for each individual composite grab. At each compositing location, a target measurement will be recorded in the vessel GPS along with the Location ID with an “a,” “b,” or “c” suffix. These measurements will be recorded on the field forms in the same manner (e.g., there will be three sets of location coordinates, lithologic descriptions, etc.).

When the location data is loaded to the project database, a single set of location coordinates will be recorded in the project database with a Location ID that excludes the “a,” “b,” or “c” suffix. As a presumed middle time point, the “b” set of coordinates will be loaded with the primary Location ID to the project database. After the field event is completed, the target measurement associated with the “b” location composite will be compared to the line file (vessel continuous GPS measurement) to assess vessel position and the timeframe of the entire sampling event to confirm if the coordinate pair loaded to the project database is appropriate. The goal will be to finalize the location coordinate information in the project database based on the most representative position based on this analysis. Similar to discrete sample collection, a hand-held GPS device and related data will only be loaded to the project database if there is a significant problem with operation of the vessel GPS or if the vessel does not have a GPS.

Finally, after field data are collected and surveys are completed, as defined in the DQMP, the location coordinate data will be joined with the tabular data collected by the field teams and loaded to the project database.

Project Geodetic Parameters

The geodetic parameters to be used for the PDI field studies will be as follows:

Horizontal Datum: North American Datum of 1983 (2011)
Projection: State Plane Coordinate System (SPCS) Oregon North Zone
Vertical Datum: North American Vertical Datum of 1988 (NAVD88) Geoid12b
Units: International Feet

Survey Accuracy, Precision, and Control

The anticipated horizontal accuracy of environmental sampling associated with vessel and hand-held GPS devices is a range of 1 to 5 meters (target 1 to 2 meters for the DGPS unit itself). This should be consistent with RI target accuracy (Integral 2002) and best practices (Puget Sound Estuary Protocols [PSEP] 1998 and US Environmental Protection Agency [EPA] 2008).

The anticipated vertical accuracy of final elevation calculations derived from vessel sonar systems is anticipated to be 1.0 meter.

Table 1 summarizes the survey control locations used in the DEA Bathymetric Survey, which will be used for the environment sample collection work described in this SOP. Figure 1 shows the PH2 piling at Fred Devine boat dock, and Figure 2 shows the approximate locations of the survey control references. Attachment 1 contains detailed survey sheets of the control points: Raindeer, PH1 and PH2, and 2100.

Primary Equipment

- Trimble® SPS 461 GPS with dual antennas (vessel GPS)
- A-frame assembly, sampling winch (vessel boom)
- Trimble® R1 (hand held GPS), tethered to Bluetooth® capable smartphone or tablet, ESRI Collector software with Trimble® GNSS Status middleware
- GPS owner's manual
- Writing tools (pencils, Sharpie®)
- Field logbook
- Spare batteries and/or battery charger
- Compass
- Tape measure

Hand-Held GPS Operations

For ease of use, the project team will utilize smartphones tethered to the Trimble® R1 GNSS Receiver via a Bluetooth® connection. The smartphone will be configured with Trimble's middleware software called GNSS Status to convert and stream NMEA satellite data to the smartphone for real-time

correction and display to a simple electronic data collection form developed on the ESRI Collector platform. The form will contain a limited number of data fields, including location, study name and operator, date, and notes or comments. This form is not intended to duplicate the content and scope of the field data collection forms, but rather clearly link the GPS data to those forms via the unique Location ID. There are metadata fields available as well from these GPS records, such as estimated horizontal accuracy.

Collected data recorded onto the phone will be transmitted wirelessly via a synchronization process invoked when data is "saved" to the device. The data will be pushed to AECOM Online's Portal and ArcGIS Server for storage of "corrected" location coordinates, Location ID, and other information captured when the GPS sounding is recorded. The sampling event will be trackable in near-real-time as samples are collected on the ArcGIS Portal Interface. Either dedicated, experienced GPS-operators will be collecting the measurements on the smartphones, or, due to the very simple nature of the interface, field personnel will be trained to use the devices. Initial training sessions were already successfully conducted March 19-20, 2018 on use of the smartphone GPS interface. These handheld devices were successfully used for the first 2 weeks of field work. For some studies, such as the smallmouth bass tracking study, these handhelds may be used as the primary GPS due to smaller vessel configuration.

Vessel Navigation and Equipment Operation

Vessel positioning will be conducted through the marine navigation and hydrographic software package HYPACK. This software package allows the visualization of the vessel over navigable charts, the processing of satellite corrections, stored hardware, and vessel parameters, as well as the storing of physical target locations during sampling activities. HYPACK version 2017 will be used for this project.

Vessel position is measured using a Trimble SPS 461 GPS dual antenna receiver. The dual antennas provide precise vessel positioning via both satellite and differential radio corrections along with heading correction to 0.09 degree. GPS data is output through a serial connection into computer running the HYPACK software, for vessel positioning and target collection.

At each sampling location, depth to mudline will be measured using an onboard fathometer (with lead line as confirmation as needed) immediately prior to or during the sampling. Water depths are measured at each station using an Airmar ss510 survey sonar at the sampling point and confirmed daily with a lead line with reference to water surface. Vertical measurements will be recorded to the nearest 0.1 foot. Water depths will be converted to elevations in NAVD88 based on the river stage at the time of sampling as recorded at the closest available tide gage.

Data Processing and QA/QC Procedures

All GPS devices will be subject to a position check to confirm the accuracy of the on-vessel GPS and hand-held GPS devices and to validate the positions derived from each GPS receiver. Correctors being applied as needed, resulting in a position that is within specified positioning accuracy of the DEA published position for control monument PH1 and PH2. At the start and end of each field day, the PH2 benchmark location will be visited by boat to perform a position check. At the piling serving as the control monument, the on-vessel GPS calibrated to the top of A-frame assembly will be maneuvered as close to the benchmark piling as possible to record a point. The GPS-derived position

of the sampling vessel is compared with the known horizontal location; results will be recorded in HYPACK to confirm that accuracy is within +/- 2 meters. For handheld GPS, field staff will occupy the PH1 at the Swan Island boat launch parking lot. Using the R1 and phone/tablet combination GPS setup, the field staff will hold the R1 above PH1 and wait for a satellite "fix," and when ready, the staff will record the GPS location in Collector. This GPS location will be compared to the known coordinates to confirm the accuracy is within +/- 2 meters. The survey control monuments act as a known location to allow for corrected station location coordinates during post-processing of data as needed. If a need arises to locate another benchmark, there are several USGS control points near the project area and near the AECOM project warehouse. Experienced GPS operators on the project team will be involved in all aspects of field data collection events to troubleshoot devices and assist in daily review of extracted geospatial datasets. Additional details on QA/QC procedures can be found on the DQMP.

References

AECOM (AECOM Technical Services) and Geosyntec (Geosyntec Consultants, Inc.). 2018. Data Quality Management Plan Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling. Portland Harbor Superfund Site. 22 February.

Integral (Integral Consulting). 2002. Round 1 Field Sampling Plan. Prepared for the Lower Willamette Group (LWG) for submittal and approval by EPA Region 10. June 14.

EPA (United States Environmental Protection Agency). 2008. National Geospatial Data Policy. August 24.

PSEP. 1998. Recommended Guidelines for Station Positioning in Puget Sound. Prepared for United States EPA Region 10 and the Puget Sound Water Quality Action Team. September.

USACE (United States Army Corps of Engineers). 2004. Engineering and Design Hydrographic Surveying Manual, EM 1110-2-1003, U.S. Army Corps of Engineers, April 2004

Attachments

PH Control Points of 2100, Portland Harbor (PH1 and PH2), and Raindeer survey monuments, as well as figures presenting PH2.

Table 1. Benchmark Monument Coordinates and Description

Designation	Approx. Location	Description	NAD83 (2011), Oregon SPCS North (ft)		NAVD88 Elevation (ft)
			Northing	Easting	
DEMSI-BASE	Columbia River	Fixed antenna with height at antenna reference point	718172.70	7654431.05	73.58
DEMSI- CHECK	Columbia River	Fixed antenna with height at antenna reference point	718170.73	7654419.84	71.67
RAINDEER	RM 2	USACE Brass Cap	722443.24	7614886.64	35.44
Portland Harbor (PH1)	Swan Island Boat Ramp	1/2" Iron Rod with red plastic cap stamped "DEA Control" Point is 0.3 feet south of the back of curb at the Swan Island Boat Ramp, 10.5 feet north of a cyclone fence, and 60 feet east of a light post	698702.46	7637426.37	33.38
Portland Harbor 2 (PH2)	Fred Devine Boat Dock	Reference point is 0.2 feet SE of the SE side of a 1-1/2 foot steel pile. This is the furthest SE pile at the end of the Fred Devine Diving and Salvage Company dock in the Swan Island Lagoon. This pile is to be used for daily position checks for sediment sampling operations. Pile is for position only and not elevation.	700967.87	7634507.67	NA
2100	RM 13	5/8" bolt on SW corner of screen wall at DEA office 2100 SW River Parkway, Portland, OR	678400.01	7645190.81	159.51

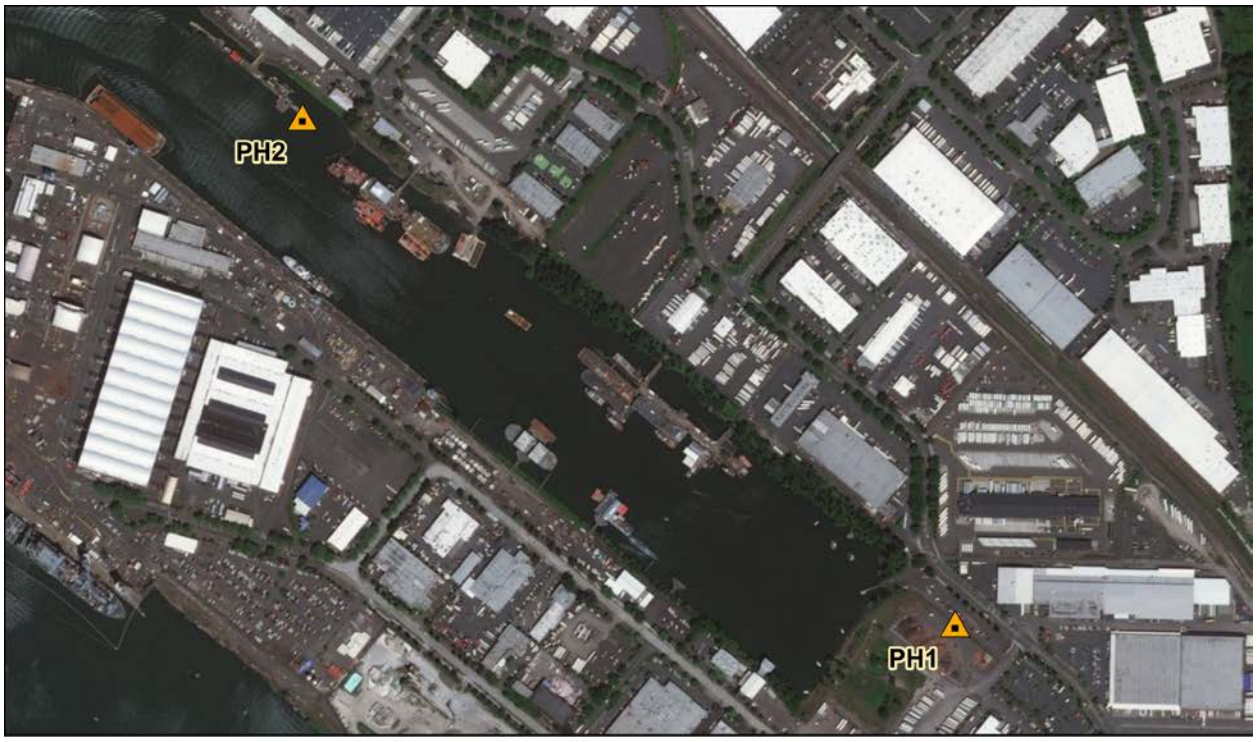
General Notes:

1. The two DEMSI and the 2100 stations are transceiver beacon stations in upland areas (Green Shade).
2. PH1 is located at the Swan Island boat ramp parking lot and accessible by foot.
3. PH2 is located at a piling at the boat dock where project-related vessels will be docked and is accessible by boat.
4. Raindeer station is located adjacent to the river and accessible by foot (for the hand-held GPS).

Acronyms:

DEA = David Evans and Associates; ft = feet; NAD83 = North American Datum of 1983; NAVD88 = North American Vertical Datum of 1988; PH = Portland Harbor; RM = river mile; USACE = US Army Corps of Engineers; SPCS = State Plane Coordinate System

Figure 1. Photograph of Piling PH2, at the end of the Fred Devine Boat Dock. Piling was captured in DEA bathymetric survey. Photo is facing northwest.



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

N 0 250 500 1,000 Feet

PH2 is located on the SE corner of the Fred Devine Boat Dock, where Gravity's boats berth every night.

PH1 is located on the SW side of the Swan Island Boat Launch parking lot, where field crews park to meet the boats at the launch dock.

Figure 2. Locations of control monuments PH1 and PH2 at Swan Island Boat Launch and Fred Devine Boat Dock, respectively.

NOTE: This form intended for field use. Unsolicited data submitted to NGS must be converted to bluebook format.

GPS STATION OBSERVATION LOG
April 16, 2003

Station Designation: (check applicable:__ FBN__ CBN__ PAC__ SAC __BM) 2100		Station PID, if any:	Date (UTC): 06-Mar-18
General Location: DEA Office 2100 SW River Parkway, Portland	Airport ID, if any:	Station 4-Character ID:	Day of Year: 065
Project Name: Portland Harbor - AETR00000034	Project Number: GPS-	Station Serial # (SSN):	Session ID:(A,B,C etc)

NAD83 Latitude o ' "	NAD83 Longitude o ' "	NAD83 Ellipsoidal Height meters	Agency Full Name: David Evans and Associates, Inc.
Observation Session Times (UTC): Sched. Start _____ Stop _____ Actual Start 18:55 Stop 23:00	Epoch Interval= 1 Seconds Elevation Mask = 10 Degrees	NAVD88 Orthometric Ht. meters GEOID99 Geoid Height meters	Operator Full Name: David T. Moehl Phone #: ( ) (360) 314-3200 e-mail address: dtm@deainc.com

Receiver Brand & Model: Trimble SPS855
P/N: 69855-60
S/N: 5506R0075
Firmware Version: 5.30
❒ CamCorder Battery, ❒ 12V DC, ✓ 110V AC, ❒ Other

Antenna Code*, Brand & Model: Trimble Zephyr 3 Base
P/N: 115000-10
S/N: 3121179869
Cable Length, meters: 10
Vehicle is Parked n/a meters ____(direction) from antenna.

Antenna plumb before session?	(✓ / N)	Circle
Antenna plumb after session?	(✓ / N)	Yes or No
Antenna oriented to true North?	(Y / N✓)	-If no,
Weather observed at antenna ht.	(Y / N✓)	explain
Antenna ground plane used?	(Y / N✓)	"
Antenna radome used?	(Y / N✓)	If yes,
Eccentric occupation (>0.5 mm)?	(Y / N✓)	describe.
Any obstructions above 10°?	(Y / N✓)	Use
Radio interference source nearby	(Y / N✓)	Vis. form

Tripod or Antenna Mount: Check one:
❒ Fixed-Leg Tripod, ❒ Collapsible-leg tripod ✓ Fixed Mount
Brand & Model: Bolt
P/N:
S/N:
Last Adjustment date:

Psychrometer (if used) Brand & Model:
P/N:
S/N:
Last Calibration or check Date:

** ANTENNA HEIGHT **	Before Session Begins: Meters	Feet	After Session Ends: Meters	Feet
A= Datum point to Top of Tripod (Tripod Height)	0.000		0.000	
B=Additional offset to ARP if any (Tribrach/Spacer)	0.000		0.000	
H= Antenna Height = A + B = Datum Point to Antenna Reference Point (ARP)	0.000	0.00	0.000	0.00

Meters = Feet x (0.3048)
Height Entered Into Receiver = 0.000 meters.
Note &/or sketch **ANY** unusual conditions. Be **Very Explicit** as to where and how Measured!

Barometer (if used) Brand & Model:
S/N:

Weather Data	Weather Codes	Time (UTC)	Dry-Bulb Temp Fahrenheit	Dry-Bulb Temp Celsius	WetBulb Temp Fahrenheit	WetBulb Temp Celsius	Rel. % Humidity	Atm. Pressure inches Hg	Atm. Pressure millibar
Before	00000	18:55							
Middle									
After	00000	23:00							

Remarks, Comments on Problems, Sketches, Pencil Rubbing, etc:

5/8" bolt found on the southeast corner of the VAC screen wall on DEA office roof at 2100 SW River Parkway, Portland, OR. The geodetic antenna was screwed tight to the top of the double nut on the 5/8" bolt. The antenna height = zero to the antenna reference point (bottom of antenna mount).

Weather codes are required. Weather data are optional but encouraged. *Antenna code comes from ant_info file furnished by project coordinator.

Data File Name(s): 00750650.T02
(Standard NGS Format = aaaaddds.xxx)
where aaaa=4-Character ID, ddd=Day of Year, s=Session ID, xxx=file dependant extension

Updated Station Description: ❒ Attached ❒ Submitted earlier
Visibility Obstruction Form: ❒ Attached ❒ Submitted earlier
Photographs of Station: ✓ Attached ❒ Submitted earlier
Pencil Rubbing of Mark: ❒ Attached

LOG CHECKED BY: Jon Dasler

Table of Weather Codes	CODE	PROBLEM	VISIBILITY	TEMPERATURE	CLOUD COVER	WIND
	0	did not occur	Good, over 15 miles	Normal, 32° F- 80° F	Clear, below 20%	Calm, under 5mph (8km/h)
	1	did occur	Fair, 7-15 miles	Hot, over 80°F (27 C)	Cloudy, 20% to 70%	Moderate, 5 to 15 mph
	2	- not used -	Poor, under 7 miles	Cold, below 32° F (0 C)	Overcast, over 70%	Strong, over15 mph (24km/h)
Examples:	00000 = No problem, good visibility, normal temp, clear, calm wind			12121 = Problems, poor visibility, hot, overcast, moderate wind		

Photo of Monument 2100

Photo of Monument 2100

GNSS Setup on 2100

NOTE: This form intended for field use. Unsolicited data submitted to NGS must be converted to bluebook format.

GPS STATION OBSERVATION LOG
April 16, 2003

Station Designation: (check applicable:__ FBN__ CBN__ PAC__ SAC __BM) Portland Harbor 1 (PH1)		Station PID, if any:	Date (UTC): 06-Mar-18
General Location: Swan Island Boat Launch	Airport ID, if any:	Station 4-Character ID:	Day of Year: 065
Project Name: Portland Harbor - AETR00000034	Project Number: GPS-	Station Serial # (SSN):	Session ID:(A,B,C etc)

NAD83 Latitude: o ' "
NAD83 Longitude: o ' "
NAD83 Ellipsoidal Height: meters
NAVD88 Orthometric Ht.: meters
GEOID99 Geoid Height: meters

Agency Full Name: David Evans and Associate, Inc.
Operator Full Name: David T. Moehl
Phone #: ( ) (360) 314-3200
e-mail address: dtm@deainc.com

Observation Session Times (UTC):
Sched. Start _____ Stop _____
Actual Start 19:30 Stop 21:32

Epoch Interval= 1 Seconds
Elevation Mask = 10 Degrees

Receiver Brand & Model: Trimble SPS985
P/N: 82500-60
S/N: 5616F59510
Firmware Version: 5.30
❒ CamCorder Battery, ❒ 12V DC, ❒ 110V AC, ✓ Other

Antenna Code*, Brand & Model: Trimble SPS985 Internal
P/N:
S/N:
Cable Length, meters: n/a
Vehicle is Parked 10 meters N (direction) from antenna.

Antenna plumb before session?	(✓ / N)	Circle
Antenna plumb after session?	(✓ / N)	Yes or No
Antenna oriented to true North?	(Y / N✓)	-If no,
Weather observed at antenna ht.	(Y / N✓)	explain
Antenna ground plane used?	(Y / N✓)	"
Antenna radome used?	(Y / N✓)	If yes,
Eccentric occupation (>0.5 mm)?	(Y / N✓)	describe.
Any obstructions above 10°?	(Y / N✓)	Use
Radio interference source nearby	(Y / N✓)	Vis. form

Tripod or Antenna Mount: Check one:
✓ Fixed-Leg Tripod, ❒ Collapsible-leg tripod ❒ Fixed Mount
Brand & Model: Seco fixed height
P/N:
S/N: 5115-00-FLY
Last Adjustment date: 2018-03-05

Psychrometer (if used) Brand & Model:
P/N:
S/N:
Last Calibration or check Date:

** ANTENNA HEIGHT **	Before Session Begins: Meters	Feet	After Session Ends: Meters	Feet
A= Datum point to Top of Tripod (Tripod Height)	2.000		2.000	
B= Additional offset to ARP if any (Tribrach/Spacer)	0.000		0.000	
H= Antenna Height = A + B = Datum Point to Antenna Reference Point (ARP)	2.000	6.56	2.000	6.56

Meters = Feet x (0.3048)
Height Entered Into Receiver = 2.000 meters.
Note &/or sketch **ANY** unusual conditions. Be **Very Explicit** as to where and how Measured!

Barometer (if used) Brand & Model:
S/N:

Weather Data	Weather Codes	Time (UTC)	Dry-Bulb Temp Fahrenheit	Dry-Bulb Temp Celsius	WetBulb Temp Fahrenheit	WetBulb Temp Celsius	Rel. % Humidity	Atm. Pressure inches Hg	Atm. Pressure millibar
Before	00000	19:30							
Middle									
After	00000	21:32							

Remarks, Comments on Problems, Sketches, Pencil Rubbing, etc:

Control point is a 1/2" iron rod with red plastic cap stamped "DEA CONTROL" set 0.1' below natural grade. Control point is 0.3' south of the back of curb, 10.5' north of a cyclone fence and 60' easterly of the 2nd light post east of the boat ramp. See detached sketch and photos.

Weather codes are required. Weather data are optional but encouraged. *Antenna code comes from ant_info file furnished by project coordinator.

Data File Name(s): 95100650.T02
(Standard NGS Format = aaaaddds.xxx)
where aaaa=4-Character ID, ddd=Day of Year, s=Session ID, xxx=file dependant extension

Updated Station Description: ❒ Attached ❒ Submitted earlier
Visibility Obstruction Form: ❒ Attached ❒ Submitted earlier
Photographs of Station: ✓ Attached ❒ Submitted earlier
Pencil Rubbing of Mark: ❒ Attached

LOG CHECKED BY: Jon Dasler

Table of Weather Codes

CODE	PROBLEM	VISIBILITY	TEMPERATURE	CLOUD COVER	WIND
0	did not occur	Good, over 15 miles	Normal, 32° F- 80° F	Clear, below 20%	Calm, under 5mph (8km/h)
1	did occur	Fair, 7-15 miles	Hot, over 80°F (27 C)	Cloudy, 20% to 70%	Moderate, 5 to 15 mph
2	- not used -	Poor, under 7 miles	Cold, below 32° F (0 C)	Overcast, over 70%	Strong, over15 mph (24km/h)

Examples: 00000 = No problem, good visibility, normal temp, clear, calm wind 12121 = Problems, poor visibility, hot, overcast, moderate wind

Sketch of Monument PH1

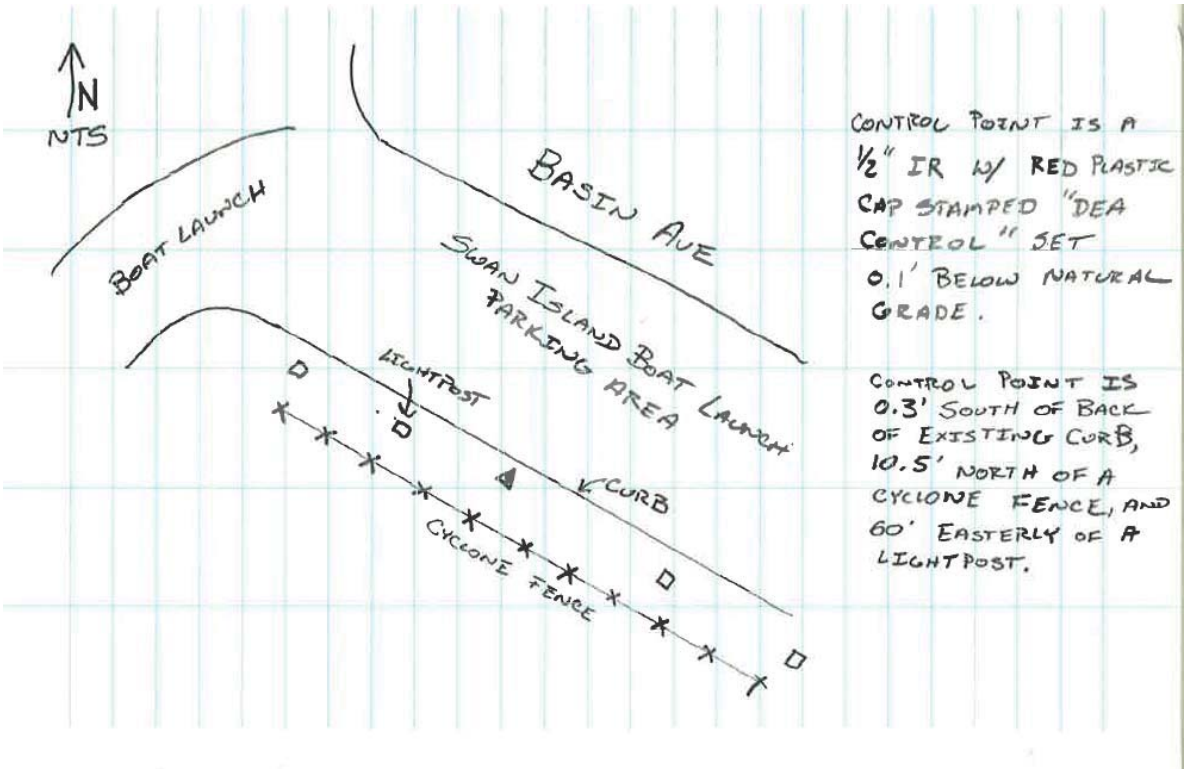


Photo of Monument PH1

GNSS Setup on PH1

NOTE: This form intended for field use. Unsolicited data submitted to NGS must be converted to bluebook format.

GPS STATION OBSERVATION LOG
April 16, 2003

Station Designation: (check applicable:__ FBN__ CBN__ PAC__ SAC __BM) Portland Harbor 2 (PH2)		Station PID, if any:	Date (UTC): 20-Apr-18
General Location: Fred Devine Boat Dock	Airport ID, if any:	Station 4-Character ID:	Day of Year: 111
Project Name: Portland Harbor - AETR00000034	Project Number: GPS-	Station Serial # (SSN):	Session ID:(A,B,C etc)

NAD83 Latitude o ' "	NAD83 Longitude o ' "	NAD83 Ellipsoidal Height meters	Agency Full Name: David Evans and Associate, Inc.
Observation Session Times (UTC): Sched. Start _____ Stop _____ Actual Start 19:45 Stop 19:49	Epoch Interval= 1 Seconds Elevation Mask = 10 Degrees	NAVD88 Orthometric Ht. meters GEOID99 Geoid Height meters	Operator Full Name: David T. Moehl Phone #: ( ) (360) 314-3200 e-mail address: dtm@deainc.com

Receiver Brand & Model: Trimble SPS985	Antenna Code*, Brand & Model: Trimble SPS985 Internal	Antenna plumb before session? (Y / N) ✓ Circle
P/N: 82500-60	P/N:	Antenna plumb after session? (Y / N) ✓ Yes or No
S/N: 5616F59510	S/N:	Antenna oriented to true North? (Y / N) ✓ -If no,
Firmware Version: 5.30	Cable Length, meters: n/a	Weather observed at antenna ht. (Y / N) ✓ explain
❒ CamCorder Battery, ❒ 12V DC, ❒ 110V AC, ✓ Other	Vehicle is Parked n/a meters ____(direction) from antenna.	Antenna ground plane used? (Y / N) ✓ "
		Antenna radome used? (Y / N) ✓ If yes,
		Eccentric occupation (>0.5 mm)? (Y / N) ✓ describe.
		Any obstructions above 10°? (Y / N) ✓ Use
		Radio interference source nearby (Y / N) ✓ Vis. form

Tripod or Antenna Mount: Check one:
✓ Fixed-Leg Tripod, ❒ Collapsible-leg tripod ❒ Fixed Mount
Brand & Model: Seco fixed height
P/N:
S/N: 5115-00-FLY
Last Adjustment date: 2018-03-05

Psychrometer (if used) Brand & Model:
P/N:
S/N:
Last Calibration or check Date:

** ANTENNA HEIGHT **	Before Session Begins: Meters	Feet	After Session Ends: Meters	Feet
A= Datum point to Top of Tripod (Tripod Height)	2.000		2.000	
B=Additional offset to ARP if any (Tribrach/Spacer)	0.000		0.000	
H= Antenna Height = A + B = Datum Point to Antenna Reference Point (ARP)	2.000	6.56	2.000	6.56

Meters = Feet x (0.3048)
Height Entered Into Receiver = 2.000 meters.
Note &/or sketch **ANY** unusual conditions. Be **Very Explicit** as to where and how Measured!

Barometer (if used) Brand & Model:
S/N:

Weather Data	Weather Codes	Time (UTC)	Dry-Bulb Temp Fahrenheit	Dry-Bulb Temp Celsius	WetBulb Temp Fahrenheit	WetBulb Temp Celsius	Rel. % Humidity	Atm. Pressure inches Hg	Atm. Pressure millibar
Before	00010	19:45							
Middle									
After	00010	19:49							

Remarks, Comments on Problems, Sketches, Pencil Rubbing, etc:

Reference point is 0.2 feet SE of the SE side of a 1-1/2 foot steel pile. This is the furthest SE pile at the end of the Fred Devine Diving and Salvage Company dock in the Swan Island Lagoon. This pile is to be used for daily position checks for sediment sampling operations. Pile is for position only and not elevation.
NAD83(2011) Oregon North Zone International Feet Coordinates
North 700967.9 East 7634507.7

Weather codes are required. Weather data are optional but encouraged. *Antenna code comes from ant_info file furnished by project coordinator.

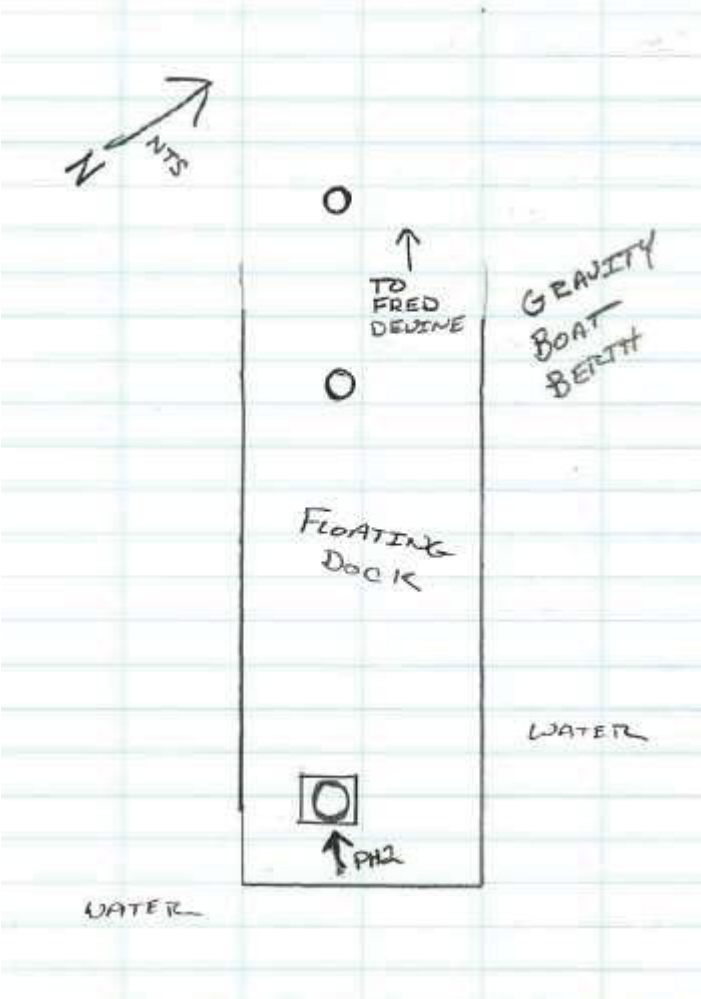
Data File Name(s):
(Standard NGS Format = aaaaddds.xxx)
where aaaa=4-Character ID, ddd=Day of Year, s=Session ID, xxx=file dependant extension

Updated Station Description: ❒ Attached ❒ Submitted earlier
Visibility Obstruction Form: ❒ Attached ❒ Submitted earlier
Photographs of Station: ✓ Attached ❒ Submitted earlier
Pencil Rubbing of Mark: ❒ Attached

LOG CHECKED BY: Jon Dasler

Table of Weather Codes	CODE	PROBLEM	VISIBILITY	TEMPERATURE	CLOUD COVER	WIND
	0	did not occur	Good, over 15 miles	Normal, 32° F- 80° F	Clear, below 20%	Calm, under 5mph (8km/h)
	1	did occur	Fair, 7-15 miles	Hot, over 80°F (27 C)	Cloudy, 20% to 70%	Moderate, 5 to 15 mph
	2	- not used -	Poor, under 7 miles	Cold, below 32° F (0 C)	Overcast, over 70%	Strong, over15 mph (24km/h)
Examples:	00000 = No problem, good visibility, normal temp, clear, calm wind				12121 = Problems, poor visibility, hot, overcast, moderate wind	

Sketch and Fieldnotes



200 CHK PH1

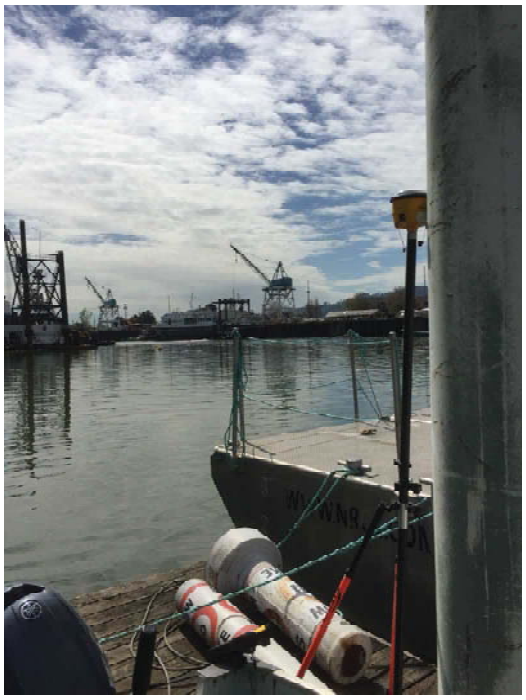
	KNOWN COORDS	OBS	Δ (FT)
	N = 698702.46	N = 698702.45	0.01
	E = 7637426.37	E = 7637426.39	0.02
	Z = 33.38	Z = 33.37	0.01

201 SE FACE OF PILE
3-MIN OBS
N = 700967.87
E = 7634507.64
Z = N/A

202 SW FACE TOPO
203 NW FACE TOPO
204 NE FACE TOPO

Overview of PH2 Pile

GNSS Setup on PH2 Pile



View facing south

View facing northwest

NOTE: This form intended for field use. Unsolicited data submitted to NGS must be converted to bluebook format.

GPS STATION OBSERVATION LOG
April 16, 2003

Station Designation: (check applicable:__ FBN__ CBN__ PAC__ SAC __BM) Raindeer		Station PID, if any:	Date (UTC): 06-Mar-18
General Location: Sauvie Island, Willamette River	Airport ID, if any:	Station 4-Character ID:	Day of Year: 065
Project Name: Portland Harbor - AETR00000034	Project Number: GPS-	Station Serial # (SSN):	Session ID:(A,B,C etc)

NAD83 Latitude ° ' "	NAD83 Longitude ° ' "	NAD83 Ellipsoidal Height meters	Agency Full Name: David Evans and Associates, Inc.
Observation Session Times (UTC): Sched. Start _____ Stop _____ Actual Start 17:38 Stop 23:45	Epoch Interval= 1 Seconds Elevation Mask = 10 Degrees	NAVD88 Orthometric Ht. meters GEOID99 Geoid Height meters	Operator Full Name: David T. Moehl Phone #: ( ) (360) 314-3200 e-mail address: dtm@deainc.com

Receiver Brand & Model: Trimble SPS855	Antenna Code*, Brand & Model: Trimble Zephyr 3 Base	Antenna plumb before session? (✓Y / N) Circle
P/N: 69855-60	P/N: 115000-00	Antenna plumb after session? (✓Y / N) Yes or No
S/N: 5506R0074	S/N: 1551129193	Antenna oriented to true North? (✓Y / N) -If no,
Firmware Version: 5.30	Cable Length, meters: 10	Weather observed at antenna ht. (Y / N✓) explain
❒ CamCorder Battery, ✓❒ 12V DC, ❒ 110V AC, ❒ Other	Vehicle is Parked n/a meters ____(direction) from antenna.	Antenna ground plane used? (Y / N✓) "
		Antenna radome used? (Y / N✓) If yes,
		Eccentric occupation (>0.5 mm)? (Y / N✓) describe.
		Any obstructions above 10°? (Y / N✓) Use
		Radio interference source nearby (Y / N✓) Vis. form

Tripod or Antenna Mount: Check one:
✓❒ Fixed-Leg Tripod, ❒ Collapsible-leg tripod ❒ Fixed Mount
Brand & Model: Seco fixed height
P/N:
S/N: 5115-00-FLY
Last Adjustment date: 2018-03-05

Psychrometer (if used) Brand & Model:
P/N:
S/N:
Last Calibration or check Date:

** ANTENNA HEIGHT **	Before Session Begins: Meters	Feet	After Session Ends: Meters	Feet
A= Datum point to Top of Tripod (Tripod Height)	2.000		2.000	
B=Additional offset to ARP if any (Tribrach/Spacer)	-0.003		-0.003	
H= Antenna Height = A + B = Datum Point to Antenna Reference Point (ARP)	1.997	6.55	1.997	6.55

Meters = Feet x (0.3048)
Height Entered Into Receiver = 2.000 meters.
Note &/or sketch **ANY** unusual conditions. Be **Very Explicit** as to where and how Measured!

Barometer (if used) Brand & Model:
S/N:

Weather Data	Weather Codes	Time (UTC)	Dry-Bulb Temp Fahrenheit	Dry-Bulb Temp Celsius	WetBulb Temp Fahrenheit	WetBulb Temp Celsius	Rel. % Humidity	Atm. Pressure inches Hg	Atm. Pressure millibar
Before	00000	17:38							
Middle									
After	00000	23:45							

Remarks, Comments on Problems, Sketches, Pencil Rubbing, etc:

Weather codes are required. Weather data are optional but encouraged. *Antenna code comes from ant_info file furnished by project coordinator.

Data File Name(s): 00740650.T02
(Standard NGS Format = aaaaddds.xxx)
where aaaa=4-Character ID, ddd=Day of Year, s=Session ID, xxx=file dependant extension

Updated Station Description: ❒ Attached ❒ Submitted earlier
Visibility Obstruction Form: ❒ Attached ❒ Submitted earlier
Photographs of Station: ✓Attached ❒ Submitted earlier
Pencil Rubbing of Mark: ❒ Attached

LOG CHECKED BY: Jon Dasler

Table of Weather Codes	CODE	PROBLEM	VISIBILITY	TEMPERATURE	CLOUD COVER	WIND
	0	did not occur	Good, over 15 miles	Normal, 32° F- 80° F	Clear, below 20%	Calm, under 5mph (8km/h)
	1	did occur	Fair, 7-15 miles	Hot, over 80°F (27 C)	Cloudy, 20% to 70%	Moderate, 5 to 15 mph
	2	- not used -	Poor, under 7 miles	Cold, below 32° F (0 C)	Overcast, over 70%	Strong, over15 mph (24km/h)
Examples:	00000 = No problem, good visibility, normal temp, clear, calm wind			12121 = Problems, poor visibility, hot, overcast, moderate wind		

Photo of Monument RAINDEER

Photo of Monument RAINDEER

GNSS Setup on RAINDEER

SURFACE SEDIMENT SAMPLING AND PROCESSING

The purpose of this standard operating procedure (SOP) is to define and standardize the methods for collecting surface sediment samples from freshwater or marine environments. For the purpose of this SOP, surface sediments are defined as those from 0 to at most 30 cm below the sediment-water interface. The actual definition of surface sediments is typically program-specific and is dependent on the purpose of the study and the regulatory criteria (if any) to which the data will be compared.

This SOP utilizes and augments the procedures outlined in Puget Sound Estuary Program (PSEP 1996) guidelines. A goal of this SOP is to ensure that the highest quality, most representative data be collected, and that these data are comparable to data collected by different programs that follow PSEP guidelines.

SUMMARY OF METHOD

Sediment samples for chemical and toxicity analysis are collected using a surface sediment sampling device (e.g., grab sampler). If a sample meets acceptability guidelines, overlying water is siphoned off the surface and the sediment is described in the field log. Sediment samples for chemical analysis may be collected directly from the sampler (e.g., volatile organic compounds and sulfides) or sediment from the sampler may be homogenized using decontaminated, stainless-steel containers and utensils prior to being placed in sample jars. Sediment from several sampler casts may also be composited.

SUPPLIES AND EQUIPMENT

A generalized supply and equipment list is provided below. Additional equipment may be required depending on project requirements.

- Sampling device:
  Grab sampler or box corer

- Field equipment:
  Siphoning hose
  Stainless-steel bowls or containers
  Stainless-steel spoons, spatulas, and/or mixer
  Decontamination supplies
  (Alconox™ detergent, 0.1 N nitric acid, methanol dionized water)
  Personal protective equipment for field team
  (rain gear, safety goggles, hard hats, nitrile gloves)
  First Aid kit
  Cell phone

Sample containers
Bubble wrap
Sample jar labels
Clear tape
Permanent markers
Pencils
Coolers
Ice

- Documentation

  Waterproof field logbook
  Field sampling plan
  Health and safety plan
  Correction forms
  Request for change forms
  Waterproof sample description forms

PROCEDURES

EQUIPMENT DECONTAMINATION

The basic procedure used most commonly in Integral field projects to decontaminate field sampling equipment is as follows:

1. Rinse with tap or vessel water.
2. Wash with brush and Alconox™ detergent.
3. Rinse with tap or vessel water.
4. Rinse with distilled water.
5. Rinse with 0.1 N Nitric acid (optional - if metals analysis is to be performed).
6. Rinse with methanol or hexane (optional - if organics analysis is to be performed or adhering petroleum residue present).
7. Rinse with distilled water.
8. Cover with aluminum foil (dull side down).

This procedure may be modified depending on site-specific requirements, as described in PSEP (1986). For example, if sampling is in areas known to be uncontaminated or only slightly contaminated, the solvent and/or acid rinses may be eliminated. Conversely, if creosote or other petroleum-based residue is encountered, a hexane rinse may be added.

Decontamination with acid or solvents should always be performed outdoors using appropriate protective equipment, including, at a minimum, chemical-resistant gloves (e.g., nitrile) and goggles. All decontamination liquids that include solvents or acids should be contained in tightly sealed buckets or other containers for disposal in an approved onshore facility. Alternatively, low-vapor pressure solvents may be evaporated in a well-ventilated open area away from the work zone.

SEDIMENT SAMPLE COLLECTION

To collect sediment for chemical and biological analyses, a sampler that obtains a quantifiable volume of sediment with minimal disturbance of the sediments must be employed. Additionally, the sampler should be composed of a material such as stainless steel or aluminum, or have a non-contaminating coating such as Teflon™. Samplers capable of providing high-quality sediment samples include grab-type samplers (van Veen, Smith-McIntyres, Young grab, power-grab and ponar grab) and box cores (Soutar, mini-Soutar, Gray-O'Hara, spade core). Some programs require a sampler that collects from a specific area (e.g., 0.1 m^2). Most sampling devices are typically a standard size; however, some non-standard sizes are available to meet the requirements of specific programs. Grab samplers, especially the van Veen grab, are the most commonly used samplers to collect surface sediment. Power grab samplers are often used for programs requiring collection of sediment deeper than 10 cm or in areas with debris.

A hydraulic winch system should be used to deploy the sampler at a rate not exceeding 1 m/sec to minimize the bow wake associated with sampler descent. Once the sampler hits the bottom, the jaws are slowly closed and the sampler is brought to the deck of the vessel at a rate not exceeding 1 m/sec to minimize any washing and disturbance of the sediment within the sampler. At the moment the sampler hits the bottom, the time, depth, and location of sample acquisition are recorded in the field logbook.

Once onboard, the sampler is secured, any overlying water is carefully siphoned off, and the sample is inspected to determine acceptability. Criteria used to determine acceptability are those detailed in PSEP (1986), except when noted in the project-specific field sampling plan (FSP). These criteria include but are not limited to:

- There is minimal or no excessive water leakage from the jaws of the sampler.
- There is no excessive turbidity in the water overlying the sample.
- The sampler is not over-penetrated.

- The sediment surface appears to be intact with minimal disturbance.
- The program-specified penetration depths are attained.

If the sample meets acceptability criteria, the sample is recorded and observations entered into a sample description form or log. Once the sample has been characterized, the sediment is then sub-sampled for chemical and biological analyses.

SAMPLE PROCESSING

Sediment for chemical and/or toxicity analyses is removed from the sampler using a stainless-steel spoon. Depending on programmatic goals, the upper 2 to 30 cm of sediment are removed. To prevent possible cross contamination, sediments touching the margins of the sampler are not used.

Samples for volatile compounds (either organics or sulfides) are collected using a decontaminated stainless-steel spoon while sediment is still in the sampler. These sediments are not homogenized. The volatile organics sample jar should be tightly packed with sediment (to eliminate obvious air pockets) and filled so that there is no headspace remaining in the jar. Alternatively, if there is adequate water in the sediment, the container may be filled to overflowing so that a convex meniscus forms at the top, and the cap carefully placed on the jar. Once sealed, there should be no air bubbles. The sulfides sample is preserved with 0.2 N zinc acetate.

The remaining sediment is then placed into a pre-cleaned, stainless-steel bowl. Typically, sediment from a minimum of three separate casts of the sampler is composited at each station. Once a sufficient amount of sediment has been collected, the sediment is homogenized until it is of uniform color and has obtained a smooth consistency. It is then dispensed into pre-cleaned sample jars for the various chemical or biological analyses. Sample jars for biological analyses should be filled to the top with sediment to minimize available headspace. This procedure will minimize any oxidation reactions within the sediment. Sample jars for chemical analysis may be frozen for storage, leaving enough headspace left in the container to allow for expansion of the sediment upon freezing. After dispensing the sediment, the containers are then placed into coolers with ice and are either shipped directly to the analytical laboratories or transported to a storage facility.

CHAIN-OF-CUSTODY

Field

The cruise leader or other designated field sample custodian is responsible for all sample tracking and chain-of-custody procedures until sample custody is transferred to the laboratory. Custody procedures in the field are as follows:

1. Record all field and sample collection activities (including sample identification number, collection time and date) in the field logbook. While being used in the field, the logbook remains with the field team at all times. Upon completion of the sampling effort, the logbook should be reproduced and then kept in a secure area.
2. Complete a chain-of-custody form whenever samples are being transferred or removed from the custody of field sampling personnel. A sample form is provided in Appendix B. Record each individual sample on the form. Include additional information to assist in sample tracking such as collection date and time, number of containers, and sample matrix. The chain-of-custody may also serve as the sample analysis request form, with the required analysis indicated for each individual sample.
3. Sign the form and ensure that the samples are not left unattended unless secured.
4. Store, pack, or ship samples as described in the following section. Place the original completed chain-of-custody form in a sealed plastic bag inside the shipping container. A copy is retained by the shipping party.
5. Complete a separate custody form for each individual shipping container or a single form for all samples in multiple shipping containers in a single shipment, with the number of containers noted on the custody form.
6. Attach completed custody seals to any shipping container that will be sent to the laboratory by delivery service or courier. Delivery personnel are not required to sign the custody form if custody seals are used. Custody seals are used to detect unauthorized tampering with the samples. Gummed paper or tape should be used so that the seal must be broken when the container is opened. The laboratory sample custodian (or other sample recipient) will establish the integrity of the seals.

7. The laboratory custodian (or other sample recipient) acknowledges receipt of the samples by signing, dating, and noting the time of transfer on the chain-of-custody form. The condition of the samples and any problems or irregularities (e.g., cracked or broken jars, loose lids, evidence of tampering) should also be recorded. Return a copy of the completed custody form to the project manger or designated sample coordinator.

Laboratory

The laboratory will designate a sample custodian who is responsible for receiving samples and documenting their progress through the laboratory analytical process. Each custodian will ensure that the chain-of-custody and sample tracking forms are properly completed, signed, and initialed on transfer of the samples. Specific laboratory chain-of-custody procedures should be in writing, included in the laboratory QA plan, and approved prior to beginning sampling and analysis. Laboratory custody procedures should include the following:

- A designated laboratory person initiates and maintains a sample tracking log that will follow each sample through all stages of laboratory processing and analysis.
- The laboratory tracking log includes, at a minimum, the sample number, location and type of storage, date and time of each removal, and signature of the person removing or returning the sample.
- The final disposition of the sample is recorded.

CHAIN-OF-CUSTODY QUALITY CONTROL PROCEDURES

Complete and correct chain-of-custody is essential to ensure and demonstrate sample integrity. Errors in entering information or transferring custody can result in analytical or data reporting errors. Inaccuracies or errors in sample tracking and custody records can compromise data usability, particularly as legal evidence.

Quality control procedures include the following:

- Allow adequate time to take accurate and complete field records and to carefully complete chain-of-custody forms.
- When possible, work in pairs or more to complete the chain-of-custody form and check for accurate information entry.

- Complete all custody records in ink; errors should be neatly crossed out and corrected and initialed by the person making the change.
- Immediately notify the project manager of any deviation from required custody procedures.

PACKING AND SHIPPING SAMPLES

Environmental samples are packed in a manner to reduce the chance of sample breakage, ensure sample integrity, and prevent material leakage and potential exposure to hazardous materials in the event of breakage. Samples are placed in sealed plastic bags and packed in a sturdy container with adequate packing material to prevent breakage. Ice or dry ice may be included to maintain sample storage conditions. Samples are transported by field personnel or shipped via courier or common carrier. Shipping procedures are in accordance with U.S. Department of Transportation regulations (49 CFR 173.6 and 49 CFR 173.24).

All preserved samples should be shipped as soon as possible after completion of sampling. This minimizes the number of people handling samples and protects sample quality and security.

Sample Packing

Upon completion of final sample inventory by the field sample custodian and completion of chain-of-custody, samples are packed as follows:

1. If not already done after sample collection, wipe the outside of each sample container and lid with a disposable cloth to remove any soil or sediment adhering to the outside of the jar and place each container in a sealed plastic bag (e.g., ziplock).
2. Wrap each glass sample container in bubble wrap or place it in a bubble wrap plastic bag. [Note: When samples are being transported by field personnel directly from the field site to the laboratory (thereby ensuring careful handling), this step is recommended but may be omitted. However, this step is required when a courier or delivery service is transporting the samples.]
3. Line the shipping container with heavy-duty plastic bags (e.g., garbage bags) and bubble wrap. Use a leak-proof, sturdy container that can withstand rough treatment during shipping. If ice chests or coolers are used, the drain should be securely plugged and sealed with duct tape.

4. Place the samples tightly in the shipping container:
   - Use dividers or bubble wrap to separate all glass containers
   - Fill any empty space in the shipping cooler or box with packing material so that the jars are held securely.

5. Place the original completed chain-of-custody form in a sealed plastic bag and place it inside the shipping container. If using a cooler or ice chest, the form should be securely taped to the inside of lid.
6. For liquid samples, absorbent material (e.g., vermiculite) should be placed in the container in sufficient quantity such that all liquid could be absorbed.
7. Tie or seal the bag lining the shipping container.
8. If required to meet sample storage requirements, fill the ice chest with crushed or block ice, blue ice (refrigerated samples, 4°C) or dry ice (frozen samples). A temperature blank (provided by the laboratory) should be packed in each cooler.
9. If samples for volatile organics analysis (VOA) are included in the shipping container, two VOA trip blanks (provided by the analytical laboratory) should also be packed in the cooler.
10. Seal shipping container securely with packing or duct tape.
11. If the shipping container will be transported by anyone other than the person who completed and signed the chain-of-custody form, attach completed custody seals so that the shipping container cannot be opened without breaking the seal.
12. Attach a *This End Up* label to each side of the shipping container to ensure that jars are transported in an upright position. A *Fragile* label may also be attached to reduce rough handling of the samples.
13. Label the shipping container with all appropriate information (name of project, time and date, responsible person and company name, address and phone) to enable positive identification.

Sample Shipping

Packed containers may be delivered to the laboratory or storage facility by field personnel, courier, or common carrier (FedEx, UPS). However, any outside carrier or courier service must provide a delivery receipt. The carrier or courier must also ensure delivery time if holding time and storage conditions are critical.

Unless arranged in advance, shipping charges should be prepaid by sender to avoid confusion and possible rejection of the package by the laboratory.

The adequacy of handling and shipping procedures is reflected in the condition of the samples upon receipt by the laboratory:

- No jars are cracked or broken.
- There is no evidence of sample leakage.
- Measuring the temperature of the temperature black indicates that correct storage conditions have been maintained.

The sample custodian or other designated person is responsible for confirming that copies of all shipping documents, completed in full and correctly, are on file at Integral.

QUALITY CONTROL PROCEDURES

Field quality control (QC) samples that may be collected during surface sediment sampling are the same as for any field sampling program. The types and frequency of field QC sample collection are project-specific and will be described in the project field sampling plan. The most commonly collected field QC sample are described below (PSEP 1996):

- **Field Blank**. A field blank is a sample of analyte-free water that is supplied by the laboratory. The field blank is generated by transferring the analyte-free water to another laboratory-supplied sample container while at the field sampling location. Field blank results are used to measure and document any possible onsite contamination.

- **Field Split Sample**. A field split sample consists of aliquots of the same homogenized sediment sample that are equally distributed in two sets of sample containers. These samples may be analyzed identically or analyzed by different laboratories to evaluate repeatability of sample handling and analytical procedures, sample heterogeneity, and analytical procedures.

- **Field Replicate**. A field replicate consists of a second sample that is collected using the same sampling methodology used to obtain the first sample. It is collected at the same sampling location and as soon after the original sample as possible. Analysis of the field replicate allows evaluation of the repeatability of field sampling methodologies, as well as the heterogeneity of the sample matrix. Statistical analysis of multiple replicates may also be used to calculate the likely range of an analyte concentration at a given sampling location.

REFERENCES

PSEP. 1996. Puget Sound Estuary Program: Recommended Protocols for Measuring Selected Environmental Variables in Puget Sound. Final Report. TC-3991-04. Prepared for U.S. Environmental Protection Agency, Region 10 and Puget Sound Estuary Program, Seattle, WA. Tetra Tech and HRA, Inc., Bellevue, WA.

STANDARD OPERATING PROCEDURE SOP-02

MANAGEMENT OF INVESTIGATION-DERIVED WASTE

Introduction

Investigation derived wastes (IDW) generated during the Pre-Remedial Design Investigations at the Portland Harbor Superfund Site may include:

- Soils/sediments
- Surface water
- Other materials:
    - Personal protective equipment
    - Disposable sampling equipment
    - Spent decontamination liquids
    - Plastic sheeting, containers, etc.

The management of these wastes will be conducted to limit exposure of Site personnel to hazardous materials, and to prevent introduction of contaminated materials to uncontaminated environmental media at the Site (soils, sediment). The following Standard Operating Procedures (SOPs) establish protocols for testing, storage, and disposal of these materials.

Disposal of laboratory test equipment and supplies will be handled in accordance with the laboratory Quality Assurance Project Plan (QAPP).

General

IDW management will follow guidance described in the Office of Solid Waste and Emergency Response (OSWER) document, Guide to Management of Investigation-Derived Wastes (United States Environmental Protection Agency [EPA] 1992). This guidance discusses factors to consider as part of an IDW management program. These factors include protectiveness of human health and the environment, compliance with applicable and relevant or appropriate requirement (ARAR)-based cleanup levels, land disposal restrictions, storage requirements, recordkeeping and manifesting, and handling of non- Resource Conservation and Recovery Act (RCRA) hazardous wastes. The IDW management program described in this section incorporates these factors in the program.

All IDW identified as potentially contaminated with hazardous materials will be stored in a designated and clearly marked IDW management area located at the AECOM Technical Services (AECOM) Field Laboratory. All vessels will also be clearly labeled to indicate the source of the IDW. The IDW storage area will be inspected daily to ensure that storage procedures (as outlined below) are being followed. Any violations of these procedures will be

documented and remedied as quickly as possible. Potentially contaminated IDW will be identified based on its origin, olfactory evidence, and visual evidence. Laboratory testing will be required to determine the proper disposition of these IDW.

Media Specific IDW Management

Sediment/Soils

Waste soils and sediments will be generated as excess sample material. The required testing and handling of this IDW will depend on its origin and characteristics. Olfactory and visual observations will be used to determine if the soils contain potentially elevated levels of hazardous materials. The amount of sediment generated will be minimized to the volume necessary for sampling and analysis, if possible. During field operations, leftover sediment material will be returned to the location it was generated from unless a significant sheen or non-aqueous phase liquid (NAPL) is observed. If significant sheen or NAPL is observed, sediment on the vessel or laboratory processing area will be temporally stored in 5-gallon buckets with lids, then transferred to 55-gallon drums. Each drum will be labeled using a grease pencil or paint pen to indicate the date sealed, location, and contents. Each of the sealed drums will then be staged at a designated solid waste management unit location for later disposal characterization.

Surface Water

Sampling activities may result in the creation of surface water sheens. Sorbent booms will be deployed if significant sheen is encountered on the water surface during coring/grab sampling. A small support boat may be used to manage the boom so the sampling vessel can operate without interruption. AECOM will coordinate with the Office of Spill Prevention Section on additional mitigation measures and agency notifications for releases. Surface water generated during sediment collection will be returned to the lake unless a significant sheen is observed. If a sheen is observed, water will be contained in 55-gallon drums or plastic containers and managed accordingly.

Personal Protective Equipment (PPE)

Investigation-derived PPE consists of gloves, chemically protective clothing, respirator canisters, and other one-time use equipment used during the field investigation. All used PPE will be containerized in plastic garbage bags and disposed of on-site for subsequent transport to the municipal landfill.

Decontamination Fluids

Decontamination fluids will be drummed up in either 55-gallon drums or disposed of in sanitary sewers if no significant sheen is observed. Alconox used on the boat will be discarded overboard if no significant sheen is observed. The decontamination containers will be kept on-site until the water has been analyzed for hazardous materials, at which time the water will be discarded appropriately.

Chemical Liquid Wastes

Chemical liquid wastes will include the spent solvents and acids and other residual chemicals generated during the decontamination process.

Waste acids and solvents will be collected in (dedicated) satellite containers as follows:

- Waste acids (e.g., hydrogen chloride, nitric acid) will be collected in a plastic storage carboy (20-L) SEPARATE FROM WASTE SOLVENTS, labeled with a Class 8 Corrosive Liquid label and containing a tag that indicates acid name, concentration, and volume along with users' initials and date/time.
- Waste solvents (e.g., acetone, methanol, and hexane) will be collected in Type I or II UL-approved galvanized steel disposal can, SEPARATE FROM WASTE ACIDS, labeled with a Class 3 Flammable Liquid label and containing a tag that indicates solvent name, concentration, and volume along with users' initials and date/time.

Solvent Waste (Acetone, Methanol, Hexane)

- Assign a unique identification number to the Type I or II UL-approved steel disposal can (clearly marked on the top and sides).
- Prepare a log for the drum, listing the volume and concentration of each solvent transferred to the drum along with date/time.
- Place a label indicating that the drum contains IDW pending characterization and a Class 3 Flammable Liquid label on the drum.
- Close the drum after each transfer.
- Store the drum in a secure area at the field facility until pickup by an authorized waste handler at the end of the field phase. Drums containing hazardous waste will be removed from the facility within the time mandated for the governing hazardous waste generator status (large quantity generator, small quantity generator, or conditionally except generator).

Other Materials

All plastic sheeting, sampling containers, and other disposable equipment that is free from hazardous materials will be containerized in plastic garbage bags and disposed of on-site for subsequent transport to the municipal landfill. Materials that have visible NAPL will also be drummed and shipped off-site for disposal at an approved facility. Non-disposable or bulky materials may be decontaminated and re-used or disposed as solid waste (see SOP for decontamination). Other disposable materials used on-site (tarps covering non-contaminated soils, caution tape, potable water containers) that have not contacted contaminated media will be disposed as solid waste.

Testing and Disposal

All drummed materials will be tested to determine the proper disposal method. Composite samples will be collected from each drum for analysis. Composite samples will be collected such that reasonable likelihood exists that the entire volume of material in a drum is represented in the sample.

Composite samples will be tested for the parameters identified in the QAPP. Modifications of this analyte list may be made based on specific knowledge of the origin and likely contaminants in the materials.

Soils contaminated above hazardous waste criteria will be shipped to a licensed disposal facility following any further required waste characterization or stabilization.

References

United States Environmental Protection Agency (EPA). 1992. Guide to Management of Investigation-Derived Wastes. Office of Solid Waste and Emergency Response. 9345-03FS.

STANDARD OPERATING PROCEDURE

FIELD WET SIEVING FOR GRAIN SIZE

INTRODUCTION

This Standard Operating Procedure (SOP) has been developed for the Pre-Remedial Design Sampling and Baseline Investigations (PDI) at the Portland Harbor Superfund Site located in Portland, Oregon. The objective of this SOP is to establish standard procedures for conducting wet sieving of sediment samples in the field for grain size screening. Conducting a wet sieve analysis is a useful field application to understand the percentage of fine grained sediments, by volume. Fine-grained sediments are classified as material that passes through a No. 200 sieve (nominal sieve opening size 0.074 millimeters).

This SOP provides basic steps to guide the process of conducting wet sieving in the field. The intended audience of this document includes all personnel involved in planning, field sampling, and conducting wet sieve analysis.

Equipment will include:

- No. 200 sieve (stainless-steel is preferred)
- 200 milliliter (ml) graduated cylinder with leveling edge at the top (or 100 ml depending on size if sieve screen)
- Disposable gloves
- Mixing bowl and utensil
- Squirt bottle
- Rinse water for helping the material pass through sieve
- Writing tools (pencils, Sharpie®)
- Field log book

FIELD WET SIEVE METHODS

The following sections outline the basic steps involved in conducting wet sieving techniques by the field team.

1. Put on a pair of disposable gloves.
2. Homogenize a representative aliquot of sediment using appropriate nonreactive processing equipment:

a. Collect an appropriate aliquot of sediment of at least 200 ml and place in a stainless-steel bowl.

b. Homogenize the sediment by mixing with stainless-steel utensil until uniform consistency and color is reached.

c. Decant excessive water from homogenized mix.

d. Visually inspect homogenized composite and record color and texture information in field notes.

3. Measure out 200 ml of sediment and place on No. 200 sieve (100 ml of sediment could also be used depending on the size of the sieve screen):

   a. Remove any large objects that would not be sampled (gravel or larger, clams, large sticks, etc.).

   b. Completely fill a 200 ml graduated cylinder with the homogenized sediment and scrape off any excess sediment so that the sediment is flush with the top of the graduated cylinder.

   c. Empty contents from 200 ml graduated cylinder onto surface of No. 200 sieve. Make sure all sediment from cylinder is in sieve; use a squirt bottle and spray water, if needed, to help ensure all sediment gets onto the sieve.

4. Wet sieving:

   a. Carefully use river water to help push fine-grained sediment through No. 200 sieve, making sure not to splash out any sediment from the sides of the sieve. Wash all sediment in sieve, as fine grain sediment can adhere to coarse sediment, leaves, or other small debris.

   b. Shaking of the sieve from side-to-side to allow passage of material smaller than the sieve openings is appropriate; however, care must be taken not to spill any sediment out the sides of the sieve.

   c. Slow mixing of sediment within the sieve, using a gloved hand or appropriate nonreactive utensil, may be conducted to help work the finer particle-size fractions through the sieve. Care must be taken not to press on the sieve screen or scrape materials, as to prevent compromising sieve openings.

5. Measuring sieved material:

   a. Once all wash water has passed through the sieve, begin collecting material retained on the sieve using a nonreactive spoon, taking care not to damage the screen. Water can again be used to help gather sediment that did not pass through the screen to a single area on the sieve, making it easier to collect sediment with a spoon. Sediment that did not pass through the sieve will be placed back into the 200 ml graduated

cylinder for a final volume check. Make sure that all sediment is collected from the sieve and placed in the 200 ml graduated cylinder.

b. Allow sediment within graduated cylinder to settle, as best as possible, and then record new volume of sediment.

6. Determine percentage of fines in sediment sample:

   a. Record the initial volume of sediment before sieving.

   b. Record the new (residual) sediment volume in the 200 ml graduated cylinder after sieving.

   c. Divide the volume of the sediment remaining in the graduated cylinder by 200 ml (initial volume).

   d. Take the new number and subtract from 1. (For example, if 150 ml remains, then divide 150 by 200 = 0.75. Then, 1 – 0.75 = 0.25, or 25% fines.)

   e. Record the percent fines by volume in the field notebook.

APPENDIX C – Rerandomization of Upriver Sediment Locations Based on 2018 Soft Sediment Probing Survey, FSP Addendum

FINAL

Appendix C – Rerandomization of Upriver Sediment Grab Locations Based on 2018 Soft Sediment Probing Survey, Addendum

Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling

Portland Harbor Superfund Site

AECOM
Geosyntec Project Number: PNG0767

June 22, 2018

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United States Environmental Protection Agency, Region 10
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CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

June 22, 2018

Kenneth M. Tyrrell
PDI Project Coordinator
AECOM Technical Services

Date

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Figure 4a-h. Proposed Downtown/Upriver Reach Surface Grab Locations (revised)

1. INTRODUCTION

This Field Sampling Plan (FSP) Addendum presents proposed rerandomized upriver surface sediment sampling locations based on recent soft sediment probing results. Soft sediment probing data were collected in April 2018 by Geosyntec Consultants, Inc. (Geosyntec) and AECOM Technical Services (AECOM) to identify areas of high proportions of fine-grained soft sediment. This FSP addendum (1) documents the field methods used for upriver probing; (2) describes the mapping of soft sediment areas; and (3) selects randomized gridded target locations for collection of surface sediment samples in areas identified as predominantly soft sediments. The potential need for rerandomization is outlined in *Section 2.1.4 Pre-Screening D/U Sediments for Grain Size* of the Pre-Remedial Design Investigation (PDI) Surface Sediment Sampling FSP (AECOM and Geosyntec 2018) approved by the United States Environmental Protection Agency (EPA) on March 29, 2018.

As described in Section 2.1.4 of the FSP (AECOM and Geosyntec 2018), surface sediment sampling in the Downtown and Upriver Reaches (D/U Reach) will target sample locations representative of fine material (including organic carbon and colloids and silt and clay particles) that is likely to be transported downstream. Surface sediment sampling locations are developed to target samples with >35% fines (sum of silt and clay fractions).

2. FIELD METHODS

Between April 2 and 6, 2018, AECOM and Geosyntec field staff along with EPA oversight conducted a field reconnaissance survey to confirm the bottom conditions of the D/U Reaches using three tools (presented in sequential order of use):

1. BioSonar® acoustic sonar
2. Mechanical hand-probing using 18-foot-long sediment probe
3. Grab sample collection and visual classification of sediment texture (along with field wet sieving)

The survey area extended from river mile (RM) 11.8 up to RM 26.4 (northeast and upstream of Willamette Falls). During this one-week field survey, 15,446 BioSonar® data points were collected, 275 locations were hand-probed, and 57 visual confirmation samples were collected. The field methods and approach are described in more detail below. Figure 1 series (1a–1h) presents the sonar and probing locations.

2.1 BioSonar Acoustic Sonar

BioSonar® was conducted on the first day (April 2, 2018) to help provide spatial coverage and help identify hard-bottom areas that would be excluded from sampling. BioSonar® acoustic sonar was identified by the field team as a tool that would provide better spatial coverage of the

deeper, middle-channel river areas that were beyond the reach of the hand-probe; its use was approved by EPA in May 2018 in Change Request 4.

BioSonar® uses a single-beam Echosounder that generates five acoustic sonar pings per second. The BioSonar® data contain information about bottom sediment substrate type (density and texture) embedded in the echo signal. Visual Habitat® software uses statistical signal processing techniques (Principal Component Analysis) to decode the signal and identify the composition of the bed material (e.g., rock, sand, and mud substrates). The BioSonar® tool also provides water depth soundings. Differential global position system (DGPS) is incorporated into the Echosounder to provide accuracy of less than 3 meters with DGPS updated every second. The sounder was located at the bow of the research vessel, and the vessel moved in sweeping transects across the river approximately every one tenth mile.

2.2 Mechanical Hand-Probing

Mechanical hand-probing was conducted from April 3 to 5, 2018, using an 18-foot-long metal probe. Probing of the sediments was performed at transects approximately every 0.1 RM but limited to areas where the water depth was less than 18 feet (primarily the eastern and western shores of the river). Along each transect, the metal probe was inserted manually through the water column into the surface sediment to classify the substrate as either soft, medium, or hard based on the probe operator's assessment of bottom substrate resistance to the probe (and confirmed with a visual ponar grab). Beyond a depth of 18 feet, sediment could not be assessed using the probing technique; therefore, the BioSonar® tool was used, as described above.

2.3 Visual Classification and Wet Sieving of Grab Samples

On April 6, 2018, a subset of areas was revisited where the mechanical hand-probing identified the bottom substrate as soft sediment, and grab samples were collected to verify the BioSonar® and mechanical hand-probing results. Sediment was obtained using a Ponar grab sampler deployed from the research vessel and visually classified according to the American Society for Testing and Materials (ASTM) visual-soil classification method described in Appendix A-1 of the FSP.

In addition to visual classification of the sediment, field wet sieving techniques were conducted on the grab samples by the field team on the vessel deck to quantify the percent fines by volume. A 200-milliliter sample of sediment was sieved through a No. 200 sieve (74-micrometer mesh), and the volume of sediment retained on the sieve was recorded in the field notebook along with the calculated percentage of fines (Table 1).

3. DATA ANALYSIS

The evaluation of the field reconnaissance survey data included three data analysis steps to select 60 proposed D/U Reach surface sediment sampling locations (30 in the Downtown Reach, 30 in the Upriver Reach). Step 1 included a review of the BioSonar® data to exclude large areas of hard bottom substrate from further data analysis, primarily from the middle of the channel. Step 2 included the interpolation of the remaining areas and classification of soft, medium, and hard bottom substrates based on the hand-probing, visual classification, and wet-sieving results. Step 3 included randomized placement of 60 locations in the areas identified as soft bottom with >35% fines. These steps are described in more detail below.

3.1 Step 1 – Review of BioSonar® Data and Determination of Mid-Channel Hard Bottom

The BioSonar® soundings point-data (categorized as 1, 2, 3, 4, 5, and 6 return ratings) were processed and decoded into groupings of soft, medium, and hard bottom substrates.[1] A statistical comparison was conducted between a "hard" BioSonar® return and what was classified as "hard" during the mechanical probing/visual classification to determine if the sonar data could be used to support the mapping of areas determined to be hard bottom. Figure 2 presents the correlation between BioSonar® data indicating hard bottom substrates and the average percentage of fine sediments based on results of visual grab sample confirmation and 2004 Remedial Investigation/Feasibility Study (RI/FS) data points.[2]

The BioSonar® data suggest that the middle of the channel almost exclusively features hard-bottom substrates. Multiple ponar grabs in the middle of the channel confirmed sediment generally contained < 35% fines based on visual classification. The multiple data types evaluated (including the 2004 RI/FS data) show that the middle channel of the river generally does not contain soft sediment substrate with greater than 35% fines. Based on this conclusion, the middle channel area was excluded from further analysis in Steps 2 and 3. The hard bottom mid-channel area was delineated manually by "connecting the green dots" among the sonar "soft bottom" returns near the middle of the channel. The middle channel areas are unlikely to feature soft sediment with > 35% fines. Figure 1 series (1a–1h) presents the BioSonar® results and the mid-channel exclusion area that was generated based on the hard bottom designation. The area encompasses 51% of the D/U Reach.

3.2 Step 2 – Interpolation of Spatial Extents

Following exclusion of the middle of the river that is hard-bottom under Step 1, the remaining areas were interpolated using Thiessen polygons for spatial extents. Each polygon was assigned a

[1] The data is classified into the six sediment hardness classifications using a Fuzzy Centroid Mean (FCM) Algorithm.
[2] The correlations included sonar data within a 100-foot radius of a known, discrete probe or data point.

classification value of *soft, medium, or hard* based on the hand-probing data and visual confirmation of the probe data:

- Soft Bottom – areas identified as predominantly soft silt size fractions with easy penetration by the hand probe (then visually confirmed as containing >35% fines with a grab sample).
- Medium Bottom – areas identified as medium hard substrates from the hand-probing data were generally classified as predominantly sand.
- Hard Bottom – areas where hand-probing data hit "hard" substrate, and penetration was zero or minimal, were generally classified as containing dense sand, gravel, or cemented cobble.

Figure 3 series (3a–3h) presents the Thiessen polygons, hand-probe results, and percent fines from historical surface sediment samples collected during the 2004 RI/FS for comparison. As shown in Figure 3, Thiessen polygons are located on the river margins, nearshore, and back eddy areas of the river and "clipped" to exclude the mid-channel area. The mid-channel hard-bottom area that was determined in Step 1 was used during the generation of the Thiessen polygons to prevent shoreline probe data from giving a false characterization of sediment conditions (false positive) in the middle of the river. Table 2 presents the area (in acres) of probing area, exclusion area, and remaining hard, medium, and soft sediment > 35% fines area.

3.3 Step 3- Grid Derivation and Sample Randomization

The total soft-bottom area to be sampled within the D/U Reach, as delineated by the survey efforts, consists of non-contiguous polygons spread among the length of the two reaches. Soft sediment bottom areas with > 35% fines comprise 315 acres (16%) of the D/U Reach based on the Thiessen polygons. As designated in the Work Plan (Geosyntec 2017), both the Downtown Reach (RM 11.8 to 16.6) and the Upstream Reach (RM 16.6 to 28.4) are to each include 30 randomly determined sample locations for subsequent surface sediment sample collection.

3.3.1 Grid Derivation

To distribute these sample locations in a randomized manner such that the samples would be evenly distributed along the length of the reaches where soft sediment areas are present, a grid was generated within the soft sediment areas such that 30 cells were present in the Upriver Reach and 30 cells were present in the Downtown Reach. While this step was not specifically mentioned in the Surface Sediment FSP, this step is proposed because it is consistent with the grid cell approach used to randomly place surface sediment samples within the site and to provide spatial coverage across all soft sediment areas. A grid pattern avoids potential randomization in which some portions of soft sediment in the D/U Reach areas are not sampled or are sampled at extremely high density compared to other areas of soft sediment.

To generate the grid cells, once the Thiessen polygons had been generated in Step 2, the total length of soft sediment areas was measured, and then 60 evenly spaced grids were plotted within the soft sediment areas to allow for an even distribution of randomized sample grid cells laterally along the river. The total lateral length of soft sediment areas was approximately 1,625 feet (ft), of which 675 ft is in the Downtown Reach and 950 ft is in the Upriver Reach. Grid sizes were similar between the D/U Reaches, with the slight difference resulting from the higher lateral length of soft sediments in the Upriver Reach.

3.3.2 Revision of Soft Sediment Polygons

Following review of the randomized sample locations and discussion with EPA, EPA requested that the results of the BioSonar survey be used to refine the areas of soft sediments that considered multiple lines of evidence including sonar results (green/soft areas), probe results, historic data, best professional judgement, and river and sediment flow dynamics. The goal was to develop smaller areas for targeted sampling of areas with higher confidence of soft sediment being present. Following EPA approval of the refined footprints, samples were rerandomized as described below.

3.3.3 Sample Randomization

Surface sediment sample locations were randomly generated within each of the 60 soft sediment grid cells (one location per cell) using the Create Random Points tool in ArcGIS 10. The same randomization approach and tool were used for the randomly generated stratified random surface sediment sample locations within the Site described in the Work Plan (Geosyntec 2017). Figure 4 series (4a–4h) presents the grid cells, soft sediment areas as Thiessen polygons, and proposed sediment locations (x/y coordinates will be provided to the field crews and EPA after the target locations have been approved by EPA). Based on this approach, the samples are randomly distributed within areas that are likely to yield samples of soft sediments.

4. RESULTS AND RECOMMENDATIONS

The stratified random grid approach for soft sediment areas provides spatial coverage across the D/U Reaches and is consistent with the work plan methodology used to select the locations for the stratified random samples within the site. Consistent with the Surface Sediment FSP, the goal is to collect the surface sediment samples as three-point composite grab samples.

The average distance between a known probe point (from the D/U reconnaissance) indicating soft sediment and a random sample location is approximately 150 feet, with a maximum distance of approximately 300 feet. Therefore, uncertainty exists regarding changes in surface sediment composition between the probed and randomly proposed location within a grid cell. For this reason and as described below, field staff will have flexibility in employing their best professional judgment to select an Alternate 1 location as necessary. Collection of surface

sediment samples will follow the revised protocol outlined in Section 4.4 of the FSP, with some notable changes[3]:

- Go to primary target area and begin attempting to collect a three-point composite sample within a 50-foot radius of primary target.
- After collection of the first grab sample at the primary target, classify the substrate as described in Section 4.3.2 of the Surface Sediment FSP, including a visual estimate of percent fines. If the substrate is classified as:
    - Substrate 1 – Soft Sediment: Collect the surface sediment samples per the FSP protocol. At the field team's discretion, wet sieving may be performed on the first sediment grab sample to evaluate percent fines by volume.
        - Selecting Alternate 1 Location: If wet sieving results indicate insufficient fine material at the primary target location, probe the surface sediment moving toward the shoreline (beginning at ½ the distance to shore) or laterally along the shoreline until soft sediment is encountered. The field crew will use best professional judgement to determine where to probe based on the grid cell size, shape and physical features present. Once an area of soft sediment has been identified, this will be designated Alternate 1. A three-point composite sample will be attempted within a 50-foot radius of the selected Alternate 1 location.
    - Substrates 2 (Soft Sediment with Debris) or 3 (Natural Hard Sediment Bottom): Field staff will collect up to six attempts and will retain the three grabs with the deepest/best recovery depths. If significant debris is encountered, the field staff may decide to attempt an Alternate 1 location, determined in the field, before completing the six grab sample attempts.
        - Selecting Alternate 1 Location: If significant debris is encountered at the primary target location, field staff may move towards the shoreline or laterally along the shoreline staying within the grid cell.
        - The default distance will be ½ the distance towards shore, and then laterally at 25-foot increments towards the known probe point explored during the D/U Reconnaissance. Each incremental step will include a probing assessment, with substrate conditions noted at each incremental move.
        - Movement will continue, as practicable, until soft sediment is encountered. This station becomes the Alternate 1 Location. A three-point composite sample (up to six grab attempts) will be attempted within a 50-foot radius of the selected Alternate 1 location.

[3] These guidelines are for optimal sample recovery. See sentence following the bullets for minimum acceptable criteria in the case of challenging field conditions.

- Substrate 4 – No Recoverable Sediment: If Substrate 4 is encountered, attempt 3 grab samples. If any of the three grab samples do not have sufficient recovery, the field crew may move to an Alternate 1 location determined in the field.
    - Selecting Alternate 1 Location: the field team will probe the surface sediment moving toward the shoreline (beginning at ½ the distance to shore) or laterally along the shoreline until soft sediment is encountered. The field crew will use best professional judgement to determine where to probe based on the grid cell size, shape, and physical features present. Once an area of soft sediment has been identified, this station becomes the Alternate 1 Location. A three-point composite sample (up to six grab attempts) will be attempted within a 50-foot radius of the selected Alternate 1 location.

- If the bottom is soft, then conduct wet sieving on the first successful grab sample prior to sample collection to confirm > 35 percent fines by volume in the field;
- Field crews will document field conditions, weights used, probing/wet sieving results, each grab sample attempt, and will note the boundaries between hard and soft sediments during probing. Where attempted sampling locations are not yielding fine sediment, field crews have the flexibility to move off station to sample in areas of soft sediments as described in the selection of Alternate 1 locations above.

The minimum acceptable field criteria for a sample will include a one-point composite of at least 4-centimeter recovery, with visual characterization indicating > 35% fines (by volume). If the field crew is unable to collect an acceptable soft sediment sample with > 35% fines within a grid cell, then alternate options for that grid cell will be discussed with the Project Manager and EPA. The field crew may move to another grid cell while alternate options are being decided.

The D/U Reach surface sediment samples will be analyzed as described in Section 2.1.4 of the Surface Sediment FSP. All samples will first be analyzed on an expedited basis for grain size to confirm grain size is within the criteria included in the FSP. If the grain size results are within the stated criteria in the FSP, the held sediment will be analyzed for all Record of Decision (ROD) Table 17 sediment contaminants of concern (COCs) and TOC.

The historical dataset and the final decision criteria listed in Surface Sediment FSP (for deciding whether or not to analyze for full-suite ROD COCs) are based on laboratory measurement results of grain size. Laboratory ASTM grain size method uses the #200 sieve, but results are calculated by dry weight and not volume (which is used for field wet sieving). Since sand-size fractions weigh more than silt/clay-size fractions, the laboratory results will likely be lower. Hence, it is recommended to relax the <u>final</u> criteria described in the PDI Surface Sediment FSP from 35 to 25 percent fines to account for (i) this field/lab measurement difference; and (ii) recent laboratory results of the Oregon Department of Environmental Quality (ODEQ) Upriver Reach Sediment Characterization investigation (2018) where all samples had < 30% fines (dry weight).

5. REFERENCES

AECOM and Geosyntec. 2018. Pre-Remedial Design Investigation (PDI) Surface Sediment Sampling Field Sampling Plan. Portland Harbor Superfund Site, Portland, Oregon. Prepared for the Pre-RD AOC Group for submittal to USEPA Region 10. 29 March.

Geosyntec (Geosyntec Consultants, Inc.). 2017. Final Work Plan, Portland Harbor Pre-Remedial Design Investigation Studies, Portland Harbor Superfund Site, Portland, Oregon. Prepared for the Pre-RD AOC Group for submittal to EPA Region 10. Attachment to the Statement of Work. 19 December.

ODEQ (Oregon Department of Environmental Quality). 2018. Final Field and Data Report, Upriver Reach Sediment Characterization, Lower Willamette River, Portland, Oregon. Prepared by GSI Water Solutions Inc. and Hart Crowser and prepared for State of Oregon Department of Environmental Quality. 8 May.

TABLES

Table 1. Field Wet Sieving Results and Visual Estimates of Percent Fines

PDI Upriver Survey Date	River Mile	Probe No.	Water Depth	Field Wet Sieve Volumes (200 mL)			Pre-Sieve Visual Description
				Fines Passing (< No. 200 sieve)	Fines Remaining (>No. 200 Sieve)	Percent Fines	
4/3/2018	17.6 E	58*	5.2	130	50	72%	silt with fine grain sand
	18.9 E	72*	7.5	80	150	35%	poorly graded fine sand with silt
4/4/2018	26.0 W	115	11.8	70	130	35%	poorly graded fine sand, trace woody debris
	25.6 E	113	5.1	75	125	38%	poorly graded fine sand with silt
	24.5 W	126	3.3	120	80	60%	silt with fine grain sand
	24.2 W	130	7.1	20	180	10%	well graded sand trace gravel and some silt
	23.3 W	137	13.1	130	70	65%	silt with some fine sand
	22.8 E	98	4.5	110	90	55%	silt with fine sands and trace organic debris
	20.2 W	153	3.6	130	70	65%	silt with fine sands and trace organic debris
	19.5 W	159	6.3	100	100	50%	silt with fine sand
4/5/2018	19.3 E	77	7.2	100	100	50%	silt with fine sand
	19.2 W	163	6.6	80	120	40%	sand with silt
	18.9 E	72	8.6	100	100	50%	silt with fine sand
	18.7 E	70	9.1	90	110	45%	silt with fine sand
	18.5 W	170	4.8	140	60	70%	silt with trace fine sand
	18.5 E	67	5.9	110	90	55%	silt with some fine sand
	18.2 W	173	6.1	80	120	40%	silt with organic material
	18.0 W	175	6.3	140	60	70%	silt with fine sand and trace organic material
	17.8 E	60	5.5	120	80	60%	silt with some fine sand
	17.4 E	57	5.5	130	70	65%	silt with fine sand
	17.6 W	178	6.2	150	50	75%	silt with trace fine sand
	17.1 W	184	5.8	160	40	80%	silt with trace fine sand
	17.0 E	52	6.3	150	50	75%	silt with trace fine sand
	16.8 E	49	14.2	130	70	65%	silt with trace fine sand
	16.8 W	187	5.9	100	100	50%	silt with fine sand
	16.3 E	45	5.4	90	110	45%	silty sand with trace gravel
	16.0 E	42	4.4	130	70	65%	silt with fine sand and trace organics
	15.7 E	39	13.4	140	60	70%	silt with trace fine sand and trace organic material
	14.9 E	220	11.3	75	125	38%	silty sand with trace organics
	14.5 E	223	9.5	50	150	25%	fine sand some silt and some organic material
4/5/2018	14.2 E	226	15.9	120	80	60%	silt with fine sand and trace

PDI Upriver Survey Date	River Mile	Probe No.	Water Depth	Field Wet Sieve Volumes (200 mL)			Pre-Sieve Visual Description
				Fines Passing (< No. 200 sieve)	Fines Remaining (>No. 200 Sieve)	Percent Fines	
							oxidized nodes
	15.6 W	197	8.8	90	110	45%	silt with fine sand
	15.4 E	35	5.6	110	90	55%	silt with fine sand
	14.9 E	30	6.8	80	120	40%	sand with silt
	14.9 W	204	12.0	110	90	55%	silt with fine sand
	14.6 E	26	5.4	155	45	78%	silt with trace fine sands
	13.8 W	229	10.3	150	50	75%	silt with trace fine sand and trace organic material
	13.3 W	234	15.3	90	110	45%	silt with trace fine sand and trace organic material
	12.8 E	10	12.9	100	100	50%	silt with fine sand
	12.2 E	5	12.5	140	60	70%	silt with trace fine sand and trace organic material
	12.0 W	236	4.5	150	50	75%	silt with trace fine sand
	11.8 W	238	8.2	150	50	75%	silt with fine sand and trace organic material
4/6/2018	28.3 W	240	10.3	120	80	60%	silt with fine sand, moderate weeds and trace clams
	28.3 W	241	4.3	120	80	60%	silt with fine sand and trace organics
	27.8 W	245	11.3	80	120	40%	fine to medium sand with silt and trace organics
	27.3 W	250	9.8	110	90	55%	silt with fine sand and trace organics
	27.0 W	253	12.5	130	70	65%	silt with some fine sand and trace clams
	26.7 W	257	9.6	160	40	80%	silt with trace fine sand and trace organic material
	26.9 E	260	12.8	120	80	60%	silt with some fine sand and trace organics
	27.4 E	265	10	130	70	65%	silt with some fine sand
	27.9 E	270	10.7	100	100	50%	silt with some fine sand and some organics
	28.3 E	274	10.3	150	50	75%	silt with trace sand and trace organic material

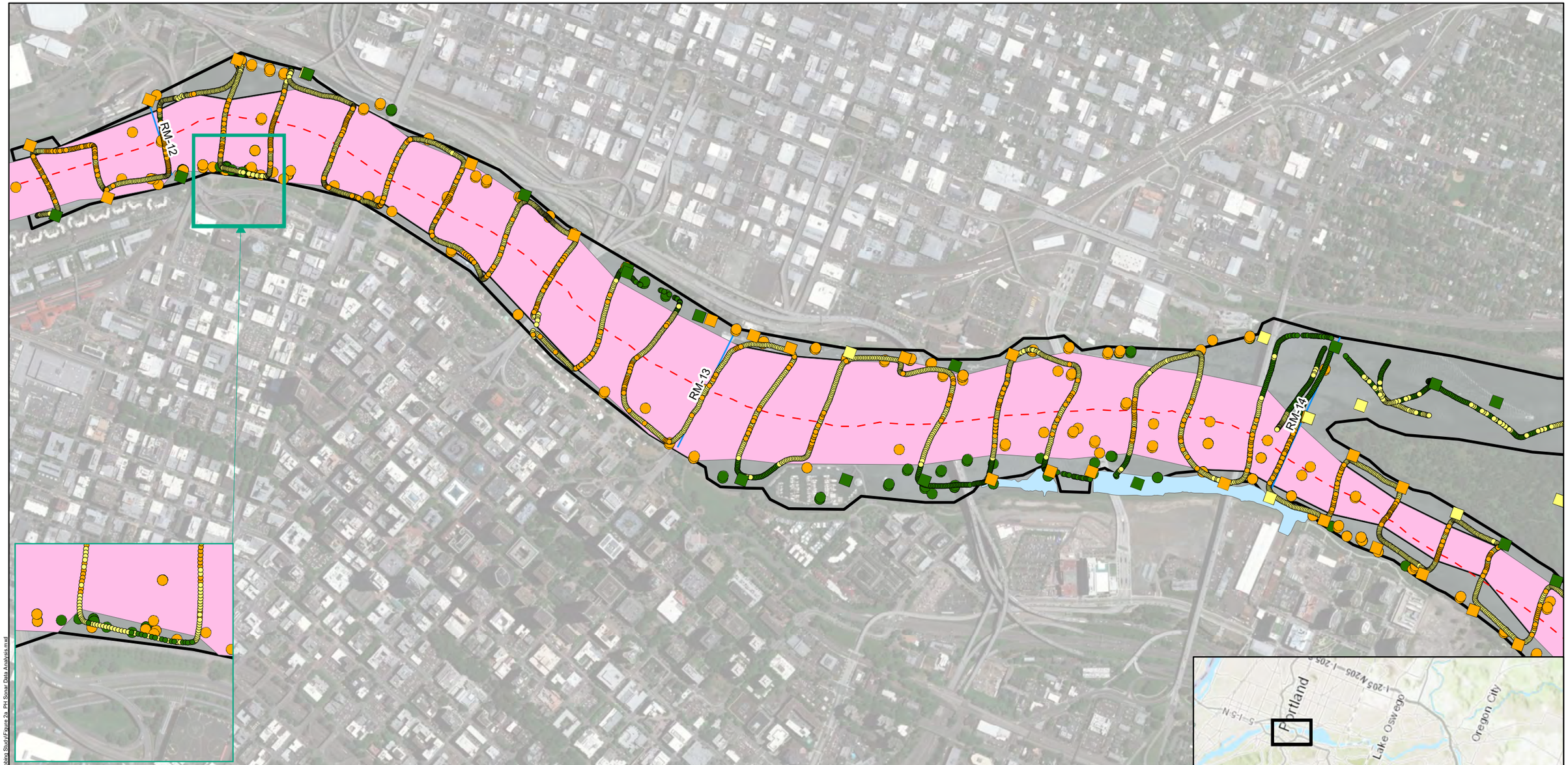
Notes:

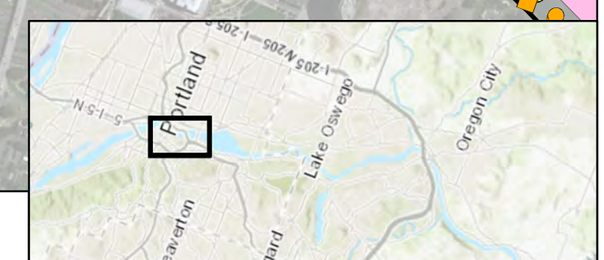
* The starting volume for the first two sieves was not 200 milliliters.

Table 2. Percent Distribution of Soft, Medium, and Hard Bottom Areas in the D/U Reach

Upriver Area		Area (acres)	Percentage of Entire Area (% of 1,939 acres)
Total D/U Reach		1,939	100%
Mid-Channel Hard Bottom Excluded Footprint (Excluded from Interpolation		990	51%
Remaining Area (Included for Interpolation)		949	49%
Remaining Areas	Remaining Area Classified as Soft Only	315	16%
	Remaining Area Classified as Medium Only	208	11%
	Remaining Area Classified as Hard Only	406	21%
	Remaining Area not Included, Result of Thiessen Polygon Anomalies	20	2%

FIGURES





Legend

Hand Probe Bottom Condition

- Soft
- Medium
- Hard

Sonar Probe Bottom Condition

- Soft
- Medium
- Hard

Historic Fines Percentage

- ≤ 35%
- > 35%

- River Mile Marker
- Approximate River Centerline
- Capped Area (Existing)
- Excluded Mid-channel Bottom Area
- Sample Placement Analysis Extent

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Historic fines data from 2004 RI/FS dataset.
3. RM - river mile.
4, Biosonar ® transducer used for mudline bottom hardness screening, followed by 18' long hand push probe.
5. Survey data in NAD 83 OSPN Intl.feet.
6. Exclusion area based on 2018 Biosonar ® data, 2018 probe results, and historic fines data.
7. June 2018 exclusion area based on change from connect-the -hard -orange-dots to connect-the-soft-green-dots.

N

1,000 500 0 1,000 2,000 Feet

Upriver 2018 Soft Sediment Probing Data
RM 11.8 to 14

Portland Harbor Superfund Site
PDI Surface Sediment FSP

AECOM Geosyntec consultants

Figure **1a**

MI/SEA | June 15, 2018

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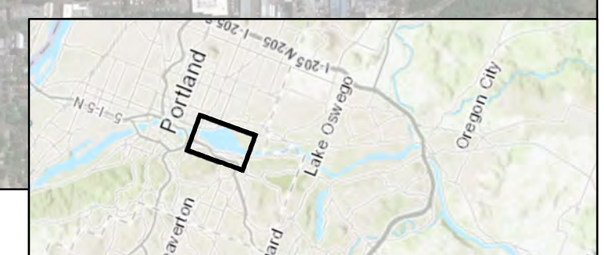

Legend

Hand Probe Bottom Condition
- Soft
- Medium
- Hard

Sonar Probe Bottom Condition
- Soft
- Medium
- Hard

Historic Fines Percentage
- ≤ 35%
- > 35%

- River Mile Marker
- Approximate River Centerline
- Capped Area (Existing)
- Excluded Mid-channel Bottom Area
- Sample Placement Analysis Extent

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Historic fines data from 2004 RI/FS dataset.
3. RM - river mile.
4. Biosonar ® transducer used for mudline bottom hardness screening, followed by 18' long hand push probe, and visial confirmation using a ponar grab at soft sediment areas.
5. Survey data in NAD 83 OSPN Intl.feet.

N

1,000 500 0 1,000 2,000 Feet

Upriver 2018 Soft Sediment Probing Data
RM 14 to 16

Portland Harbor Superfund Site
PDI Surface Sediment FSP

AECOM Geosyntec consultants

Figure **1b**

MI/SEA June 15, 2018

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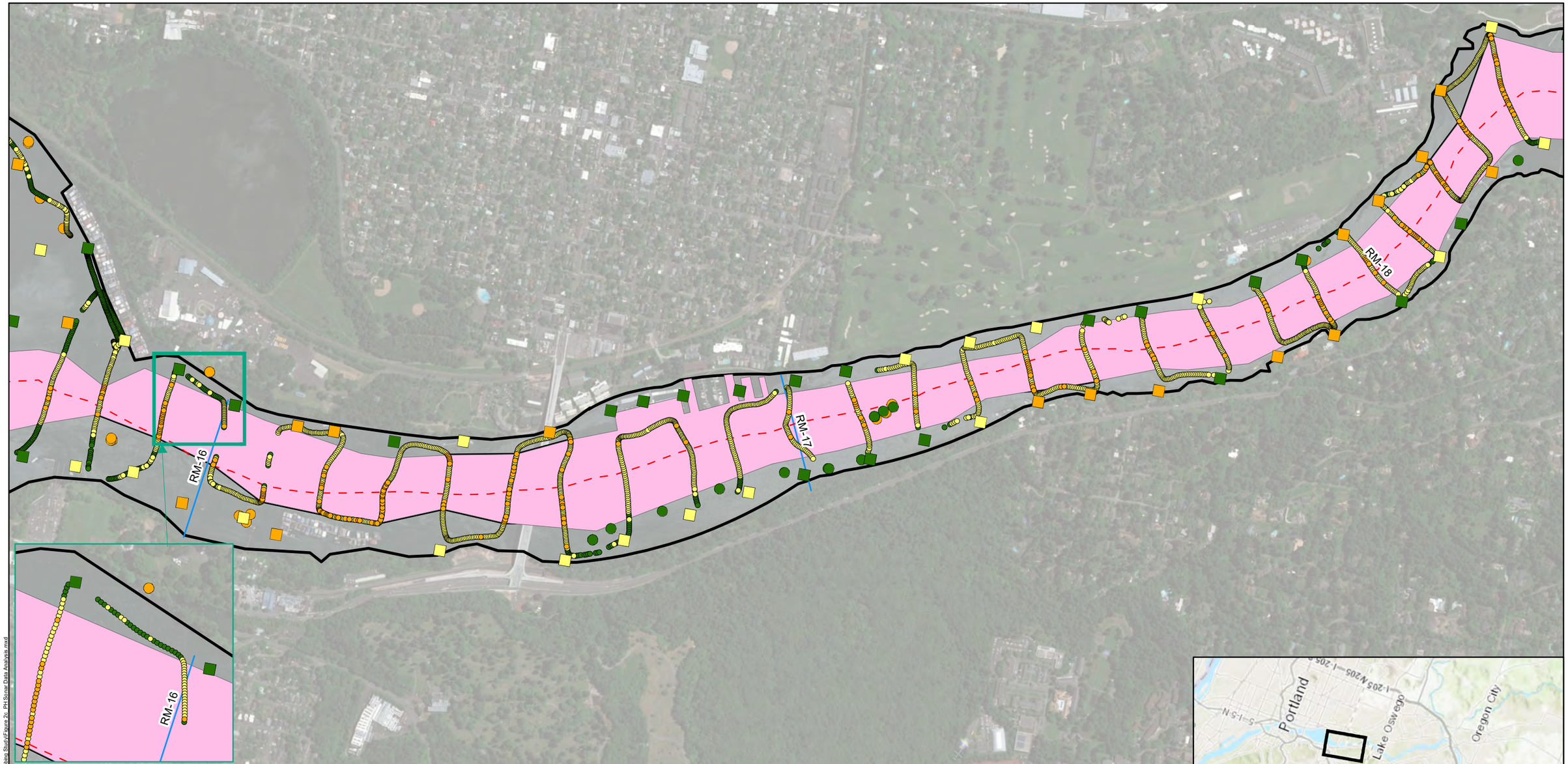

Legend

Hand Probe Bottom Condition

- Soft
- Medium
- Hard

Sonar Probe Bottom Condition

- Soft
- Medium
- Hard

Historic Fines Percentage

- ≤ 35%
- > 35%

- River Mile Marker
- Approximate River Centerline
- Buffer Based On Hard Bottom Designation
- Sample Placement Analysis Extent

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Historic fines data from 2004 RI/FS dataset.
3. RM - river mile.
4. Biosonar ® transducer used for mudline bottom hardness screening, followed by 18' long hand push probe, and visial confirmation using a ponar grab at soft sediment areas.
5. Survey data in NAD 83 OSPN Intl.feet.

N

1,000 500 0 1,000 2,000 Feet

Upriver 2018 Soft Sediment Probing Data
RM 16 to 18

Portland Harbor Superfund Site
PDI Surface Sediment FSP

AECOM Geosyntec consultants

MI/SEA | June 15, 2018

Figure **1c**

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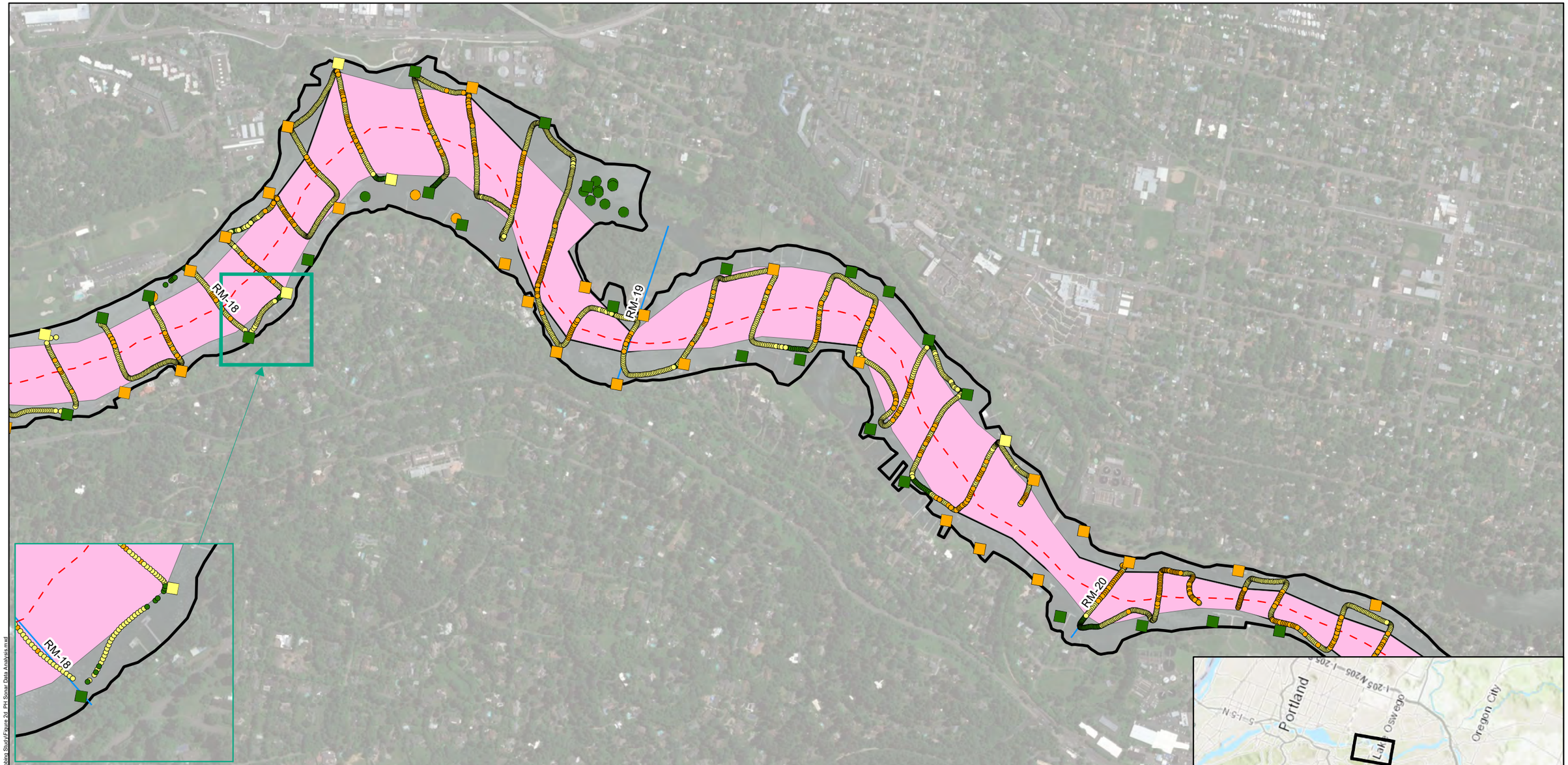

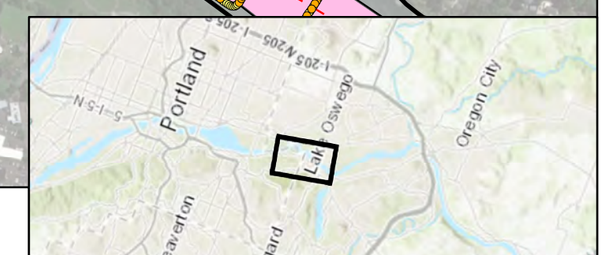

Legend

Hand Probe Bottom Condition

- Soft
- Medium
- Hard

Sonar Probe Bottom Condition

- Soft
- Medium
- Hard

Historic Fines Percentage

- ≤ 35%
- > 35%

- River Mile Marker
- Approximate River Centerline
- Excluded Mid-channel Bottom Area
- Sample Placement Analysis Extent

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Historic fines data from 2004 RI/FS dataset.
3. RM - river mile.
4. Biosonar ® transducer used for mudline bottom hardness screening, followed by 18' long hand push probe, and visial confirmation using a ponar grab at soft sediment areas.
5. Survey data in NAD 83 OSPN Intl.feet.

N

1,000 500 0 1,000 2,000 Feet

Upriver 2018 Soft Sediment Probing Data
RM 18 to 20

Portland Harbor Superfund Site
PDI Surface Sediment FSP

AECOM Geosyntec consultants

Figure **1d**

MI/SEA | June 15, 2018

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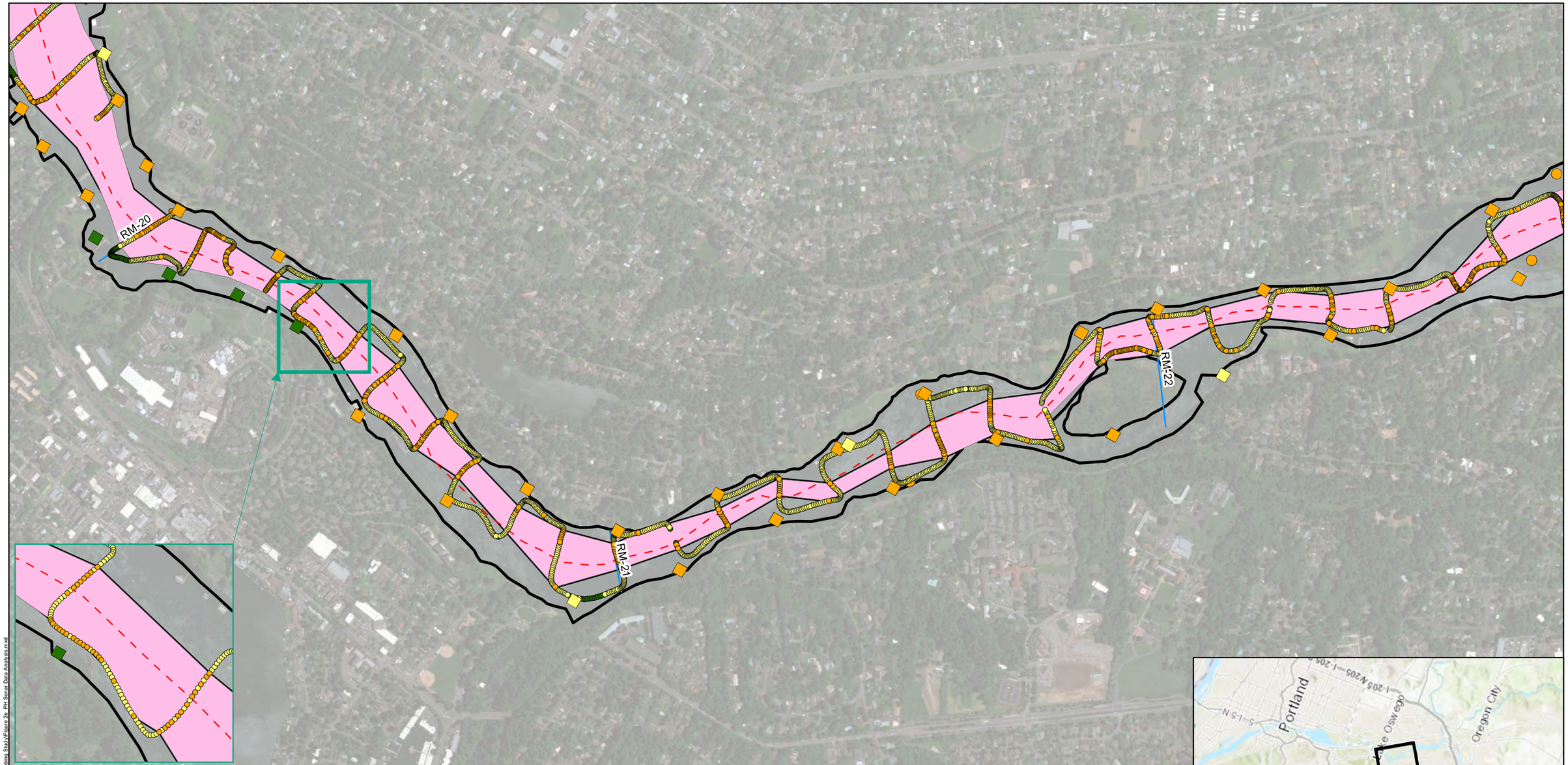
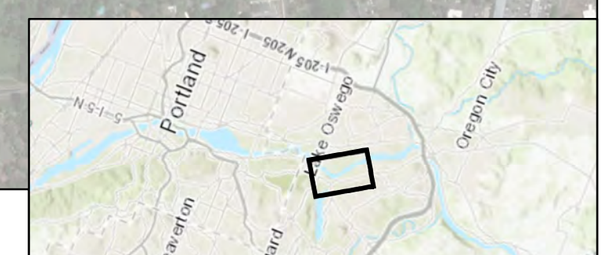




Legend

Hand Probe Bottom Condition

- Soft
- Medium
- Hard

Sonar Probe Bottom Condition

- Soft
- Medium
- Hard

Historic Fines Percentage

- ≤ 35%
- > 35%

- River Mile Marker
- Approximate River Centerline
- Excluded Mid-channel Bottom Area
- Sample Placement Analysis Extent

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Historic fines data from 2004 RI/FS dataset.
3. RM - river mile.
4, Biosonar ® transducer used for mudline bottom hardness screening, followed by 18' long hand push probe, and visial confirmation using a ponar grab at soft sediment areas.
5. Survey data in NAD 83 OSPN Intl.feet.

N

1,000 500 0 1,000 2,000 Feet

Upriver 2018 Soft Sediment Probing Data
RM 20 to 22

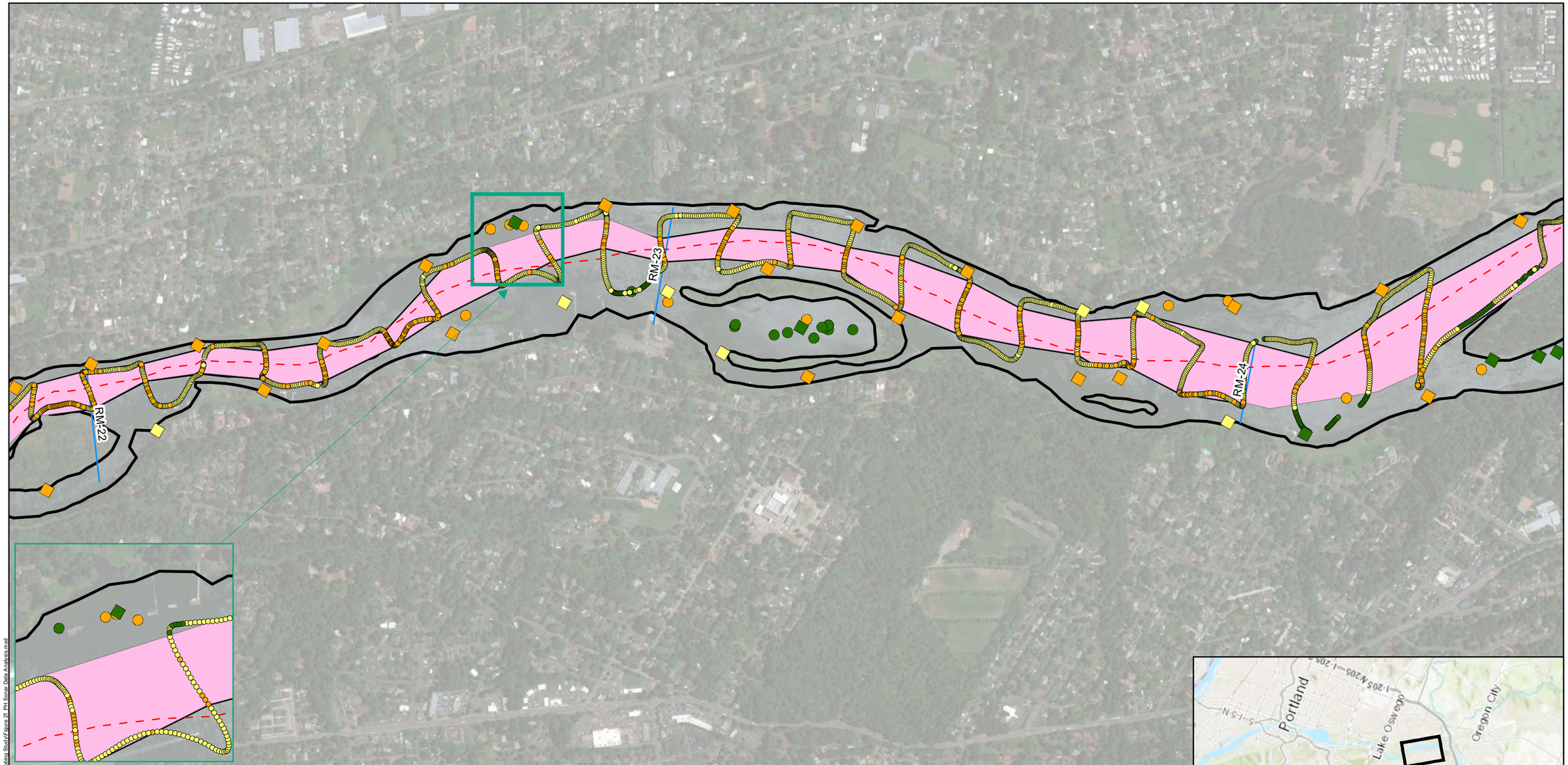
Portland Harbor Superfund Site
PDI Surface Sediment FSP

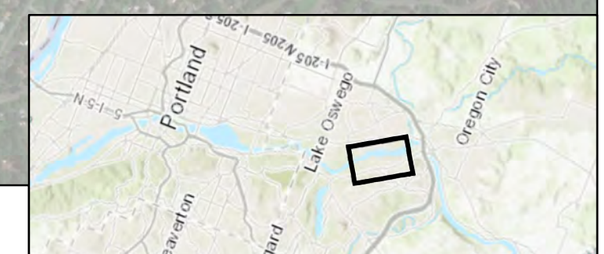
AECOM Geosyntec consultants

Figure **1e**

MI/SEA June 15, 2018

Path: P:\Projects\Portland Pre-Design PN\07\67A\900 GIS and CAD\2018 Soft Sediment Probing Study\Figure 2e_PH Sonar Data Analysis.mxd





Legend

Hand Probe Bottom Condition
- Soft
- Medium
- Hard

Sonar Probe Bottom Condition
- Soft
- Medium
- Hard

Historic Fines Percentage
- ≤ 35%
- > 35%

- River Mile Marker
- Approximate River Centerline
- Excluded Mid-channel Bottom Area
- Sample Placement Analysis Extent

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Historic fines data from 2004 RI/FS dataset.
3. RM - river mile.
4, Biosonar ® transducer used for mudline bottom hardness screening, followed by 18' long hand push probe, and visial confirmation using a ponar grab at soft sediment areas.
5. Survey data in NAD 83 OSPN Intl.feet.

N

1,000 500 0 1,000 2,000 Feet

Upriver 2018 Soft Sediment Probing Data
RM 22 to 24

Portland Harbor Superfund Site
PDI Surface Sediment FSP

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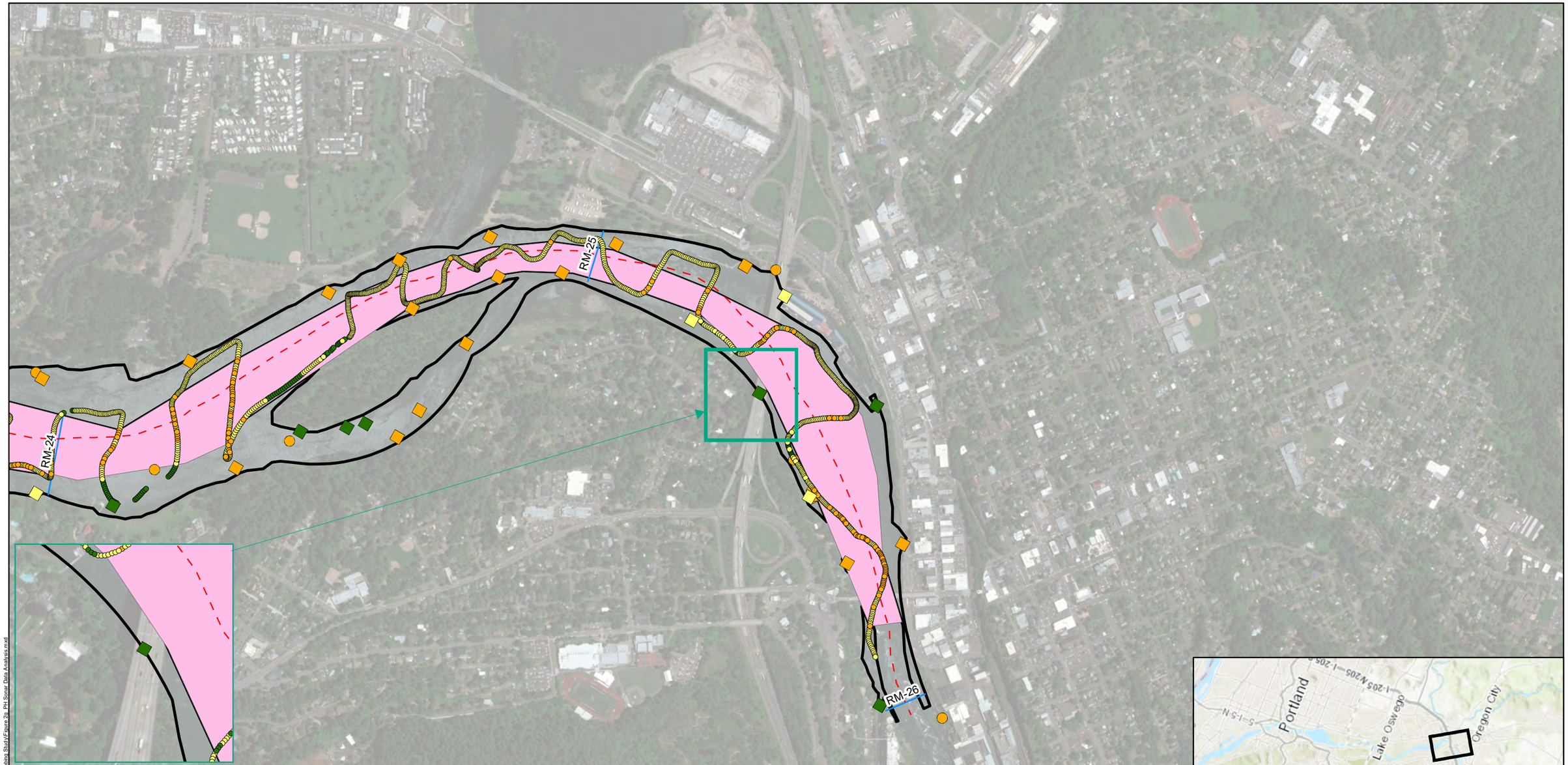
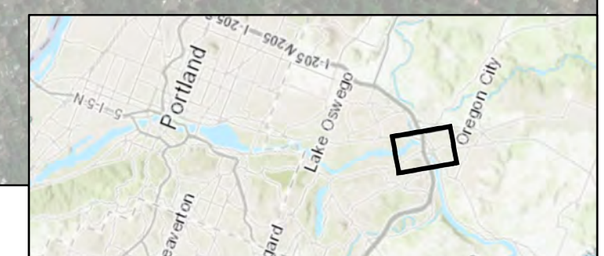
MI/SEA | June 15, 2018

Figure **1f**

Path: P:\Projects\Portland Pre-Design PN\60707A\900 GIS and CAD\2018 Soft Sediment Probing Stud\Figure 2f PH Sonar Data Analysis.mxd





Legend

Hand Probe Bottom Condition
- Soft
- Medium
- Hard

Sonar Probe Bottom Condition
- Soft
- Medium
- Hard

Historic Fines Percentage
- ≤ 35%
- > 35%

- River Mile Marker
- Approximate River Centerline
- Excluded Mid-channel Bottom Area
- Sample Placement Analysis Extent

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Historic fines data from 2004 RI/FS dataset.
3. RM - river mile.
4, Biosonar ® transducer used for mudline bottom hardness screening, followed by 18' long hand push probe, and visial confirmation using a ponar grab at soft sediment areas.
5. Survey data in NAD 83 OSPN Intl.feet.

N

1,000 500 0 1,000 2,000 Feet

Upriver 2018 Soft Sediment Probing Data
RM 24 to 26

Portland Harbor Superfund Site
PDI Surface Sediment FSP

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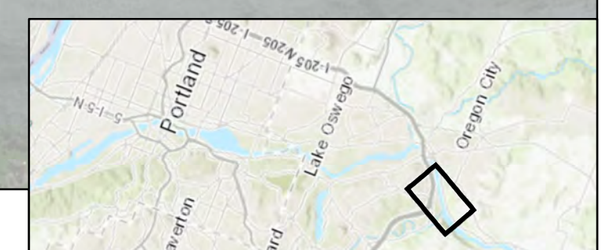
Figure 1g

MI/SEA | June 15, 2018

Path: P:\Projects\Portland Pre-Design PNG0767A\900 GIS and CAD\2018 Soft Sediment Probing Study\Figure 2g_PH Sonar Data Analysis.mxd



Legend

Hand Probe Bottom Condition

- Soft
- Medium
- Hard

Sonar Probe Bottom Condition

- Soft
- Medium
- Hard

Historic Fines Percentage

- ≤ 35%
- > 35%

- River Mile Marker
- Approximate River Centerline
- Excluded Mid-channel Bottom Area
- Sample Placement Analysis Extent

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Historic fines data from 2004 RI/FS dataset.
3. RM - river mile.
4, Biosonar ® transducer used for mudline bottom hardness screening, followed by 18' long hand push probe, and visial confirmation using a ponar grab at soft sediment areas.
5. Survey data in NAD 83 OSPN Intl.feet.

N

1,000 500 0 1,000 2,000 Feet

Upriver 2018 Soft Sediment Probing Data
RM 27 to 28.6

Portland Harbor Superfund Site
PDI Surface Sediment FSP

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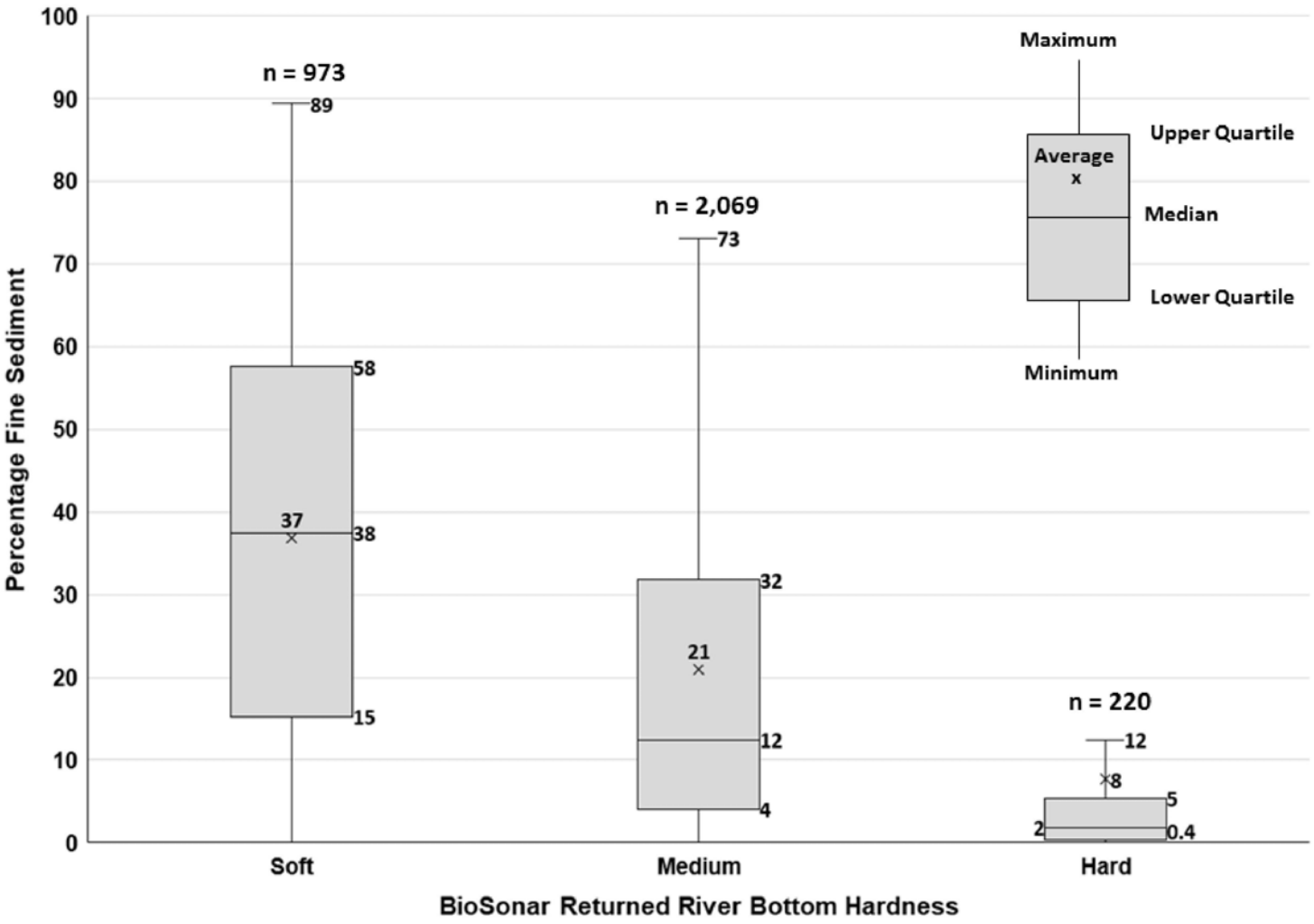
Figure **1h**

MI/SEA | June 15, 2018

Path: P:\Projects\Portland Pre-Design PN\07/67A\900 GIS and CAD\2018 Soft Sediment Probing Study\Figure 2h_PH Sonar Data Analysis.mxd



Path: P:\Projects\Portland Pre-Design PNG0767A\900 GIS and CAD\2018 Soft Sediment Probing Study\Figure 1

Note:
Data provided in Figure 2 was collected on 2 April, 2018 with the use of a single beam sonar and analyzed through BioSonar®. Over 15,000 sonar points were recorded and then compared against sediment grab data points. The BioSonar® data located within 100 feet of a sediment Grab Data point was compared against the percent fines of that grab. The comparison was used to determine the statistical accuracy of the BioSonar® data with a total of 3,262 data points analyzed. Figure 2 shows that statistically hard BioSonar® data is not likely to contain soft sediment based on sediment grab data comparison.

Biosonar® Data Located within 100ft Radius of a Sediment Grab Data Point Compared to Percent Fines of that Data Point

Portland Harbor Superfund Site
PDI Surface Sediment FSP

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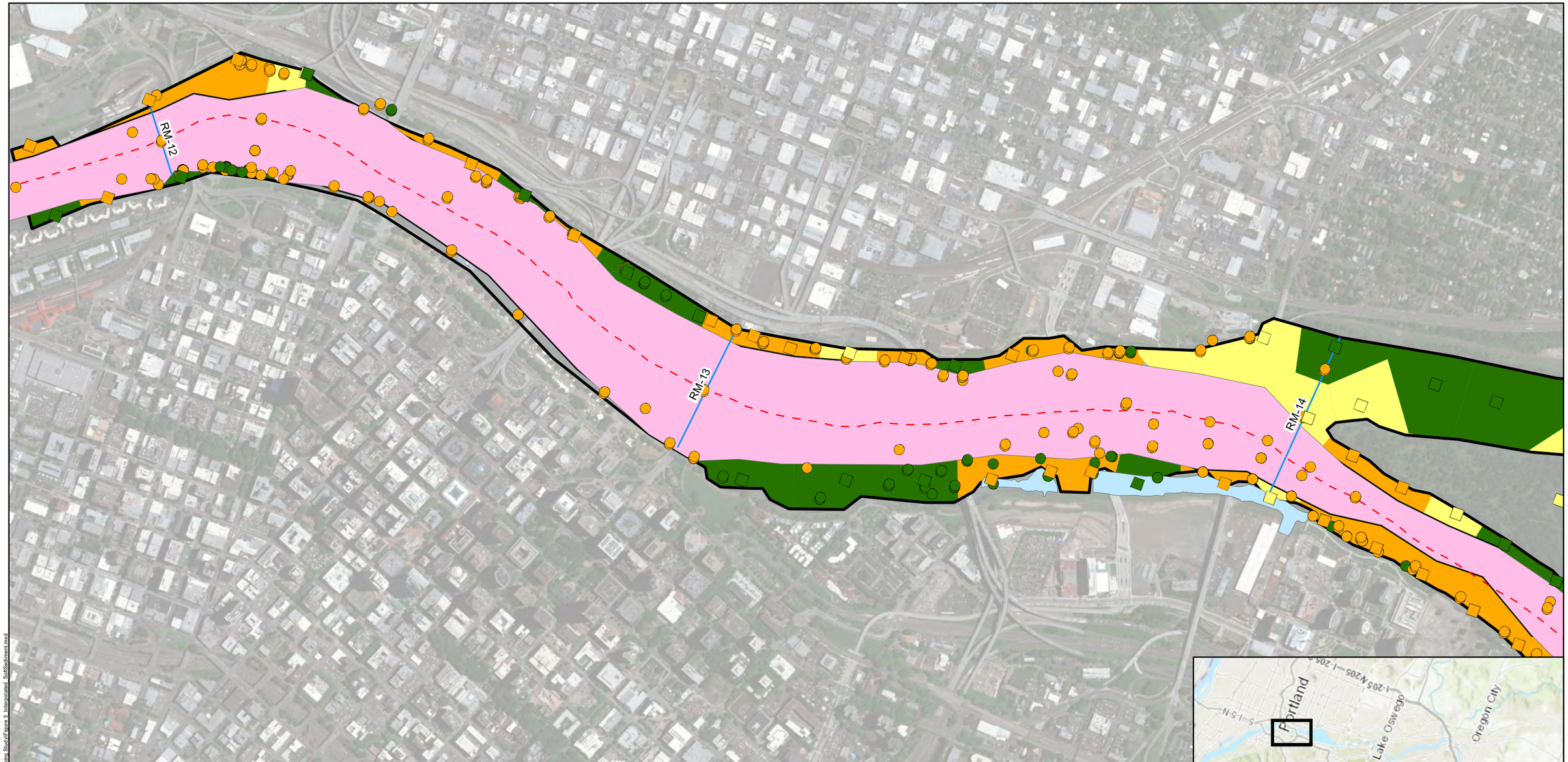
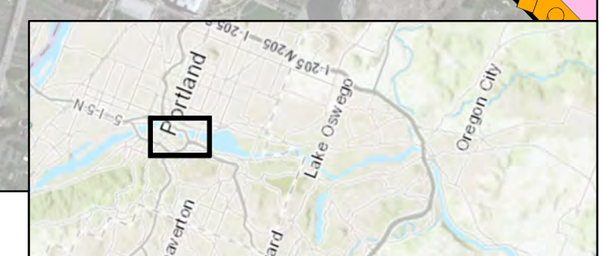
Figure 2

MI/SEA | May 23, 2018





Legend

Hand Probe Bottom Condition

- Soft
- Medium
- Hard

Hand Probe Derived Bottom Condition Polygons

- Soft
- Medium
- Hard

Historic Fines Percentage

- ≤ 35%
- > 35%

- River Mile Marker
- Approximate River Centerline
- Capped Area (Existing)
- Excluded Mid-channel Bottom Area
- Sample Placement Analysis Extent

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Historic fines data from 2004 RI/FS dataset.
3. RM - river mile.
4, Biosonar ® trasducer used for mudline bottom hardness screening, followed by 18' long hand push probe, and visial confirmation using a ponar grab at soft sediment areas.
5. Survey data in NAD 83 OSPN Intl.feet.

N

1,000 500 0 1,000 2,000 Feet

2018 Interpolated Upriver Areas of Soft Sediment
RM 11.8 to 14

Portland Harbor Superfund Site
PDI Surface Sediment FSP

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Figure **3a**

MI/SEA | June 15, 2018

Path: P:\Projects\Portland Pre-Design PN\C0707A\0/00 GIS and CAD\2018 Soft Sediment Probing Stud\Figure 3_Interpolated_SoftSediment.mxd

Legend

Hand Probe Bottom Condition

- Soft
- Medium
- Hard

Hand Probe Derived Bottom Condition Polygons

- Soft
- Medium
- Hard

Historic Fines Percentage

- ≤ 35%
- > 35%

- River Mile Marker
- Approximate River Centerline
- Capped Area (Existing)
- Excluded Mid-channel Bottom Area
- Sample Placement Analysis Extent

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Historic fines data from 2004 RI/FS dataset.
3. RM - river mile.
4, Biosonar ® trasducer used for mudline bottom hardness screening, followed by 18' long hand push probe, and visial confirmation using a ponar grab at soft sediment areas.
5. Survey data in NAD 83 OSPN Intl.feet.

N

1,000 500 0 1,000 2,000 Feet

2018 Interpolated Upriver Areas of Soft Sediment RM 14 to 16

Portland Harbor Superfund Site
PDI Surface Sediment FSP

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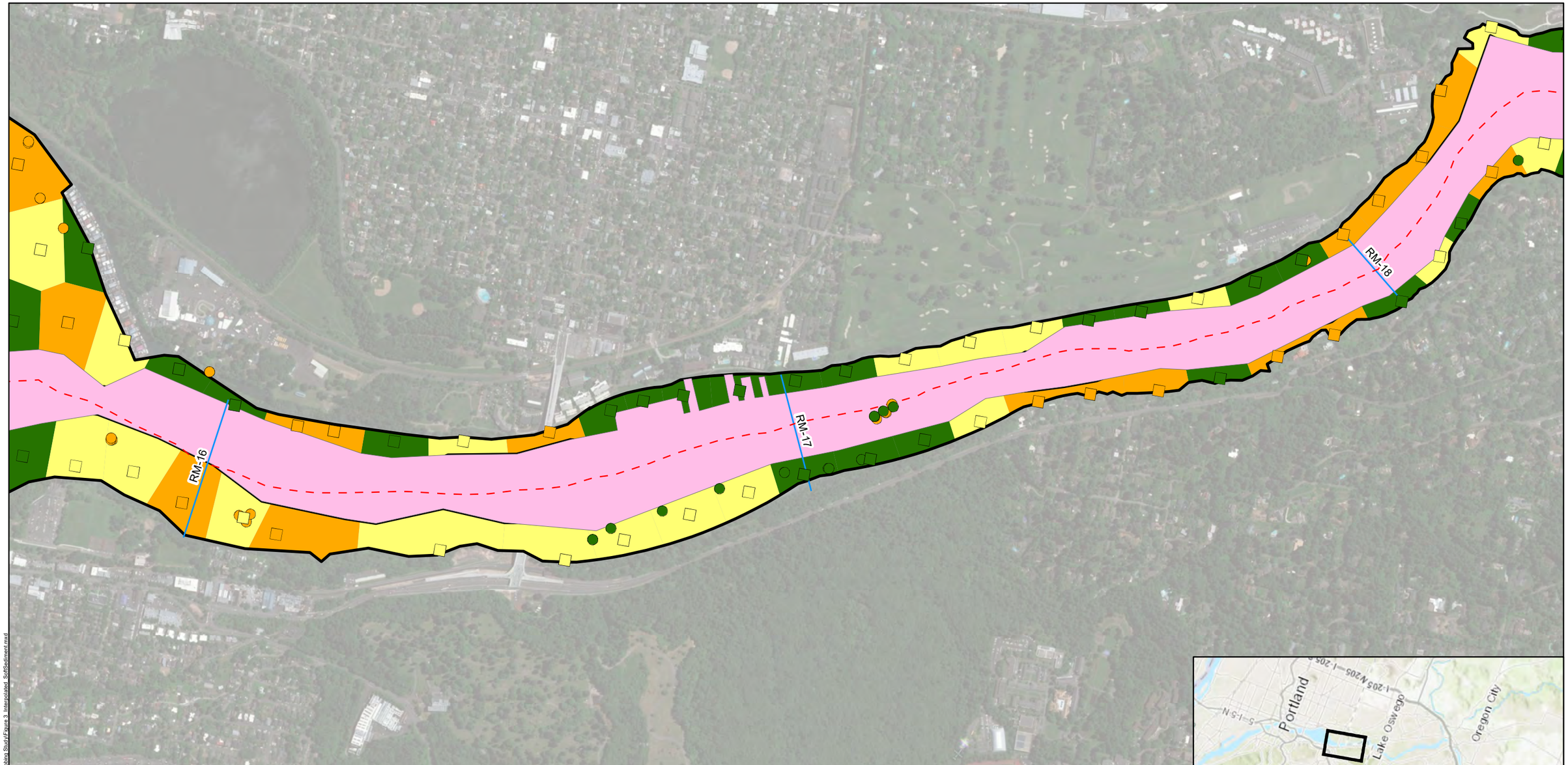
MI/SEA | June 15, 2018

Figure 3b

Path: P:\Projects\Portland Pre-Design PN\07\67A\00 GIS and CAD\2018 Soft Sediment Probing Study\Figure 3_Interpolated_SoftSediment.mxd



Legend

Hand Probe Bottom Condition

- Soft
- Medium
- Hard

Hand Probe Derived Bottom Condition Polygons

- Soft
- Medium
- Hard

Historic Fines Percentage

- ≤ 35%
- > 35%

- River Mile Marker
- Approximate River Centerline
- Excluded Mid-channel Bottom Area
- Sample Placement Analysis Extent

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Historic fines data from 2004 RI/FS dataset.
3. RM - river mile.
4, Biosonar ® trasducer used for mudline bottom hardness screening, followed by 18' long hand push probe, and visial confirmation using a ponar grab at soft sediment areas.
5. Survey data in NAD 83 OSPN Intl.feet.

N

1,000 500 0 1,000 2,000 Feet

2018 Interpolated Upriver Areas of Soft Sediment RM 16 to 18

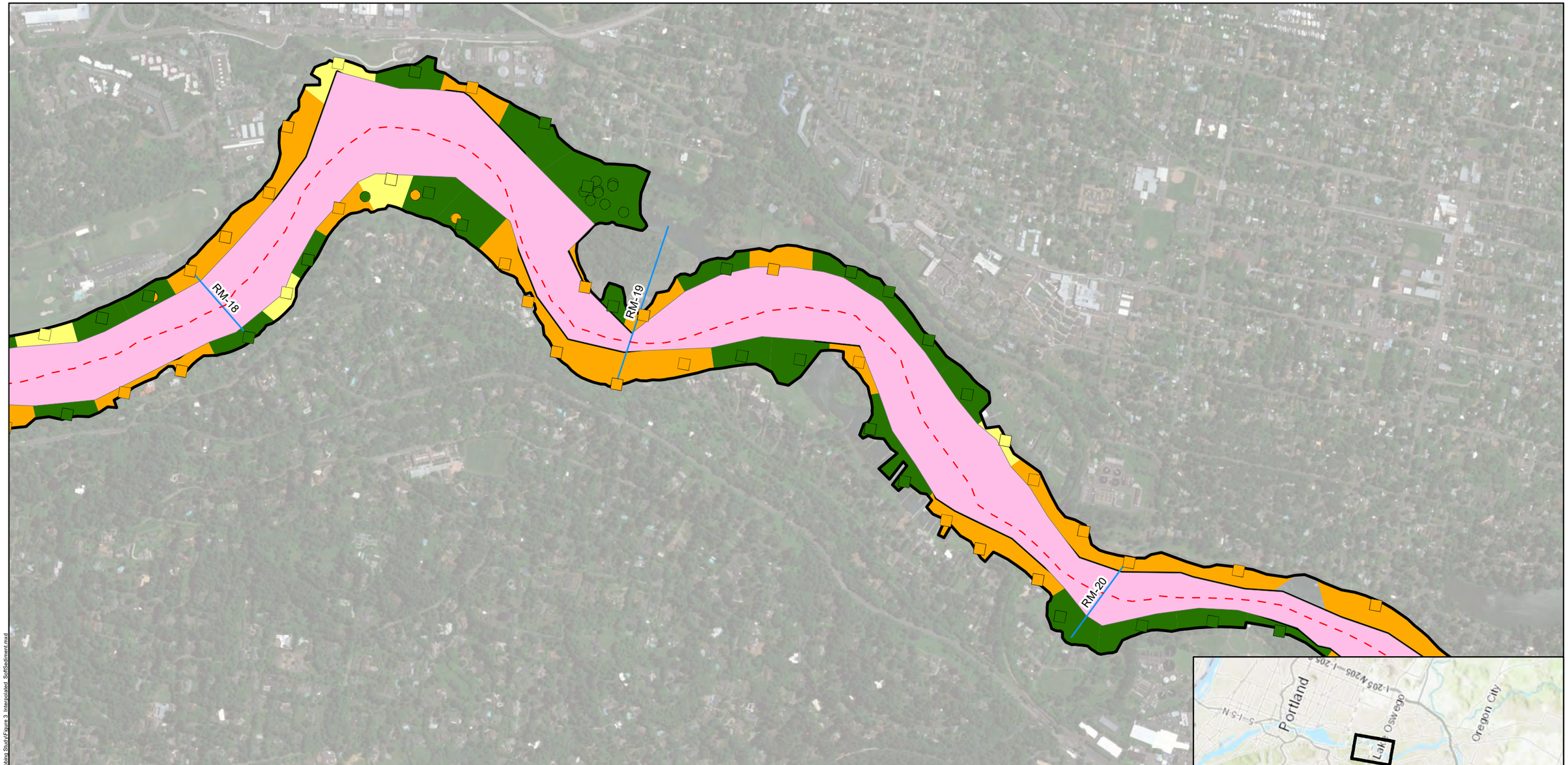
Portland Harbor Superfund Site
PDI Surface Sediment FSP

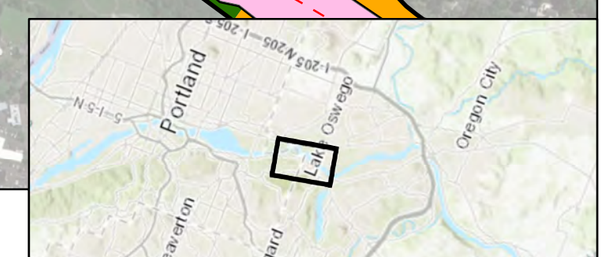
AECOM Geosyntec consultants

MI/SEA | June 15, 2018

Figure 3c

Path: P:\Projects\Portland Pre-Design PN 60787A\900 GIS and CAD\2018 Soft Sediment Probing Study\Figure 3_Interpolated_SoftSediment.mxd





Legend

Hand Probe Bottom Condition

- Soft
- Medium
- Hard

Hand Probe Derived Bottom Condition Polygons

- Soft
- Medium
- Hard

Historic Fines Percentage

- ≤ 35%
- > 35%

- River Mile Marker
- Approximate River Centerline
- Excluded Mid-channel Bottom Area
- Sample Placement Analysis Extent

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Historic fines data from 2004 RI/FS dataset.
3. RM - river mile.
4, Biosonar ® trasducer used for mudline bottom hardness screening, followed by 18' long hand push probe, and visial confirmation using a ponar grab at soft sediment areas.
5. Survey data in NAD 83 OSPN Intl.feet.

N

1,000 500 0 1,000 2,000 Feet

2018 Interpolated Upriver Areas of Soft Sediment RM 18 to 20

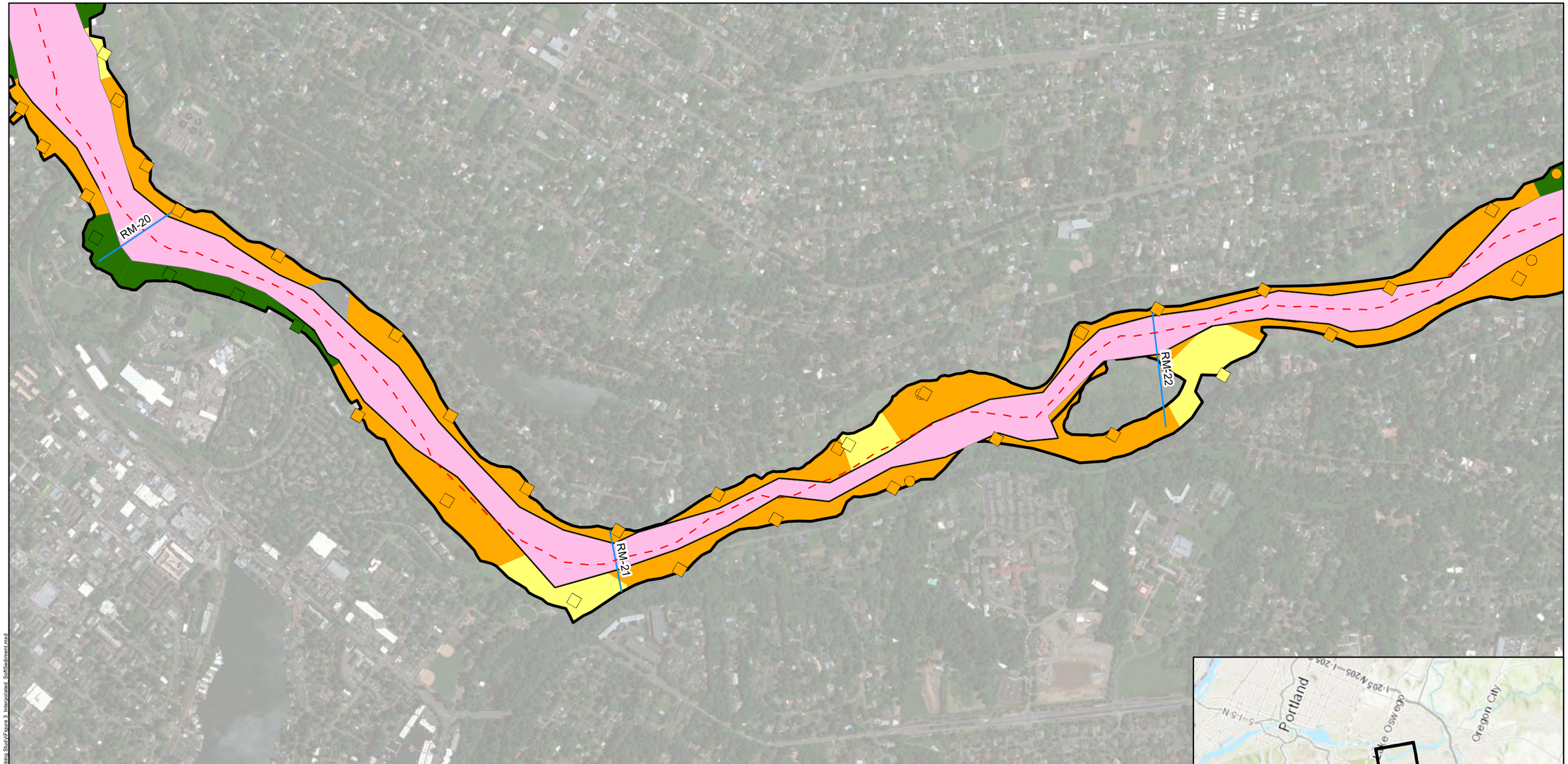
Portland Harbor Superfund Site
PDI Surface Sediment FSP

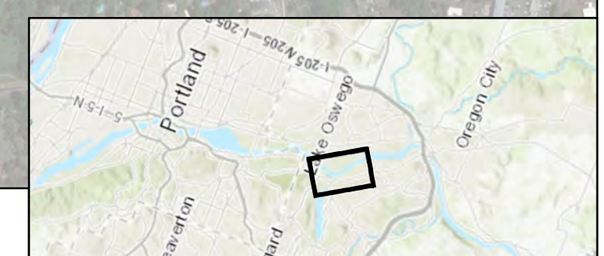
AECOM Geosyntec consultants

MI/SEA | June 15, 2018

Figure **3d**

Path: P:\Projects\Portland Pre-Design PN 60797A\900 GIS and CAD\2018 Soft Sediment Probing Study\Figure 3_Interpolated_SoftSediment.mxd





Legend

Hand Probe Bottom Condition
- Soft
- Medium
- Hard

Hand Probe Derived Bottom Condition Polygons
- Soft
- Medium
- Hard

Historic Fines Percentage
- ≤ 35%
- > 35%

- River Mile Marker
- Approximate River Centerline
- Excluded Mid-channel Bottom Area
- Sample Placement Analysis Extent

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Historic fines data from 2004 RI/FS dataset.
3. RM - river mile.
4, Biosonar ® trasducer used for mudline bottom hardness screening, followed by 18' long hand push probe, and visial confirmation using a ponar grab at soft sediment areas.
5. Survey data in NAD 83 OSPN Intl.feet.

N

1,000 500 0 1,000 2,000 Feet

2018 Interpolated Upriver Areas of Soft Sediment RM 20 to 22

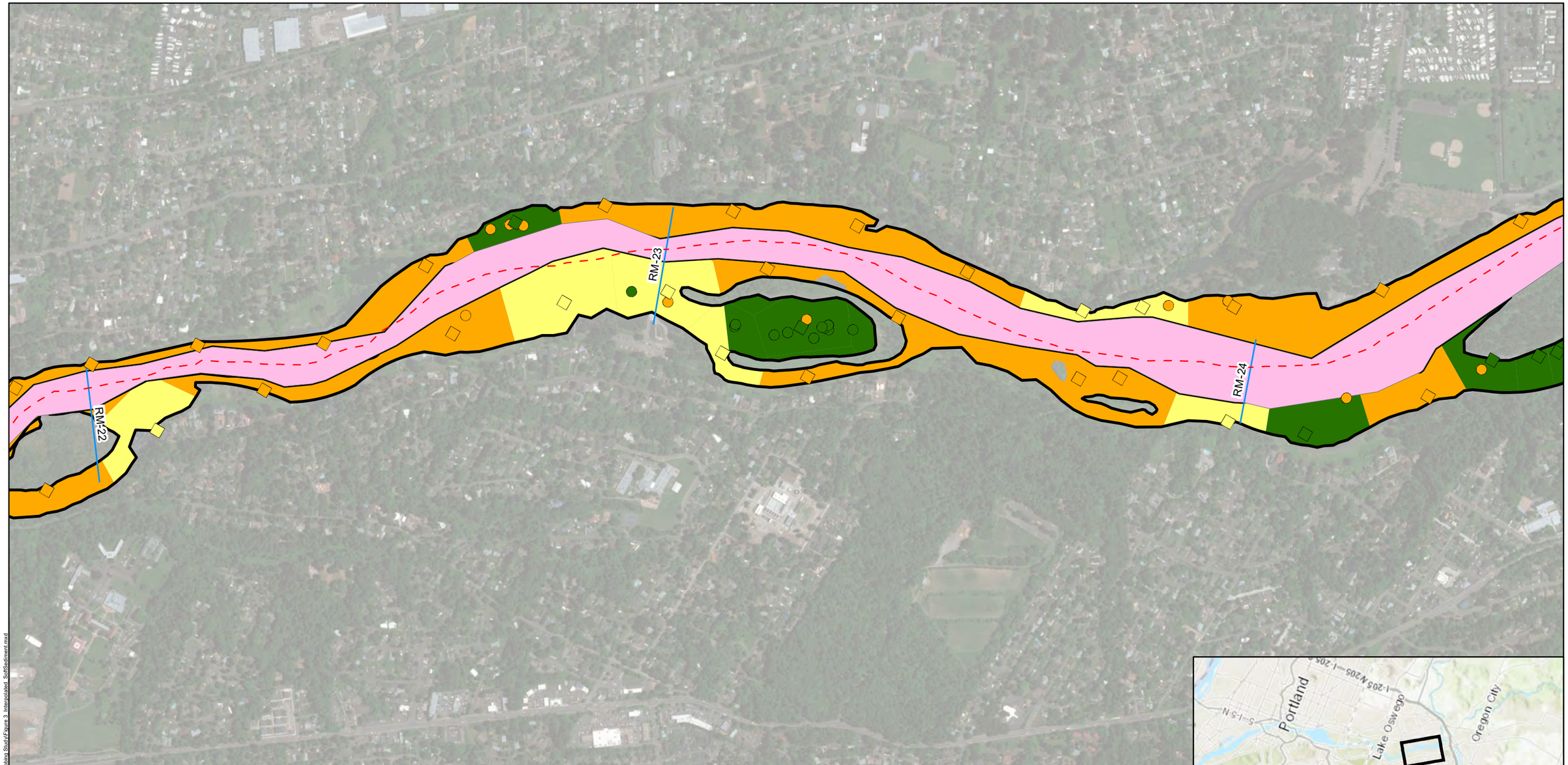
Portland Harbor Superfund Site
PDI Surface Sediment FSP

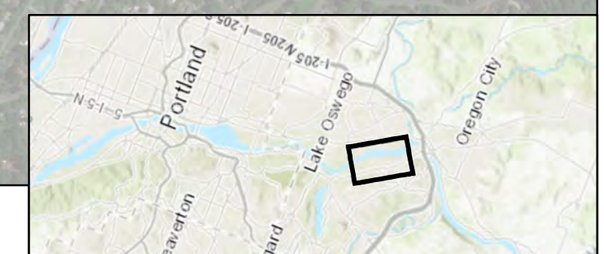
AECOM Geosyntec consultants

Figure 3e

MI/SEA | June 15, 2018

Path: P:\Projects\Portland Pre-Design PNG0767A\900 GIS and CAD\2018 Soft Sediment Probing Study\Figure 3_Interpolated_SoftSediment.mxd





Legend

Hand Probe Bottom Condition

- Soft
- Medium
- Hard

Hand Probe Derived Bottom Condition Polygons

- Soft
- Medium
- Hard

Historic Fines Percentage

- ≤ 35%
- > 35%

- River Mile Marker
- Approximate River Centerline
- Excluded Mid-channel Bottom Area
- Sample Placement Analysis Extent

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Historic fines data from 2004 RI/FS dataset.
3. RM - river mile.
4, Biosonar ® trasducer used for mudline bottom hardness screening, followed by 18' long hand push probe, and visial confirmation using a ponar grab at soft sediment areas.
5. Survey data in NAD 83 OSPN Intl.feet.

N

1,000 500 0 1,000 2,000 Feet

2018 Interpolated Upriver Areas of Soft Sediment RM 22 to 24

Portland Harbor Superfund Site
PDI Surface Sediment FSP

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Figure 3f

MI/SEA | June 15, 2018

Path: P:\Projects\Portland Pre-Design PN G0767A\900 GIS and CAD\2018 Soft Sediment Probing Study\Figure 3_Interpolated_SoftSediment.mxd

Legend

Hand Probe Bottom Condition
- Soft
- Medium
- Hard

Hand Probe Derived Bottom Condition Polygons
- Soft
- Medium
- Hard

Historic Fines Percentage
- ≤ 35%
- > 35%

- River Mile Marker
- Approximate River Centerline
- Excluded Mid-channel Bottom Area
- Sample Placement Analysis Extent

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Historic fines data from 2004 RI/FS dataset.
3. RM - river mile.
4, Biosonar ® trasducer used for mudline bottom hardness screening, followed by 18' long hand push probe, and visial confirmation using a ponar grab at soft sediment areas.
5. Survey data in NAD 83 OSPN Intl.feet.

N

1,000 500 0 1,000 2,000 Feet

2018 Interpolated Upriver Areas of Soft Sediment
RM 24 to 26

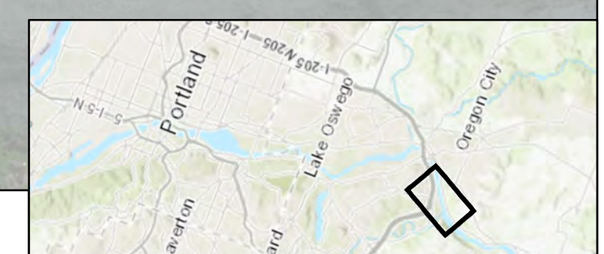
Portland Harbor Superfund Site
PDI Surface Sediment FSP

AECOM Geosyntec consultants

Figure 3g

MI/SEA | June 15, 2018

Path: P:\Projects\Portland Pre-Design PNG0767A\900 GIS and CAD\2018 Soft Sediment Probing Study\Figure 3_Interpolated_SoftSediment.mxd



Legend

Hand Probe Bottom Condition

- Soft
- Medium
- Hard

Hand Probe Derived Bottom Condition Polygons

- Soft
- Medium
- Hard

Historic Fines Percentage

- ≤ 35%
- > 35%

- River Mile Marker
- Approximate River Centerline
- Excluded Mid-channel Bottom Area
- Sample Placement Analysis Extent

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Historic fines data from 2004 RI/FS dataset.
3. RM - river mile.
4, Biosonar ® trasducer used for mudline bottom hardness screening, followed by 18' long hand push probe, and visial confirmation using a ponar grab at soft sediment areas.
5. Survey data in NAD 83 OSPN Intl.feet.

N

1,000 500 0 1,000 2,000 Feet

2018 Interpolated Upriver Areas of Soft Sediment RM 27 to 28.6

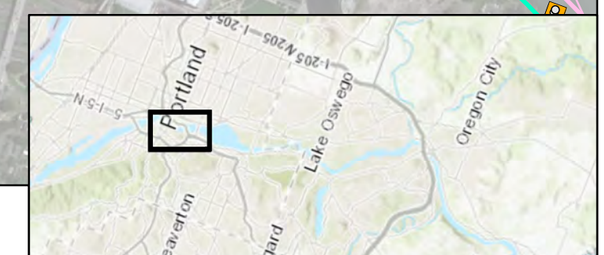
Portland Harbor Superfund Site
PDI Surface Sediment FSP

AECOM Geosyntec consultants

Figure 3h

MI/SEA June 15, 2018

Path: P:\Projects\Portland Pre-Design PN 60787A\900 GIS and CAD\2018 Soft Sediment Probing Study\Figure 3_Interpolated_SoftSediment.mxd



Legend

- Proposed Sediment FSP Grab Sample Location (n = 60)

Hand Probe Bottom Condition

- Soft (> 35% fines)

Percent Fines - Historic RI and 2018 Surface Sediment

- < 30 %
- 30 - 60 %
- > 60 %

Percent TOC - Historic RI Surface Sediment

- < 0.5 %
- 0.5- 2.5 %
- > 2.5 %
- Areas of Soft Sediment Based on 2018 Hand Probing Data
- Excluded Mid-channel Hard Bottom Area
- Analysis Grid
- River Mile Marker
- Capped Area (Existing)

N

1,000 500 0 1,000 2,000 Feet

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Downtown Reach defined as (RM 11.8 -16.6) and the Upriver Reach (RM 16.6 - 28.4).
3. RM - river mile.
4. Biosonar ® transducer used for mudline bottom hardness screening, followed by 18' long hand push probe, and visial confirmation using a ponar grab at soft sediment areas.
5. Survey data in NAD 83 OSPN Intl.feet.
6. The approximate lateral distance along the shore used to define the Analysis Grids was approximately 675 ft in the Downtown reach and 950 ft in the Upriver reach.
7. Points were generated randomly inside the Hand Probe Thiessen Polygons within each of the Analysis Grids using the Create Random Points tool in ArcGIS 10. The 60 proposed grab locations were divided (30 ea) between the Downtown and the Upriver Reaches.
8. 2018 data includes ODEQ 2018 Upriver reach sampling locations and 2018 Geosyntec ponar grabs.

Proposed Downtown/Upriver Reach Surface Grab Locations (revised) RM 11.8 to 14

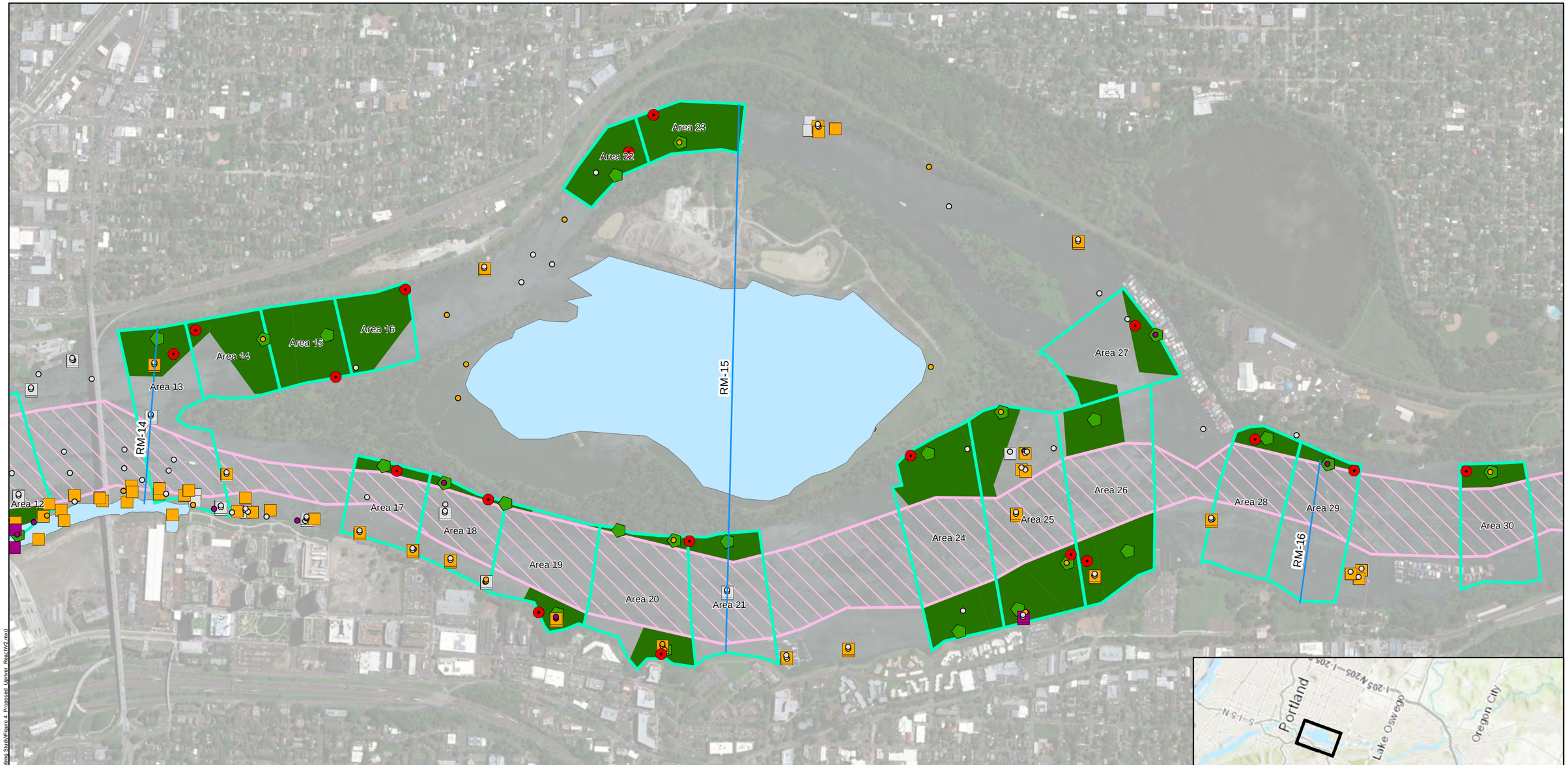
Portland Harbor Superfund Site
PDI Surface Sediment FSP

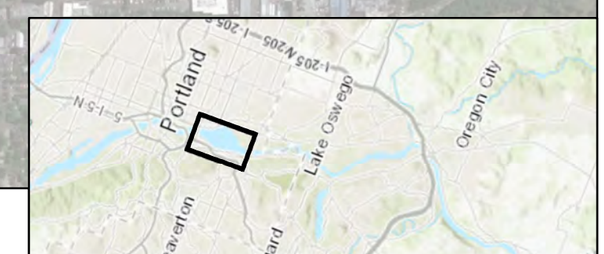
AECOM Geosyntec consultants

Figure **4a**

MI/SEA | June 15, 2018

Path: P:\Projects\Portland Pre-Design PN\0707A\00\GIS and CAD\2018 Soft Sediment Probing Study\Figure 4. Proposed Upriver Reach\V2.mxd





Legend

Proposed Sediment FSP Grab Sample Location (n = 60)

Hand Probe Bottom Condition

Soft (> 35% fines)

Percent Fines - Historic RI and 2018 Surface Sediment

< 30 %

30 - 60 %

> 60 %

Percent TOC - Historic RI Surface Sediment

< 0.5 %

0.5- 2.5 %

> 2.5 %

Areas of Soft Sediment Based on 2018 Hand Probing Data

Excluded Mid-channel Hard Bottom Area

Analysis Grid

River Mile Marker

Capped Area (Existing)

N

1,000 500 0 1,000 2,000 Feet

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Downtown Reach defined as (RM 11.8 -16.6) and the Upriver Reach (RM 16.6 - 28.4).
3. RM - river mile.
4. Biosonar ® transducer used for mudline bottom hardness screening, followed by 18' long hand push probe, and visial confirmation using a ponar grab at soft sediment areas.
5. Survey data in NAD 83 OSPN Intl.feet.
6. The approximate lateral distance along the shore used to define the Analysis Grids was approximately 675 ft in the Downtown reach and 950 ft in the Upriver reach.
7. Points were generated randomly inside the Hand Probe Thiessen Polygons within each of the Analysis Grids using the Create Random Points tool in ArcGIS 10. The 60 proposed grab locations were divided (30 ea) between the Downtown and the Upriver Reaches.
8. 2018 data includes ODEQ 2018 Upriver reach sampling locations and 2018 Geosyntec ponar grabs.

Proposed Downtown/Upriver Reach Surface Grab Locations (revised) RM 14 to 16

Portland Harbor Superfund Site
PDI Surface Sediment FSP

AECOM Geosyntec consultants

Figure 4b

MI/SEA | June 15, 2018

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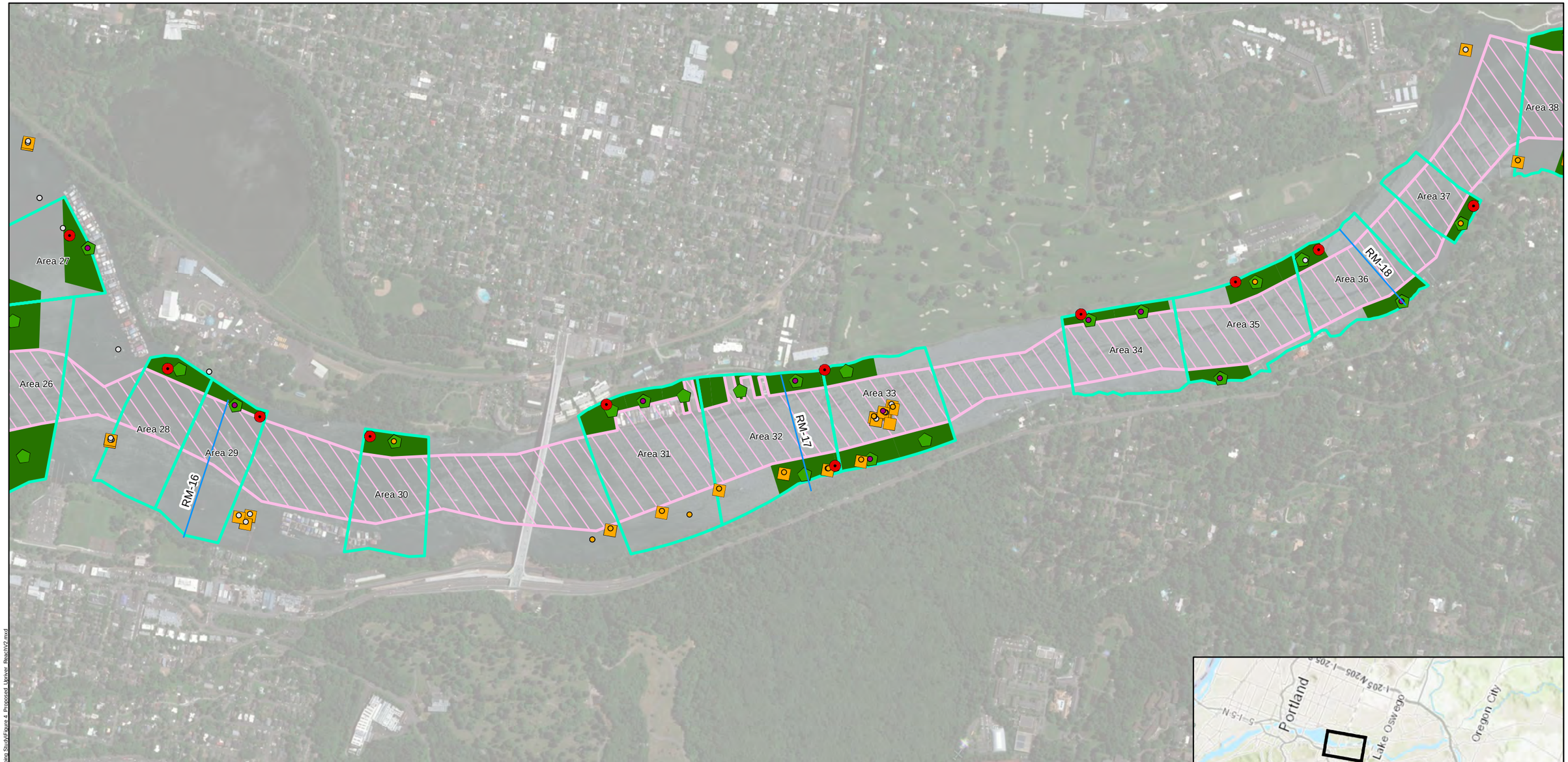

Legend

Proposed Sediment FSP Grab Sample Location (n = 60)

Hand Probe Bottom Condition

Soft (> 35% fines)

Percent Fines - Historic RI and 2018 Surface Sediment

< 30 %

30 - 60 %

> 60 %

Percent TOC - Historic RI Surface Sediment

< 0.5 %

0.5- 2.5 %

> 2.5 %

Areas of Soft Sediment Based on 2018 Hand Probing Data

Excluded Mid-channel Hard Bottom Area

Analysis Grid

River Mile Marker

N

1,000 500 0 1,000 2,000 Feet

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Downtown Reach defined as (RM 11.8 -16.6) and the Upriver Reach (RM 16.6 - 28.4).
3. RM - river mile.
4. Biosonar ® transducer used for mudline bottom hardness screening, followed by 18' long hand push probe, and visial confirmation using a ponar grab at soft sediment areas.
5. Survey data in NAD 83 OSPN Intl.feet.
6. The approximate lateral distance along the shore used to define the Analysis Grids was approximately 675 ft in the Downtown reach and 950 ft in the Upriver reach.
7. Points were generated randomly inside the Hand Probe Thiessen Polygons within each of the Analysis Grids using the Create Random Points tool in ArcGIS 10. The 60 proposed grab locations were divided (30 ea) between the Downtown and the Upriver Reaches.
8. 2018 data includes ODEQ 2018 Upriver reach sampling locations and 2018 Geosyntec ponar grabs.

Proposed Downtown/Upriver Reach Surface Grab Locations (revised) RM 16 to 18

Portland Harbor Superfund Site
PDI Surface Sediment FSP

AECOM Geosyntec consultants

Figure 4c

MI/SEA | June 15, 2018

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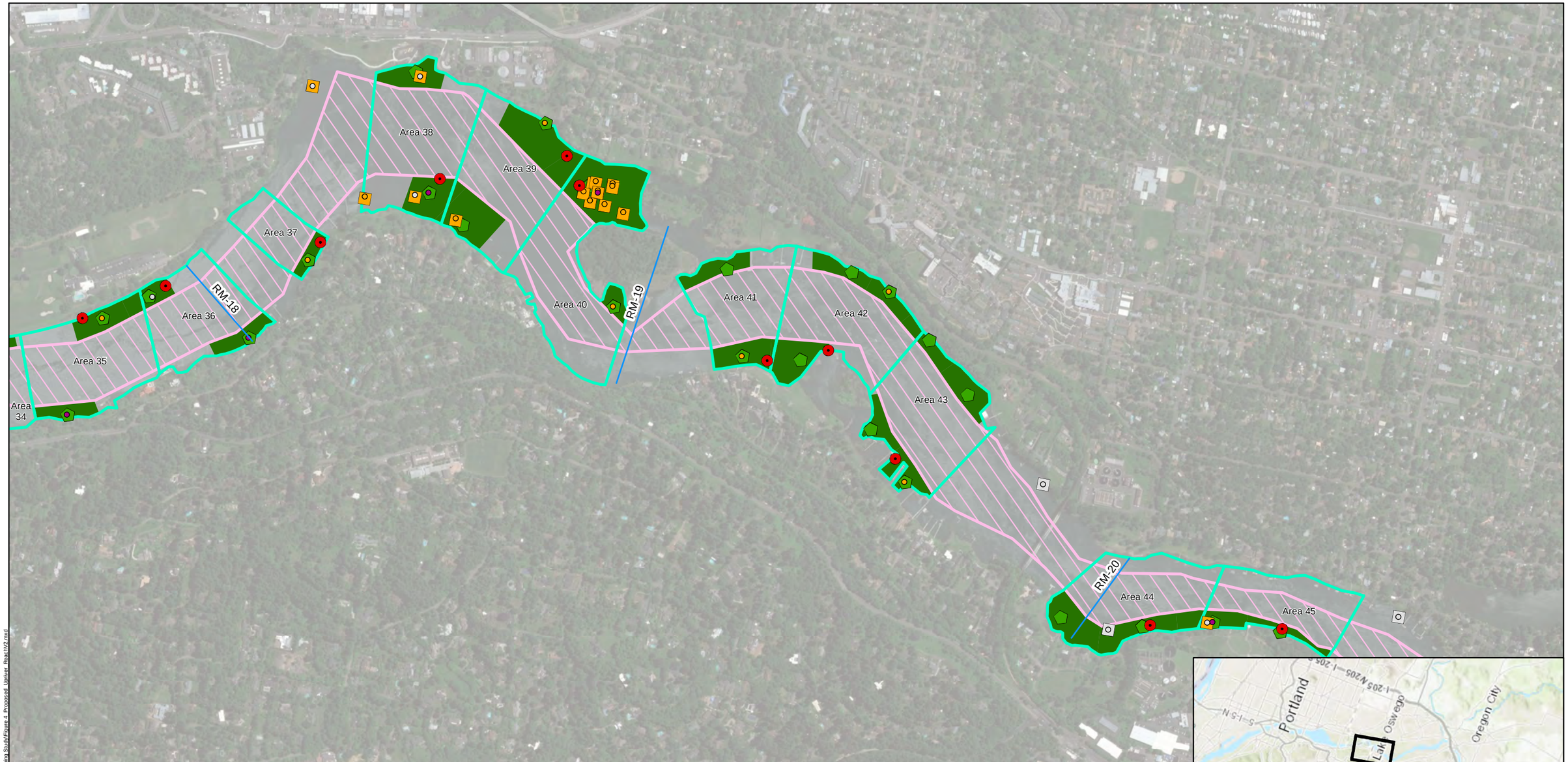


Legend

Proposed Sediment FSP Grab Sample Location (n = 60)

Hand Probe Bottom Condition

Soft (> 35% fines)

Percent Fines - Historic RI and 2018 Surface Sediment

< 30 %

30 - 60 %

> 60 %

Percent TOC - Historic RI Surface Sediment

< 0.5 %

0.5- 2.5 %

> 2.5 %

Areas of Soft Sediment Based on 2018 Hand Probing Data

Excluded Mid-channel Hard Bottom Area

Analysis Grid

River Mile Marker

N

1,000 500 0 1,000 2,000 Feet

Notes:

1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Downtown Reach defined as (RM 11.8 -16.6) and the Upriver Reach (RM 16.6 - 28.4).
3. RM - river mile.
4. Biosonar ® transducer used for mudline bottom hardness screening, followed by 18' long hand push probe, and visial confirmation using a ponar grab at soft sediment areas.
5. Survey data in NAD 83 OSPN Intl.feet.
6. The approximate lateral distance along the shore used to define the Analysis Grids was approximately 675 ft in the Downtown reach and 950 ft in the Upriver reach.
7. Points were generated randomly inside the Hand Probe Thiessen Polygons within each of the Analysis Grids using the Create Random Points tool in ArcGIS 10. The 60 proposed grab locations were divided (30 ea) between the Downtown and the Upriver Reaches.
8. 2018 data includes ODEQ 2018 Upriver reach sampling locations and 2018 Geosyntec ponar grabs.

Proposed Downtown/Upriver Reach Surface Grab Locations (revised) RM 18 to 20

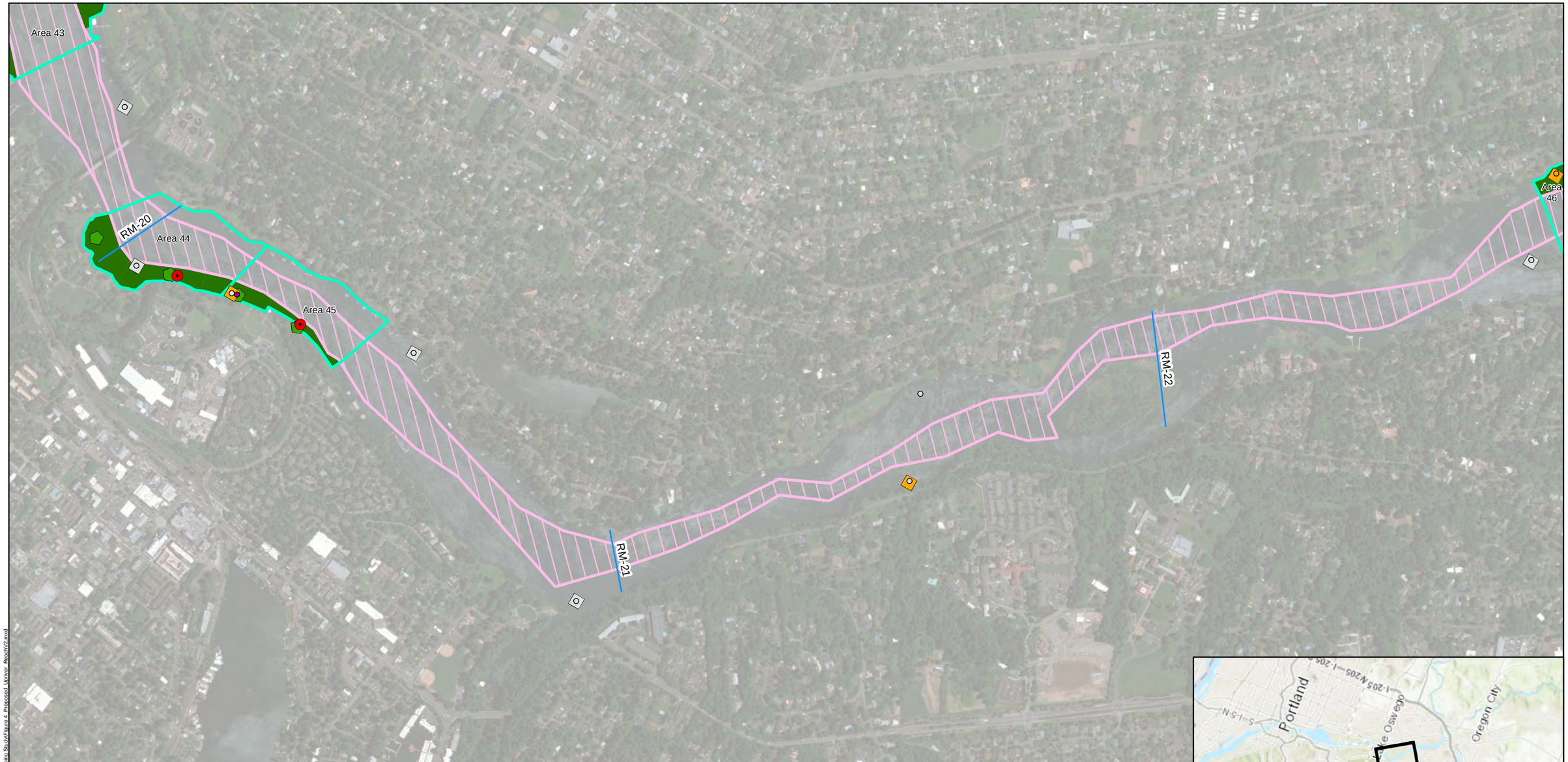
Portland Harbor Superfund Site
PDI Surface Sediment FSP

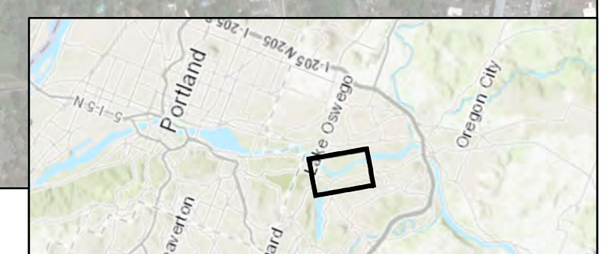
AECOM Geosyntec consultants

Figure 4d

MI/SEA | June 15, 2018

Path: P:\Projects\Portland Pre-Design PN G0767A\900 GIS and CAD\2018 Soft Sediment Probing Study\Figure 4_Proposed_Upriver_ReachV2.mxd





Legend

Proposed Sediment FSP Grab Sample Location (n = 60)

Hand Probe Bottom Condition

Soft (> 35% fines)

Percent Fines - Historic RI and 2018 Surface Sediment

< 30 %

30 - 60 %

> 60 %

Percent TOC - Historic RI Surface Sediment

< 0.5 %

0.5- 2.5 %

> 2.5 %

Areas of Soft Sediment Based on 2018 Hand Probing Data

Excluded Mid-channel Hard Bottom Area

Analysis Grid

River Mile Marker

1,000 500 0 1,000 2,000 Feet

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Downtown Reach defined as (RM 11.8 -16.6) and the Upriver Reach (RM 16.6 - 28.4).
3. RM - river mile.
4. Biosonar ® transducer used for mudline bottom hardness screening, followed by 18' long hand push probe, and visial confirmation using a ponar grab at soft sediment areas.
5. Survey data in NAD 83 OSPN Intl.feet.
6. The approximate lateral distance along the shore used to define the Analysis Grids was approximately 675 ft in the Downtown reach and 950 ft in the Upriver reach.
7. Points were generated randomly inside the Hand Probe Thiessen Polygons within each of the Analysis Grids using the Create Random Points tool in ArcGIS 10. The 60 proposed grab locations were divided (30 ea) between the Downtown and the Upriver Reaches.
8. 2018 data includes ODEQ 2018 Upriver reach sampling locations and 2018 Geosyntec ponar grabs.

Proposed Downtown/Upriver Reach Surface Grab Locations (revised) RM 20 to 22

Portland Harbor Superfund Site
PDI Surface Sediment FSP

AECOM Geosyntec consultants

Figure 4e

MI/SEA June 15, 2018

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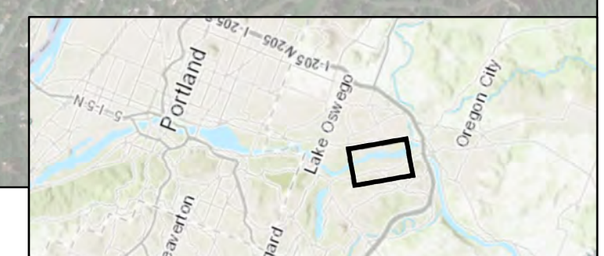


Legend

- Proposed Sediment FSP Grab Sample Location (n = 60)

Hand Probe Bottom Condition

- Soft (> 35% fines)

Percent Fines - Historic RI and 2018 Surface Sediment

- < 30 %
- 30 - 60 %
- > 60 %

Percent TOC - Historic RI Surface Sediment

- < 0.5 %
- 0.5- 2.5 %
- > 2.5 %
- Areas of Soft Sediment Based on 2018 Hand Probing Data
- Excluded Mid-channel Hard Bottom Area
- Analysis Grid
- River Mile Marker

N

1,000 500 0 1,000 2,000 Feet

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Downtown Reach defined as (RM 11.8 -16.6) and the Upriver Reach (RM 16.6 - 28.4).
3. RM - river mile.
4. Biosonar ® transducer used for mudline bottom hardness screening, followed by 18' long hand push probe, and visial confirmation using a ponar grab at soft sediment areas.
5. Survey data in NAD 83 OSPN Intl.feet.
6. The approximate lateral distance along the shore used to define the Analysis Grids was approximately 675 ft in the Downtown reach and 950 ft in the Upriver reach.
7. Points were generated randomly inside the Hand Probe Thiessen Polygons within each of the Analysis Grids using the Create Random Points tool in ArcGIS 10. The 60 proposed grab locations were divided (30 ea) between the Downtown and the Upriver Reaches.
8. 2018 data includes ODEQ 2018 Upriver reach sampling locations and 2018 Geosyntec ponar grabs.

Proposed Downtown/Upriver Reach Surface Grab Locations (revised) RM 22 to 24

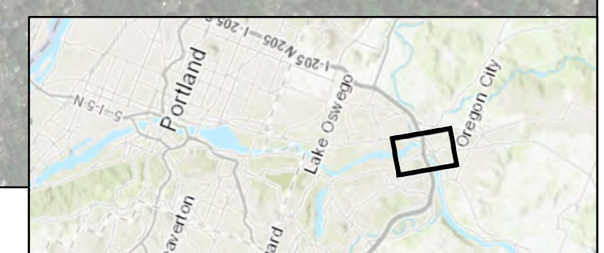
Portland Harbor Superfund Site
PDI Surface Sediment FSP

AECOM Geosyntec consultants

MI/SEA | June 15, 2018

Figure **4f**

Path: P:\Projects\Portland Pre-Design PN\G0767A\900\GIS and CAD\2018 Soft Sediment Probing Study\Figure 4 Proposed Upriver ReachV2.mxd



Legend

Proposed Sediment FSP Grab Sample Location (n = 60)

Hand Probe Bottom Condition

Soft (> 35% fines)

Percent Fines - Historic RI and 2018 Surface Sediment

< 30 %

30 - 60 %

> 60 %

Percent TOC - Historic RI Surface Sediment

< 0.5 %

0.5- 2.5 %

> 2.5 %

Areas of Soft Sediment Based on 2018 Hand Probing Data

Excluded Mid-channel Hard Bottom Area

Analysis Grid

River Mile Marker

1,000 500 0 1,000 2,000 Feet

Notes:

1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Downtown Reach defined as (RM 11.8 -16.6) and the Upriver Reach (RM 16.6 - 28.4).
3. RM - river mile.
4. Biosonar ® transducer used for mudline bottom hardness screening, followed by 18' long hand push probe, and visial confirmation using a ponar grab at soft sediment areas.
5. Survey data in NAD 83 OSPN Intl.feet.
6. The approximate lateral distance along the shore used to define the Analysis Grids was approximately 675 ft in the Downtown reach and 950 ft in the Upriver reach.
7. Points were generated randomly inside the Hand Probe Thiessen Polygons within each of the Analysis Grids using the Create Random Points tool in ArcGIS 10. The 60 proposed grab locations were divided (30 ea) between the Downtown and the Upriver Reaches.
8. 2018 data includes ODEQ 2018 Upriver reach sampling locations and 2018 Geosyntec ponar grabs.

Proposed Downtown/Upriver Reach Surface Grab Locations (revised) RM 24 to 26

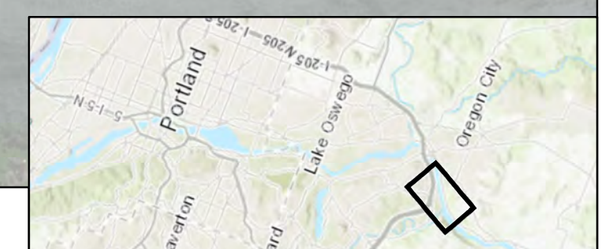
Portland Harbor Superfund Site
PDI Surface Sediment FSP

AECOM Geosyntec consultants

Figure 4g

MI/SEA | June 15, 2018

Path: P:\Projects\Portland Pre-Design PNG0767A\900 GIS and CAD\2018 Soft Sediment Probing Study\Figure 4_Proposed_Upriver_ReachV2.mxd



Legend

Proposed Sediment FSP Grab Sample Location (n = 60)

Hand Probe Bottom Condition

Soft (> 35% fines)

Percent Fines - Historic RI and 2018 Surface Sediment

< 30 %

30 - 60 %

> 60 %

Percent TOC - Historic RI Surface Sediment

< 0.5 %

0.5- 2.5 %

> 2.5 %

Areas of Soft Sediment Based on 2018 Hand Probing Data

Excluded Mid-channel Hard Bottom Area

Analysis Grid

River Mile Marker

1,000 500 0 1,000 2,000 Feet

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Downtown Reach defined as (RM 11.8 -16.6) and the Upriver Reach (RM 16.6 - 28.4).
3. RM - river mile.
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7. Points were generated randomly inside the Hand Probe Thiessen Polygons within each of the Analysis Grids using the Create Random Points tool in ArcGIS 10. The 60 proposed grab locations were divided (30 ea) between the Downtown and the Upriver Reaches.
8. 2018 data includes ODEQ 2018 Upriver reach sampling locations and 2018 Geosyntec ponar grabs.

Proposed Downtown/Upriver Reach Surface Grab Locations (revised) RM 27 to 28.6

Portland Harbor Superfund Site
PDI Surface Sediment FSP

AECOM Geosyntec consultants

Figure 4h

MI/SEA | June 15, 2018

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FINAL

Subsurface Sediment Coring Field Sampling Plan

Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling

Portland Harbor Superfund Site

AECOM Project Number: 60554349
Geosyntec Project Number: PNG0767A

Rev 1 (April 3, 2018); Rev 2 (May 30, 2018); Rev 3 (July 10, 2018), Rev 4 (July 12, 2018)

Prepared for:

United States Environmental Protection Agency, Region 10
1200 Sixth Avenue, Suite 900
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On behalf of:

Portland Harbor Pre-RD AOC Group
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CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

July 12, 2018

Kenneth M. Tyrrell
PDI Project Coordinator
AECOM Technical Services

Date

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ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
AECOM	AECOM Technical Services
ALS	ALS Environmental
Alt F Mod	Alternative F Modified SMA footprint
Anchor	Anchor Environmental LLC
ASAOC	Administrative Settlement Agreement and Order on Consent
ASTM	American Society for Testing and Materials
bml	below mudline
COCs	contaminants of concern
CRD	Columbia River Datum
CSM	Conceptual Site Model
D/F	dioxin/furans
D/U Reach	Downtown/Upriver Reach
DDT	dichlorodiphenyltrichloroethane
DDx	DDT and its derivatives
DGPS	differential global positioning system
DQMP	Data Quality Management Plan
DQOs	Data Quality Objectives
EPA	United States Environmental Protection Agency
FC	Field Coordinator
FMD	future maintenance dredge area
FS	feasibility study
FSP	Field Sampling Plan
ft	foot/feet
ft/lbs	feet per pound
Geosyntec	Geosyntec Consultants, Inc.
GIS	geographic information system
Gravity	Gravity Marine Services
ID	identification number
IDW	investigation-derived waste
Integral	Integral Consulting, Inc.
LWG	Lower Willamette Group
MHW	mean high water
NAD83 (2011)	North American Datum of 1983 National Adjustment of 2011
NAPL	non-aqueous phase liquid
NAVD88	North American Vertical Datum of 1988
PAHs	polycyclic aromatic hydrocarbons

PCBs	polychlorinated biphenyls
PDI	Pre-Remedial Design Investigation
PHSS	Portland Harbor Superfund Site
PID	photoionization detector
PRD	Portland River Datum
Pre-RD AOC Group	Pre-Remedial Design Agreement and Order on Consent Investigation Group
Pre-RD	Pre-Remedial Design
PSEP	Puget Sound Estuary Program
QA	quality assurance
QAPP	quality assurance project plan
QC	quality control
RAL	remedial action level
RI	remedial investigation
RM	river mile
ROD	Record of Decision
SC	sediment core
Site	Portland Harbor Superfund Site
SMA	sediment management area
SOPs	Standard Operating Procedures
SOW	Statement of Work
SPCS	State Plane Coordinate System
TestAmerica	TestAmerica Laboratories
TOC	total organic carbon
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey

1. INTRODUCTION

The Record of Decision (ROD) described a post-ROD sampling effort for the Portland Harbor Superfund Site (Site or PHSS; Figure 1) located in Portland, Oregon, to delineate and better refine the sediment management area (SMA) footprints, refine the Conceptual Site Model (CSM), determine baseline conditions, and support remedial design (United States Environmental Protection Agency [EPA] 2017a). Geosyntec Consultants, Inc. (Geosyntec), and AECOM Technical Services (AECOM) submitted a detailed Work Plan for Pre-Remedial Design Investigation and Baseline Sampling (PDI) on behalf of a group of industrial parties called the Pre-Remedial Design Agreement and Order on Consent Investigation Group (Pre-RD AOC Group). On December 19, 2017, EPA entered into an Administrative Settlement Agreement and Order on Consent (ASAOC) with the Pre-RD AOC Group to conduct the PDI studies at the Site (EPA 2017b). The ASAOC includes a Statement of Work (SOW) and the PDI Work Plan (as an attachment to the SOW), which generally describe the agreed upon field investigation activities, data analyses, schedule, and deliverables for the PDI.

These PDI studies are a foundational step in what will be a multi-phase effort to update current conditions from the collection of data during the remedial investigation (RI)/feasibility study (FS). The RI/FS was initiated by a group of potentially responsible parties known as the Lower Willamette Group (LWG) and completed by EPA in 2016 (EPA 2016a, 2016b). The RI consisted of three rounds of data collection, including surface and subsurface sediment, shoreline/nearshore soils, surface water, sediment traps, porewater, fish tissue, and other media from 2001 through 2007.

This Field Sampling Plan (FSP) was prepared to support the subsurface sediment sampling outlined in the PDI Work Plan (Geosyntec 2017) and the project Quality Assurance Project Plan (QAPP) (AECOM and Geosyntec 2018a). To the extent practicable, previously approved FSPs and standard operating procedures (SOPs) from the RI will be referenced.

1.1 Project Setting

The PHSS is located in Portland, Oregon, on the lower Willamette River immediately downstream of the urban downtown area from river mile (RM) 1.9 upstream to 11.8 and covers 2,190 acres. There are two reaches located immediately upstream of the Site. The Downtown Reach, which includes the urbanized area of downtown Portland, is defined by EPA as extending from RM 11.8 to RM 16.6. EPA defines the Upriver Reach as extending from RM 16.6 to RM 28.4. Collectively, RM 11.8 to RM 28.4 is referred to as the Downtown/Upriver Reach (D/U Reach).

The bathymetry elevation for most of the Site is from -30 to -50 feet (ft) Columbia River Datum (CRD) and is dominated by the authorized federal navigation channel (EPA 2017a). This channel, extending nearly bank-to-bank in some areas, doubles the natural depth of the river and allows transit of large ships into the active harbor; the PHSS serves as a major shipping route for

containerized and bulk cargo. Elevations in the federal navigation channel are generally -40 to -50 ft CRD, and the authorized depth is -40 ft CRD (or about -35 ft North American Vertical Datum of 1988 [NAVD88]). The CRD vertical datum is used by the United States Geological Survey (USGS) and United States Army Corps of Engineers (USACE); however, the primary vertical datum used for the PDI studies will be NAVD88.[1] The USGS gauging stations is located at the Morrison Bridge at RM 12.8; river levels recorded by that gauge are reported in Portland River Datum (PRD). Additional shipping and berthing areas were identified in the ROD as future maintenance dredge (FMD) areas with potential maintenance dredging requirements.

The remedy selected in the ROD (EPA 2017a), called the Alternative F Modified SMA footprint (Alt F Mod), identified 394 acres of engineered remediation with a combination of remedial technologies. The PDI subsurface sediment sampling activities are focused on refining the horizontal and vertical extent of contamination in these areas, especially the SMA areas targeted for dredging or partial dredging/capping. A total of 90 PDI cores are proposed to reduce this uncertainty. In addition, a surface sediment grab sample will be collected from each deep, in-water core location per protocols outlined in the Surface Sediment Sampling FSP.

Subsurface sediment samples will be analyzed for the focused contaminants of concern (COCs), which include dichlorodiphenyltrichloroethane (DDT) and its derivatives (DDx), polychlorinated biphenyls (PCBs, as Aroclors), polycyclic aromatic hydrocarbons (PAHs), and dioxin/furans (D/F).

1.2 Data Quality Objectives

Data Quality Objectives (DQOs) for subsurface sediment sampling are detailed in Table 3 of the project QAPP and are consistent with the PDI Work Plan (Geosyntec 2017). Criteria for acceptable laboratory quality assurance/quality control (QA/QC) are described in Section 3.3 of the project QAPP, and the analytical suite for the samples is presented in Table 2a in the project QAPP (AECOM and Geosyntec 2018a). As stated in the PDI Work Plan (attached to the ASAOC), the goal of the subsurface sampling effort is to refine the horizontal and vertical extent of contamination greater than the remedial action levels (RALs) at depth for the purpose of supporting the 30% design, to refine the CSM for remedial design purposes, and to refine the dredge volumes for 30% design cost estimation.

---

[1] CRD is used as the nautical chart datum for the lower Willamette River, using a reference plane established by the USACE in 1912. Because this datum is based on water elevations throughout the river, CRD is not a fixed/level datum but slopes upward as one moves upstream. Therefore, the NAVD88 fixed vertical datum will be the primary datum used in the PDI studies. The difference between the two datums is about 5.2 vertical ft within the Site. For reference, at RM 1.3 the difference is 5.4 ft, and at RM 12.8 the difference is 4.6 ft.

2. SAMPLING DESIGN AND APPROACH

A total of 90 core locations, presented in Figures 2a through 2f, have been selected for the PDI study to refine the spatial extent (horizontal and vertical) of the Alt F Mod active SMA remedial footprint. Methods for subsurface sediment sampling are generally consistent with EPA-approved sampling plans from the RI (Integral Consulting, Inc. [Integral] 2002, 2004, 2006), EPA guidance on collecting and processing sediment data (EPA 2014), and Puget Sound Estuary Program (PSEP) protocols (PSEP 1986).

2.1 Previous LWG RI/FS Subsurface Sediment Coring

The LWG completed three rounds of field sampling between 2002 and 2008 for the RI/FS. Subsurface sediment core sampling is summarized below.

- Subsurface samples were collected during the Round 2 field sampling event (2004-2005) in two phases: Round 2A and Round 2B (Integral and Anchor Environmental LLC [Anchor] 2005; Integral 2005).
    - During Round 2A coring between September and November 2004, a total of 218 cores were collected from 200 locations within RM 2 and RM 10. A total of 717 subsurface sediment samples were submitted for laboratory analyses.
    - During Round 2B coring in October 2005, a total of 181 subsurface samples were collected from 42 locations between RM 3.5 to RM 10.
- Subsurface sediment samples were collected during the Round 3 field sampling event (2007-2008) in two phases: Round 3A and Round 3B (Integral 2007, 2008).
    - During Round 3A coring in January and February 2007, subsurface samples were collected upstream between RM 9.5 and RM 12 and downstream of the Site between RM 0.9 and RM 1.9. A total of 24 sediment cores were collected from 18 locations in the upstream and downstream reaches combined, and 106 subsurface sediment samples were submitted for laboratory analyses.
    - During Round 3B coring between November 2007 and January 2008, a total of 94 subsurface cores were collected from 88 locations within three reaches: 1) the Site and slightly upriver of the Site between RM 2 and RM 12.2; 2) the upper reach of the Multnomah Channel; and 3) upriver between RM 15.3 and RM 26. A total of 244 subsurface sediment samples were submitted for laboratory analyses.

Post RI/FS sampling was conducted by multiple parties along the Willamette River between RM 1.9 and RM 11.8. These investigations were supplementary to the RI/FS and are discussed in the PDI Work Plan. Details on core locations were not available for many of these studies, and they were not used in locating cores for this PDI. As additional details on these post-RI/FS studies become available, information will be included in the data analysis and reporting phases.

2.2 Sediment Core Location Rationale

Proposed and historical core locations are presented in Figures 3a through 3h. Placement of the 90 proposed core locations were based on the visual assessment of subsurface contamination using 250- to 300-ft distance as a general guidance to the next nearest coring location. In some cases, stations will be re-occupied to determine the vertical extent of contamination, or a new core will be collected in an SMA where none previously existed. Proposed core locations and depths were selected to target spatial gaps from the RI subsurface data. Rationale for placement of PDI cores were based on the following concepts relative to the subsurface:

- **Spatial Resolution**. For portions of SMAs with limited subsurface data, cores were located to achieve an approximately 250 to 300 ft spacing distance to the next nearest historical coring location within an SMA, to refine the spatial resolution between data and provide improved understanding of subsurface concentration gradients between samples.
- **Horizontally Unbounded.** For spatial boundaries of SMAs with limited historical core coverage near the boundaries of a cleanup footprint, especially in dredge areas, cores were located to refine the horizontal extent of subsurface data in dredge footprints where SMAs are horizontally unbounded. This particularly applies to subsurface volume estimates toward the navigation channel.
- **Vertically Unbounded**. For portions of SMAs with historical cores, where the extent of subsurface contamination is vertically unbounded (did not “tag bottom” with a confirmed chemical concentration at depth below RALs), new PDI cores were located in the general vicinity of these RI stations (re-occupied station) to identify the vertical extent of contamination. As stated in the ROD, contamination in the subsurface sediment was identified as deep as 17 ft below mudline (bml) in the navigation channel and 19 ft bml in other areas (EPA 2017a).
- **No Subsurface Data**. For SMAs, especially those designated in the ROD for dredging, where no subsurface data previously existed, cores were located to define subsurface concentrations with depth in these areas. However, these small areas may be contouring artifacts within the geographic information system (GIS) program and may not represent actual areas of subsurface contamination. These areas will be reviewed in more detail and discussed with EPA prior to starting field work, to determine if a core is necessary in these isolated areas.
- **Nearshore Data Coverage.** For portions of SMAs with limited near-shoreline shallow cores, or no cores, PDI cores were placed in nearshore areas to provide spatial coverage towards shore for large dredging footprints, where no subsurface data exists. In the shallow region, the maximum depth of contamination was estimated to be 3.5 ft bml (EPA 2017a). Six ft depths are targeted for these nearshore (shallow) areas.

- Cores were not located in areas where remedial caps have already been placed or in the RM 11E early action area where additional subsurface data have already been collected in the last few years and remedial design negotiations are currently underway between EPA and the RM 11E Group. Figure 2e includes the approximate footprint of the RM 11E early action area.

With respect to elevations and depths bml, the ROD describes three Site regions: 1) the navigation channel and FMD areas; 2) the intermediate region (outside the navigation channel and FMD areas to -2 ft CRD [about +3 ft NAVD88]); and 3) the shallow region (shoreward of -2 ft CRD). The ROD indicates sediment with concentrations above the RALs will be dredged to at least 5 ft bml, where practicable. For the navigation channel/FMD and intermediate region, deep cores will be advanced 10 to 20 ft bml depending on the estimated vertical extent of contamination in a SMA; these cores are referred to as deep cores because they are generally located in deeper water compared to the nearshore cores. For the shallow region, cores located in the nearshore area will be advanced to a depth of 6 ft bml; these cores are referred to as nearshore cores. Deep core intervals (0 to 20 ft bml) may be collected and archived at 1 ft sample intervals from the area expected to be the bottom of contamination.

The bottom 2 ft section of retained sediment from each core will also be archived regardless of the target depth. Archiving will be completed in accordance with Section 4.4.2 of the PDI QAPP and generally consistent with Section 2.2.2 of the RI Round 2 FSP (Integral 2004, pages 13 to 15). All excess sediment samples submitted to the analytical laboratory for pending analysis will be archived at the laboratory. Excess samples will be stored frozen at less than -10 °C for up to 12 months following completion of data validation. The Pre-RD AOC Group will provide recommendations and rationale for analyzing archived core samples in a Change Request Form that will be submitted to EPA within 60 days after data validation. Laboratories will not dispose of the samples for this project until they are authorized to do so by the Project QA/QC Manager and/or EPA.

A fourth region, the riverbank region (defined as the “top of bank down to the river” in the ROD) is not included in this PDI study. The riverbank region will be addressed on a site-specific basis by EPA as part of PHSS remedial activities or Oregon Department of Environmental Quality under source control. This PDI study is focused in areas below the shoreline defined generally as the mean high water (MHW) (8 ft CRD, which is equal to about +13 ft NAVD88).

2.2.1 Example Cross Sections

Cross sections of four large SMAs were developed to help illustrate core location selection rationale (Figures 4a through 4d). Cross sections were drawn for SMAs with six or more PDI cores and large Alt F Mod active remedial footprints. Each cross section shows a mudline elevation bathymetry contour, historical RI surface sediment grabs and subsurface core locations, total PCB and total PAH concentration data (horizontally and vertically), and proposed PDI core locations. Areas with steeper slopes show two mudline bathymetry contour lines: a nearshore

line and a toe of slope line. Figures 4a through 4d show bathymetry contours that follow a set elevation datum (i.e., CRD 2009) in the upper panel; the cross sections, with an associated mudline, are used to project artifacts on a set plane in space in the lower panel. The cross-section figures are summarized below, and a core-by-core rationale is provided in Table 1.

- In Figure 4a (section A-A' RM 1.9 to RM 2.7), the cross section illustrates the limited subsurface data at the downstream end of the SMA (RM 2) and at the upstream end (RM 2.5); three cores are proposed in these areas. In the middle of the SMA (RM 2.3), PCB RAL exceedances extend to the bottom of the PDI cores (depth of contamination is vertically unbounded); four cores are proposed to fill this area. The last proposed core (RM 2) is located as a result of data greater than 300 ft apart and have varying depths of contamination between existing data.
- In Figure 4b (section B-B' International Slip), a total of seven cores are planned. Four PDI cores are located in areas with less dense historical sampling in the mouth and middle portions of the slip where contaminant thicknesses vary. Three additional PDI cores will confirm the vertical depth of contamination near the head of the slip, as a result of historical cores vertically unbounded. The step-wise mudline contours of previously dredged areas are also visible in Figure 3b.
- In Figure 4c (section C-C' RM 6.8 to RM 7.5), large remedial dredging areas are identified in the downstream shallow areas where cores are limited, and those that exist are vertically unbounded (depth of contamination is not confirmed). The upstream area has several RI cores that are vertically unbounded at depth for total PCBs. The proposed PDI cores in the downstream area will provide spatial coverage of the vertical extent of contamination. The two upstream PDI cores are intended to confirm the vertical depth of contamination; this SMA has PAH and D/F exceedances vertically unbounded.
- In Figure 4d (section D-D' Swan Island Lagoon), 10 PDI cores are proposed over the length of the lagoon for spatial coverage, and four of ten cores near the head of the lagoon are intended to confirm the vertical extent of PCB contamination exceeding RALs (some of the historical cores are vertically unbounded).

2.2.2 Sample Types, Locations, Depths

Subsurface sediment cores will be collected across the Site between RM 1.9 and RM 11.8 based on the rationale described in Section 2.2.1. Proposed locations are presented in Figures 2a through 2e. Subsurface sediment samples from shallow (nearshore) cores will vary in target collection depth from 0 to 6 ft for (shallow nearshore region) and from 0 to 20 ft target depth for the deep cores (navigation channel/FMD and intermediate region). Most of the deep cores will be driven 15 ft bml or until refusal. Core locations may be modified based on the bathymetry, surface sediment sampling work, contouring artifacts, or other additional information with EPA approval. The communication strategy with EPA will follow Section 2.3 of the QAPP (AECOM and Geosyntec 2018a). Table 1 presents the location, core depths, location identification

numbers (IDs), and rationale for subsurface sediment location selection based on the criteria described above.

Subsurface core samples will be visually logged and processed at 2 ft continuous intervals (based on the recovered depth) along the entire length of the accepted core, unless core stratigraphy indicates otherwise (see discussion in Section 4.4). The minimum sample interval will be 1 ft thickness of actual core material. The first sample will be collected from the 0 to 2 ft interval, regardless of stratigraphy. One ft sample intervals may be collected and archived from the area expected to be the bottom of contamination, to potentially provide a refined depth of contamination. The very bottom 2 ft interval of retained sediment from the core, will also be processed and archived, pending results of the upper intervals (especially for the nearshore cores).

Subsurface sample counts and selected analytes are presented in Table 2. The 60 deep cores will be collocated with PDI surface sediment grab locations collected from the 0 to 30 centimeter (0 to 1 ft) interval. Proposed subsurface core station IDs, mudline elevations, and coordinates are presented in Table 3. Figure 2 presents the proposed core locations within the Site. Core location and sample IDs will correspond with the surface sediment station ID; therefore, the core station IDs will not be numerically sequential.

2.2.3 Sample Nomenclature

The sample identification scheme for subsurface sediment sample collection will utilize a three-letter project identification code followed by a two-letter sample matrix code, unique station code, and sample depth interval. See Section 4.2.1 and Table 4 in the project QAPP (AECOM and Geosyntec 2018a) for details. In summary, the identification scheme follows:

- Project phase (PDI).
- Sample matrix (SC [sediment core]).
- Unique, sequential station number (S001 to S263). Station numbers are based on placement within the location of the river (from downstream to upstream). Surface sediment grabs (non-random) and cores are all grouped together for numbering purposes.
- Sample interval depth (2 ft up to 20 ft).

For example, a subsurface sediment core at station 10 collected from a recovered depth interval of 6 to 8 ft would have the sample ID PDI-SC-S010-6to8. See Section 4.2.1.2 of the QAPP for nomenclature associated with field duplicates and other QA/QC samples. Additional data fields that describe each unique sample and core location will be recorded in the field forms (see Appendix A) and will be included in the project database, as described in the project Data Quality Management Plan (DQMP) (AECOM and Geosyntec 2018b). These may include, for example, core recovery, *in situ* sample depth, recovered sample depth, mudline elevation, RM, SMA ID, and collection method.

2.3 Sampling Schedule

Subsurface sediment coring is targeted for the second and third quarters of 2018 (beginning July), after the surface sediment sampling and bathymetry survey have been completed, and before fish tissue sampling begins in July/August 2018. Subsurface sediment coring is expected to last 3 weeks using two sampling vessels (one vessel for deep coring and another vessel for the nearshore coring). After 2 weeks into the coring program, field progress will be assessed, and if it appears that the sampling effort is behind schedule, a third vessel and crew will likely be mobilized to complete the coring in the targeted sampling period.

2.4 Key Changes from Previously Approved RI FSPs

Subsurface sediment coring will be performed in accordance with RI project plans (Integral 2002, 2004, and 2006), except as noted in the bullets below and Section 4. SOPs from the RI will be made readily available as hard copies and PDFs on SharePoint for field staff to reference before and during field work. Key PDI changes from the RI Round 2 FSP – Sediment Sampling and Benthic Toxicity Testing (Integral 2004) include the following:

- Subsurface sediment samples will only be analyzed for the focused COCs (PCB Aroclors, PAHs, D/F, DDx), grain size, total solids, and total organic carbon (TOC). If a sample is determined to contain greater than 50% fines, then it may be submitted for additional geotechnical properties using Atterberg Limits test (American Society for Testing and Materials [ASTM] D4318). The PDI study will target about 10 to 20 samples for testing with spatial coverage of the Site (one or two per river mile or per segment) and vertical coverage in the subsurface (2 to 4 ft depth, and 4 to 6 ft depth).
- The SOP from the RI described several different coring methods;[2] the PDI study is intending to use a vibracore, but may consider other equipment (piston core, high frequency impact core or other device) for difficult areas that previously hit refusal (e.g., gravel) or areas with potential non-aqueous phase liquid (NAPL) (near RM 6 and RM 7 west) to help better refine the extent of NAPL.
- The SOP from the RI describes two sediment core processing procedures – core extrusion longitudinal splitting of the core tube via circular saw or cutting knife if a liner is used. Because of potential concerns regarding deformation or core material inside the core tube during extrusion, only the longitudinal splitting method will be used for the PDI study.

[2] The relevant SOP is Appendix F: Subsurface Sediment Sampling SOP, Round 2 Field Sampling Plan, dated June 21, 2004 and some pages extract from the earlier SOP dated March 22, 2004 Appendix E. Excerpted and included in Appendix B-2 of this PDI FSP.

- In areas with potential NAPL, a jar sheen test and Field Description Key will be used during core processing (see Appendix B-1 for Field Description Key and Jar Sheen test). When coring in areas with potential NAPL, sorbent booms and pads may be proactively deployed around the coring area and the coring equipment/vessels to minimize dispersion of NAPL sheens that may appear on the water surface.

Cores will be processed for analytical testing at 2 ft intervals, unless stratigraphy indicates otherwise, consistent with the RI and described in the 2004 Round 2 RI sediment FSP (see RI Sections 2.2.2 and 4.6.3 and Appendix F SOP dated June 2004); relevant portions of these plans have been excerpted from the RI and included in Appendix B-2 of this FSP. Stratigraphy changes may include a major observational change in the two dominant grain sizes, depositional regime, or presence/absence of anthropogenic material/indicators such as sheen, NAPL, or debris.

3. PROJECT ORGANIZATION/FIELD TEAM

3.1 Team Organization and Responsibilities

Team organization is detailed in the PDI Work Plan and in Section 2.3 of the QAPP (AECOM and Geosyntec 2018a). As it relates to this FSP, AECOM and Geosyntec are coordinating activities including management of all subcontractors, field sampling, analysis, and reporting scoping tasks. The PDI Project Coordinator, Mr. Ken Tyrrell, and PDI Project Manager, Dr. Jennifer Pretare, Ph.D. (AECOM), will be responsible for overall project coordination and providing oversight on all project deliverables. Ms. Anne Fitzpatrick (Geosyntec) is the senior technical lead for this task. Ms. Nicky Moody (AECOM) and Mr. Keith Kroeger (Geosyntec) will be the Field Coordinators (FCs) and will be generally responsible for general field QA/QC oversight. The project chemists, Ms. Julia Klens-Caprio (Geosyntec), Ms. Amy Dahl (AECOM), and Ms. Karen Mixon (AECOM), will be responsible for coordination with laboratories regarding sample volumes, logistics, schedule, detection limits and matrix interferences, and ensuring overall data quality.

Gravity Marine Services (Gravity), of Fall City, Washington, will perform vessel support, with Mr. Shawn Hinz acting as a point of contact. Analytical laboratories include ALS Environmental (ALS) in Burlington, Ontario, and TestAmerica Laboratories (TestAmerica) in Fife, Washington; Sacramento, California; and Burlington, Vermont. Additional coring contractors and equipment may be mobilized if needed, to improve core recoveries in difficult areas (e.g., refusal, large wood debris, gravel, cobbles, etc.).

3.2 Communication/Information Flow

The communication strategy is outlined in Section 2 of the QAPP (AECOM and Geosyntec 2018a). The FCs, Ms. Nicky Moody (AECOM) and Mr. Keith Kroeger (Geosyntec), will be the points of contact for field staff during the implementation of this FSP. Ms. Anne Fitzpatrick

(Geosyntec) will be the senior technical lead consulting with the field staff on core placement and interpretations, as needed, for this task. Deviations from this FSP or the project-specific QAPP will be reported to the PDI Project Manager for consultation. Significant deviations from the FSP/QAPP will be further reported to representatives of the Pre-RD AOC Group and EPA by the PDI Project Coordinator.

3.3 Coordination with EPA

The PDI Project Coordinator will notify the EPA Project Manager 1 to 2 weeks prior to beginning any field activities so that EPA can schedule any oversight activities required. The PDI Project Coordinator will also notify the EPA Project Manager once field activities have been completed.

Split samples for chemical analyses can be provided to EPA upon its request. EPA's Project Manager should contact the PDI Project Coordinator to coordinate this activity and determine appropriate logistics. If EPA elects to collect split samples, collection at stations where field duplicates are taken is recommended so that EPA's comparison samples can be evaluated relative to the field and analytical variability measured by the project team.

4. SAMPLE COLLECTION PROCEDURES

The following sections describe the procedures and methods that will be used during subsurface sediment sampling in accordance with the project QAPP, and previously approved FSPs and SOPs from the RI for methods. These procedures include health and safety procedures, sampling methods; recordkeeping; sample handling, storage, and shipping; and field quality control. All field sampling activities will follow procedures outlined in the project Health and Safety Plan (AECOM and Geosyntec 2018c).

4.1 Sampling Vessels and Equipment

Gravity will provide vessels and a Vibratory Core Tube Driver (vibracore) system to conduct subsurface sediment coring. Vibracore tubes will be advanced to various lengths as discussed in Section 2.2.2. Vibracore tubes will be sectioned on the vessel platform into transportable sizes (approximately 4 ft) and transported by vehicle to the AECOM Sample Processing Facility for processing. Core tubes will be kept upright to the extent practicable until processing.

Gravity will perform the coring activities utilizing two sampling vessels, R/V *Cayuse* and R/V *Tieton*, each vessel equipped with a model RIC-5500 vibracore system manufactured by Gravity. The RIC-5500 corer unit uses an electric motor to produce an adjustable 3,500 to 6,500 feet per pounds (ft/lbs) of impact force at a frequency of 1,500 vibrations per minute. The system is contained in a seafloor frame with legs. The RIC system will accept core tubes up to 10 meters in length and includes an active suction check valve adapter that mounts to the vibratory head for

easy swap-out on deck. A power cable will be used to deploy the system, which includes surface power on the deck of the vessel and data/controls.

Both vessels contain a virtual anchoring system that incorporates autopilot and two small motors to keep the vessel on station without needing to set fixed anchors. The R/V *Cayuse* is a 26 ft research vessel with landing craft design, crew cabin, wash-down hose, and working area. The R/V *Tieton* is a 32 ft research vessel with landing craft design and crew cabin, pilot house, and working area. Both vessels have an A-frame with custom research winch and dynamic positioning system. A minimum of 4-inch-outside diameter Lexan (preferred) or aluminum core tubes and custom core catchers will be used for core collection. Gravity's lexan core tubes (3/16 inch wall thickness) are sturdier and do not bend as easily compared to aluminum core tubes, especially in areas where compacted sediments and/or cobbles/debris are expected. Thin polycarbonate liners (4 mm) may be used in the interior of the core tubes to help core recovery and processing. A mechanical piston corer or core catchers with different materials/stiffness may be used when continued refusal or inadequate recovery is experienced. Core tubes can be adapted with an internal, mechanical piston-type device to improve core recoveries, if needed. Both of these vessels and their coring equipment have been previously used on the lower Willamette River.

Alternative vessels are available and can provide additional or backup support for in-water sampling as needed. All vessels will be moored within Swan Island Lagoon and mobilized from Swan Island public boat launch.

Additional equipment needed for coring and sample processing equipment are identified on the equipment checklist in Appendix A-1. Sample containers and preservatives, as well as coolers and packing material, will be supplied by the analytical laboratory.

4.2 Station Positioning and Vertical Control

Station positioning and vertical control will be performed as outlined in detail in the attached SOP (Appendix B-3). A differential global positioning system (DGPS) unit will be used on the vibracore A-frame to confirm the horizontal sampling locations to an accuracy of 1 to 2 meters, consistent with the RI. The DGPS accuracy will be confirmed each morning and evening at the PH-2 benchmark installed for this project at the Fred Devine Boat Dock located in Swan Island Lagoon (see GPS station log in Appendix B-3). Coordinates for this land-surveyed benchmark are 698702.46 (Northing) and 7637426.37 (Easting). Benchmark monuments and confirmed station locations will be recorded to the nearest whole foot in North American Datum of 1983 National Adjustment of 2011 (NAD83 [2011]), State Plane Coordinate System (SPCS) Oregon North Zone, International Feet.

Vertical control will be established using an on-board fathometer or lead line to measure depth to mudline at core locations at the time of collection. The fathometer accuracy will be checked regularly by vessel contractor (Gravity) and calibrated when necessary following ASTM D6318 Standard Practice for Calibrating a Fathometer Using a Bar Check Method or other similar

practice. Water depths will be converted to mudline elevations in ft NAVD88 based on synchronizing timestamped gauge data downloaded from the Northwest River Forecast Center for gauge PRT03, located near RM 12.8. As described in Appendix B-3, this river stage gauge data are reported in the Columbia River Datum (CRD), so a correction will be needed to convert to NAVD88. The vertical CRD will also be recorded. Water levels will be recorded to the nearest one tenth of a foot in the datum specified in the DQMP (AECOM and Geosyntec 2018b). Further details regarding station positioning and vertical controls are provided in Section 5.2 of Integral (2002).

4.3 Core Collection

Subsurface core sample collection will be performed as described in the RI Round 2 FSP, Section 4.0 (Integral 2004). In general, subsurface sediment coring will follow these steps:

a. Core tube caps will be removed immediately prior to placement into coring device, in order to minimize potential core contamination.

b. Position will be recorded when the vibracore first rests on the sediment surface.

c. The vibracore will be advanced without power (under its own weight), then vibration will be applied until the core tube is advanced to the target depth or refusal.

d. After a brief pause, the core tube will be extracted from the sediment using only the minimum vibratory power needed for extraction.

e. As soon as the core tube daylights to the surface water/air interface, a bottom cap will be placed over the tube to prevent material loss out of the core catcher.

f. Inspect the exterior side-walls of core tube for signs of potential NAPL and scrapes/scoring of the aluminum walls from contact with dense gravel. If NAPL is suspected, then take appropriate field precautions as described in the RI FSPs and Appendix B-1.

g. The following core collection data will be recorded on the vessel (in the core collection log [Appendix A-2 and excerpts from the RI in Appendix B-2]):

    i. Date/Time. Local date and time when the vibracoring began at each station.

    ii. Depth to Mudline. Water depth at the sampling station at the time of core collection.

    iii. Total Drive Length. Core tube length and depth of the core tube penetration into the subsurface.

    iv. Recovered Length. Thickness of the sediment column retained in the core tube prior to sectioning and removal of the core catcher.

    v. Sediment Observation. Average grain size, color, notable odors, debris, etc. observed at each of the cut ends of the core section. Visual description will follow ASTM visual-soil classification procedure.

h. Core will be accepted, rejected, or stored on the vessel pending another drive attempt. If a core sample does not meet the core acceptance criteria, then field protocols will be followed as described in Section 4.4 of this FSP.

i. After core acceptance, water will be carefully decanted from the top of the core tube to minimize sediment disturbance. Cores will be cut into segments approximately 4 to 6 ft long for handling, storage, and transport. Core tubes will be capped with aluminum foil and plastic caps, scribed on the sidewalls with core and segment ID (A, B, C, etc.) and "up" arrow, stored upright with ice, then transferred upright from the sampling vessel to the AECOM Sample Processing Facility, and stored upright in refrigerators until processed.

4.3.1 Core Acceptance Criteria

Each subsurface sediment core retrieved on deck will be compared to these acceptance criteria:

a. Overlying water is present and the surface is intact.

b. Core has 80% target recovery versus penetration (or document why recovery is less after three attempts).

c. Core tube is in good condition (not excessively bent).

d. Core appears representative of surrounding area.

e. Target penetration depth has been achieved or bedrock is encountered. If target depth is not reached due to cobbles, debris, refusal, or other difficult drilling conditions, an additional core will be attempted as described in the contingency plan (see Section 4.3.1). If NAPL is observed at depth in a core, then EPA will be notified.

4.3.2 Contingency Plan for Field Condition Impediments for Collecting Cores

During the subsurface sediment coring efforts, the field crew may encounter field conditions that preclude collection of acceptable cores at the planned location (e.g., limited access, poor recovery, safety concerns, debris/rock/bedrock causing refusal). No more than three attempts will be made to relocate the core within a 50 ft radius of the planned location if accessible.[3] If not accessible (i.e., under a dock/pier/vessel, shallow water depth), then the target radius will be increased for sample collection (e.g., 125 ft). If the first core attempt meets the acceptance criteria, then no additional cores will be collected at that station. If not, then up to two additional cores will be attempted and retained (stored on vessel deck). The best (percent recovery) of three attempts will be retained and processed.

[3] Distances proposed in this FSP were based on previous sediment project experience in EPA Region 10.

If recovery is exceptionally poor for all three attempts (< 50% recovery) , then the best core recovery will be capped and archived at the Sample Processing Facility following discussions with the PDI Project Manager and EPA. Lower acceptance criteria may be allowed and documented based on field judgement, or the location may be abandoned until further discussions with the PDI Project Manager and EPA are conducted.

If utilities run within 15 feet of a proposed coring location based on review of GIS maps and confirmed in the field with ”utility crossing” signage, then the coring location will be adjusted a minimum of 15 feet (using best professional judgement) and noted in the field notebook.

4.4 Core and Sample Processing

Subsurface sediment core processing at the field laboratory will follow these steps:

1. The AECOM Sample Processing Facility is at 1115 SE Caruthers Street, Portland, Oregon (phone #: 503-239-5884). The facility is approximately 20 blocks from the field site and will be used as a base for staging work, sample processing, sample/equipment storage, sample packaging and shipping, daily field team meetings, decontamination supplies, and other support needs (Figure 1).
2. The core tube will be split open to preserve the material stratigraphy inside the core tube using a table saw, hand-held circular saw, radial saw, shearing tool, exacto knife (if liner used), or similar device, according to methods described in RI Round 2 FSP (Integral 2004; see Appendix B-2).
3. A mini-RAE 3000 photoionization detector (PID) with 10.6 eV lamp will be used for pre-screening of each core. As soon as the core is split open, the PID monitor will be held in the ambient air space just above the open core and slowly moved down the core from top to bottom. PID readings will be recorded in the field notebook.
4. If there is a “PID hit” or if sheens/petroleum-like odors are suspected, then a headspace screening will be conducted following headspace field screening procedures described in the RI Round 2 FSP (Integral 2004) (see Section 4.6.4, excerpted from the RI and included in Appendix B-4 of this FSP). PID calibration will be conducted daily and will follow manufacturer’s instructions and additional procedures described in Appendix B-4 calibration SOP.
5. Cores will be photographed prior to sampling. Photography methods will generally follow Section 4.6.3 of the RI Round 2 FSP (Integral 2004) (see Appendix B-2). Appropriate lighting, tripods, and color calibration cards may be installed in the core processing area in order to collect consistent, high-quality photographs of the opened cores, as described in the core photography procedures SOP (see Appendix B-5).
6. Sediment cores will be visually described following ASTM D-2488 Standard Practice for Identification of Soils (Visual-Manual Procedure, ASTM D-2488). A logging key of the visual classification method is provided in Appendix A-3.

7. If potential NAPL is observed, then a jar sheen test or other device will be used over the suspected NAPL interval to further estimate (qualitatively) the presence of NAPL; see SOP in Appendix B-1. In addition, Appendix B-1 also contains a Field Description Key that describes visual descriptors for residual or free-phase NAPL observations.
8. A hand-held field torvane will be used to measure shear strength and pocket penetrometer to measure compressive strength within each sample interval. Manufacturers instructions for each field parameter tool will be followed regarding use and calibration of field equipment.
9. Subsurface sample intervals will be 2 ft intervals unless lithology indicates otherwise. Minimum interval thickness will be 1 ft. Maximum thickness will be about 3 ft in general accordance with thickness criteria in RI Round 2 FSP (Integral 2004).[4]
10. After the cores have been described and the sample intervals have been determined, sediment will be collected and homogenized within the determined sample interval until uniform in color and texture and placed into appropriate sample containers for laboratory analysis.
11. Core lithology, geotechnical indexes, PID readings, sample IDs, and sample depth intervals will be recorded in the core processing log (Appendix A-2).
12. Archived sample intervals will follow the procedures outlined in Section 4.4.2 of the QAPP.

Relevant SOPs from the RI will be followed. These SOPs are from Appendix F of the RI FSP for Round 2 (Integral 2004) and are consistent with Appendix D of the RI FSP for Round 3 (Integral 2006). Relevant SOPs have been excerpted from the RI and included in Appendix B-2 and B-4 of this FSP. These SOPs include lists of supplies and equipment, equipment decontamination, core collection, subsurface sediment sample processing, chain-of-custody, lighting, and packaging and shipping samples. The SOPs will be available in hard copy and on the project SharePoint site for easy access by the field crews.

4.5 Sample Handling and Transport

Chain-of-custody procedures will be followed as detailed in Section 4.8 of the RI Round 2 FSP and the SOP (Integral 2004) (see Appendix B-2 in this FSP for the SOP). Samples will be stored on ice at 0 to 6 degrees Celsius (°C) in a field cooler and shipped to appropriate laboratories as detailed in the RI Round 2 FSP (Integral 2004). Samples being sent to ALS' Burlington, Ontario, location will be shipped to Federal Express Depot in Cheektowaga, New York, and picked up by

[4] The RI Round 2 FSP discussed a range of 1 to 4 ft sample thickness. However, a goal of the PDI study is to refine contaminant depths, so in general, target thicknesses are much less than 4 ft (2 ft target).

the lab for transport across the border. Sections 4.8.1 and 4.8.2 of the RI Round 2 FSP along with the SOPs in Appendix F of the RI FSP for Round 2 (Integral 2004) and Appendix D of the RI FSP for Round 3 (Integral 2006) provide additional details on custody, storage, and shipping details, respectively. Additional details are provided in Section 4.3 of the QAPP (AECOM and Geosyntec 2018a).

4.6 Field Logbook and Forms

All field activities will be recorded in a field logbook as outlined in detail in Section 4.3 of the RI Round 2 FSP (Integral 2004) and described in Section 4.10.1 of the QAPP. Field forms (Appendix A-2 of this FSP) will be completed as outlined in detail in the RI Round 2 FSP (Integral 2004; excerpted and included in Appendix B-2 of this FSP):

Logbook entries will be clearly written with enough detail so that participants can reconstruct events later, if necessary. Requirements for logbook entries will include the following:

- Logbooks will be bound, with consecutively numbered pages.
- Removal of any pages, even if illegible, will be prohibited.
- Entries will be made legibly with black (or dark) waterproof ink.
- Unbiased, accurate language will be used.
- Entries will be made while activities are in progress or as soon afterward as possible (the date and time that the notation is made should be noted, as well as the time of the observation itself).
- Each consecutive day's first entry will be made on a new, blank page.
- The date and time, based on a 24-hour clock (e.g., 0900 a.m. for 9 a.m. and 2100 for 9 p.m.), will appear on each page.
- When field activity is complete, the logbook will be entered into the project file.

The type of information that may be included in the field logbook and/or field data forms includes the following:

- Names of all field staff and oversight staff
- Sampling vessel
- A record of site health and safety meetings, updates, and related monitoring
- Station name and location
- Date and collection time of each sample
- Observations made during sample collection, including weather conditions, complications, and other details associated with the sampling effort

- Adjustments made to the sample equipment to optimize sample recovery
- Sample description following ASTM visual classification
- Water depth, penetration depth, recovery length
- River stage at the Northwest River Forecast Center gauge PRT03 (close to the Morrison Bridge) or the USGS gauge 14211720 immediately prior to sampling
- Any deviations from the FSP

4.7 Decontamination Procedures

Decontamination procedures for all non-dedicated (reusable) sampling equipment (bowls, spoons, etc.) will follow methods detailed in the RI Round 2 FSP Appendix F Sediment Sampling SOP (Integral 2004), relevant portions of which have been excerpted and included as Appendix B-2 to this FSP. This SOP is consistent with the RI Round 3 FSP Appendix D Sediment Sampling SOP (Integral 2006). In summary, non-dedicated sampling equipment decontamination steps will include an initial rinse with vessel river water to dislodge particles, a scrub with brush and Alconox™ or other phosphate-free detergent, and then a rinse with deionized water. Additional rinses with nitric acid or methanol are not anticipated but may be considered based on sample conditions (e.g., excessive oily/tar residue). Rinses using nitric acid or methanol, if used, will be handled and disposed of according to Section 4.8. Sampling spoons and bowls will be covered with aluminum foil until use (dull side down). Gloves will be replaced before and after handling each sample to minimize sample contamination. Core tubes and core cutter heads will be washed in a similar manner.

4.8 Investigation-Derived Waste Disposal

Investigation-derived waste (IDW) disposal will occur as described in the Management of IDW SOP (see Appendix B-6). In general, any excess water or sediment remaining after processing core collection and sectioning will be returned to the vicinity of the collection site. No excess sediment containing NAPL principal threat waste will be returned to the vicinity of the collection site; see IDW SOP in Appendix B-6 of this FSP. Any water or sediment spilled on the deck of the sampling vessel will be washed into the surface waters at the collection site before proceeding to the next station. Phosphate-free, detergent-bearing liquid wastes from decontamination of the core sampling equipment will be washed overboard or disposed into the sanitary sewer system. Waste solvent rinses, if needed, will be held in sealed plastic buckets and disposed of into the sanitary sewer.

Tyvek, gloves, paper towels, plastic sheeting, and other waste material generated during sampling will be placed in heavyweight garbage bags or other appropriate containers and placed in normal refuse containers for disposal at a solid waste landfill. Used core tubes will be washed and then recycled. Leftover sediment after core processing, and oily or other potentially contaminated IDW will be placed in appropriate containers, characterized for disposal, and disposed of at an appropriate EPA-approved waste facility.

4.9 Field Quality Control

Field QC samples are collected to assess variability within samples (e.g., duplicates), to evaluate if potential sources of sample contamination are present (e.g., rinsate and trip blanks), or to confirm proper storage conditions of samples (e.g., temperature blanks). All QA/QC procedures are detailed in the project QAPP. Requirements for field QC samples are provided in Table 4, and a summary of all field QC sample numbers is provided in Table 5. Field duplicates and other field QC samples, such as trip blanks, temperature blanks, and rinsate blanks, will be collected as outlined in Section 4.6.1 of the project QAPP. Rinsate blanks will be collected by pouring deionized water over the sampling spoons and core tubes after field decontamination. Rinsate blanks will be collected for each sampling vessel.

5. LABORATORY ANALYSIS

Subsurface sediment core samples will be sent to the following laboratories for physical and chemical analysis:

- ALS in Burlington, Ontario, for DDx
- TestAmerica in:
    - Fife, Washington, for PCB Aroclors, PAHs,[5] TOC, grain size, and total solids (and Atterberg Limits if selected)
    - Sacramento, California, for D/F
    - Burlington, Vermont, for Atterberg Limits

Field parameters (measured at the Sample Processing Facility) will include geotechnical index testing down the length of the core at about 2 ft intervals. Measurement tools will include a hand-held field torvane to measure shear strength and pocket penetrometer to measure strength.

Additional details on the analytical methods, QA/QC requirements and procedures, and laboratory specific QA/QC requirements are detailed in Section 4.6 of the project QAPP. All samples will be placed in laboratory-supplied sample containers and preserved according to analytical protocols. Sample containers, analytical methods, preservation requirements, holding times, and sample sizes are provided for all analyses in Table 6.

[5] PAH testing changed in June 2018 from ALS Kelso, Washington, lab to TestAmerica lab in Fife for subsurface sediment sampling.

6. DATA MANAGEMENT AND REPORTING

6.1 Field Data Management

The procedures and activities outlined in this FSP are designed to ensure DQOs are met. As detailed in the project QAPP, the following data management procedures will be performed in the field:

- All samples will be given a unique identifier (Section 2.2.3 of this FSP).
- All samples will be collected and transported under chain-of-custody control (Section 4.5 of this FSP).
- Field logbooks and data sheets will be maintained (Section 4.6 of this FSP).
- Field QA/QC samples will be collected according to the project QAPP (Section 4.9 of this FSP).

6.2 Post-Analysis Data Management and Reporting

Analytical laboratories will be required to adhere to all QA/QC procedures outlined in the project QAPP. Laboratories will provide all data for field investigations in electronic format and QA/QC reports, including a narrative of the standard QA/QC protocols. Data validation and data management will be performed according to the project QAPP and DQMP. Following data validation, all data, supplementary information, and validator qualifiers will be compiled into an SQL Server database for the project. Data summary files will be provided to EPA as they become available after data validation and database management.

Results from the implementation of this FSP will be used to support the data use objectives described in Section 1.3 of the PDI Work Plan (Geosyntec 2017: Table 5). Data summaries and evaluations will be included in the PDI Evaluation Report.

7. REFERENCES

AECOM (AECOM Technical Services) and Geosyntec (Geosyntec Consultants, Inc.). 2018a. Quality Assurance Project Plan Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling. Portland Harbor Superfund Site. 23 March.

AECOM and Geosyntec. 2018b. Data Quality Management Plan Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling. Portland Harbor Superfund Site. 22 February.

AECOM and Geosyntec. 2018c. Health and Safety Plan Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling. Portland Harbor Superfund Site. 13 March.

ASTM (American Society of Testing and Materials). ASTM D-2488-93. Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). Pg. 225-235.

ASTM. ASTM D-2487-17. Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).

ASTM. 2014. ASTM D6318-03. Standard Practice for Calibrating a Fathometer Using a Bar Check Method, ASTM International, West Conshohocken, Pennsylvania.

EPA (United States Environmental Protection Agency). 2014. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846), Third Edition, Update V.

EPA. 2016a. Portland Harbor RI/FS, Final Remedial Investigation Report, Portland Oregon. United States Environmental Protection Agency Region 10, Seattle, Washington. 8 February.

EPA. 2016b. Portland Harbor RI/FS, Final Feasibility Study, Portland Oregon. United States Environmental Protection Agency Region 10, Seattle, Washington. June.

EPA. 2017a. Record of Decision Portland Harbor Superfund Site, Portland Oregon. United States Environmental Protection Agency Region 10, Seattle, Washington. January.

EPA. 2017b. ASAOC between USEPA and the Pre-RD AOC Group for Pre-Remedial Design Investigation Studies, Portland Harbor Superfund Site, Portland, Oregon. United States Environmental Protection Agency Region 10, Seattle, Washington. Attachments include the Statement of Work and the PDI Work Plan. 19 December.

Geosyntec. 2017. PDI Work Plan. Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling; Portland Harbor Superfund Site, Portland, Oregon. Prepared for the Pre-RD AOC Group as an attachment to the ASAOC for EPA Region 10. 19 December.

Integral (Integral Consulting, Inc.). 2002. Round 1 Field Sampling Plan. Prepared for the Lower Willamette Group (LWG) for submittal and approval by EPA Region 10. 14 June.

Integral. 2004. Round 2 Field Sampling Plan - Sediment Sampling and Benthic Toxicity Testing Prepared for the LWG for submittal and approval by EPA Region 10. 21 June (Sediment Sampling SOPs in Appendix F [June 21]. Note: some of the SOPs are dated March 22 in the June version.

Integral. 2005. Round 2B Subsurface Sediment Field Sampling Report, Portland Harbor RI/FS. Prepared for the LWG for submittal and approval by EPA Region 10, Seattle, Washington. 29 December.

Integral. 2006. Preliminary Upstream & Downstream Sediment Data Evaluation and Round 3A Field Sampling Plan for Upstream & Downstream Sediment Sampling. Prepared for the LWG for submittal and approval by EPA Region 10. 13 October.

Integral. 2007. Round 3A Upstream & Downstream Sediment Field Sampling Report, Portland Harbor RI/FS. Prepared for the LWG for submittal and approval by EPA Region 10, Seattle, Washington. 9 April.

Integral. 2008. Round 3B Comprehensive Sediment and Bioassay Testing Field Sampling Report, Portland Harbor RI/FS. Prepared for the LWG for submittal and approval by EPA Region 10, Seattle, Washington. 21 March.

Integral and Anchor (Anchor Environmental LLC). 2005. Round 2A Subsurface Sediment Field Sampling Report, Portland Harbor RI/FS. Prepared for LWG for submittal and approval by EPA Region 10. 10 January.

PSEP (Puget Sound Estuary Program). 1986. Puget Sound Estuary Program: Recommended Protocols for Measuring Selected Environmental Variables in Puget Sound. Final Report. TC-3991-04. Prepared for U.S. Environmental Protection Agency, Region 10 and Puget Sound Estuary Program, Seattle, Washington. Prepared by Tetra Tech and HRA, Inc., Bellevue, Washington.

TABLES

Table 1. Subsurface Sediment Core Rationale

Alternative F Mod Active Footprint Area	Sequential Core Count	Core Location #	Station ID	New Core Station	Re-Occupy Old Station	Old Station	Rationale	Proposed Core Depth (ft bml)	# of Samples	NAPL May Be Present	Additional Rationale
Deep Cores (N=60) (New Core Stations and Reoccupy Old Core Stations)											
RM 2E	1	4	PDI-SC-S004	X			Refine horizontal extent - north end	15	8	No	Better define horizontal gradient extent towards the north end (cores to the north do not tag bottom).
	2	7	PDI-SC-S007		X	C011-2	Refine vertical extent, unbounded to 16 ft bml	20-22	2	No	Reoccupy C011-2, which remains unbounded at depth with a concentration of 8,200 ug/kg PCB. Samples in proximity (C011-1, RB13, and C602) are all unbounded.
	3	9	PDI-SC-S009	X			Refine vertical and horizontal extent - southwest end	10	5	No	C604 is unbounded in vertical direction with a concentration of PCB between 75 and 200 ug/kg.
	4	10	PDI-SC-S010		X	C019-2	Refine vertical extent, unbounded to 16 ft bml	20-22	2	No	Reoccupy C019-2, which remains vertically unbounded with a concentration of 1,100 ug/kg PCB. Samples in proximity (C019-1, LWMC1, and C604) are all unbounded.
	5	11	PDI-SC-011	X			Refine horizontal and vertical extent	15	8	No	Better define horizontal gradient extent. No cores within 250 ft and nearby cores C020, C022, and C025-2 are vertically unbounded.
	6	15	PDI-SC-S015	X			Refine horizontal extent - southwest end	15	8	No	Better define horizontal towards the Navigation Channel. C605 did not tag bottom and had PCB concentration between 75 and 200 ug/kg.
RM 2.75E	7	19	PDI-SC-S019	X			Data at depth	15	8	No	No existing core in the dredge footprint. Nearby core C061, unbounded.
RM 3.5E	8	23	PDI-SC-S023		X	C0614	Vertical extent, unbounded to 10.9 ft bml	15-18	2	No	No existing core in the dredge footprint.
RM 3.8E (International Slip)	9	24	PDI-SC-S024	X			Refine horizontal extent	15	8	No	Improve concentration gradient. Spacing between cores +300ft.
	10	28	PDI-SC-S028	X			Refine horizontal extent	15	8	No	Improve concentration gradient between cores; vertical extent is different between them; spacing between cores +400 ft.
	11	30	PDI-SC-S030		X	LWMC3	Refine vertical extent in Alt F dredge footprint	15	2	No	LWMC3 unbound vertically with a concentation of PCB at 5,000 ug/kg for the entire core depth of 10 ft bml.
	12	31	PDI-SC-S031	X			Refine horizontal and vertical extent	15	8	No	Better refine horizontal and vertical extent of remediation area. Nearby grab SED11 had a PCB concentration of 2,000 ug/kg and nearby core C094 had a concentration of 2,100 ug/kg.
	13	32	PDI-SC-S032	X			Riverbank shallow core	15	8	No	Closest sample SED14 is vertically unbounded. Sample approximately 3 ft bml with a concentration of 1,100 ug/kg. Refine horizontal extent between cap and dredge.
RM3.9W	14	38	PDI-SC-S038	X			Refine horizontal and vertical extent	15	8	No	No historical cores in proposed dredge area.
RM 4W to 5W	15	53	PDI-SC-S053	X			Refine horizontal and vertical extent	15	8	No	Closest core is unbounded C626. Additionally, no historical cores in proposed dredge area.
RM 4.5E		-		No cores needed, ample amount of data and all shallow exceedances, Alt F dredge							
RM 4.51E	16	55	PDI-SC-S055		X	HC-S-42	Refine vertical extent	10	2	No	Reoccupy HC-S-42, which was vertically unbounded, core driven ~5 ft bml with a PAH concentration of 220,000 ug/kg. Help refine horizontal extent in nearshore area.
RM 4.52E		-		No cores needed, ample amount of data and all shallow exceedances, Alt F dredge							
RM 4W to 5W	17	62	PDI-SC-S062		X	C136	Refine vertical extent	15	2	No	Reoccupy C136, which is vertically unbounded, core driven ~15 ft bml with a PAH concentration of 80,000 ug/kg. No other core in existing dredge footprint.
	18	65	PDI-SC-S065		X	C142	Refine vertical extent	15	2	No	Reoccupy C142, which is vertically unbounded, core driven ~10 ft bml with a PAH concentration of 240,000 ug/kg. Hit refusal at 12.9'
	19	70	PDI-SC-S070		X	C179	Refine vertical extent	15	2	No	Reoccupy C179, which is vertically unbounded, core driven ~10 ft bml with a PAH concentration of 90,000 ug/kg. Next to C182, also unbounded vertically with a concentration of ~25,000 ug/kg.

Table 1. Subsurface Sediment Core Rationale

Alternative F Mod Active Footprint Area	Sequential Core Count	Core Location #	Station ID	New Core Station	Re-Occupy Old Station	Old Station	Rationale	Proposed Core Depth (ft bml)	# of Samples	NAPL May Be Present	Additional Rationale
RM 5 to 6	20	83	PDI-SC-S083	X			Refine vertical/horizontal extent	15	8	No	Nearby historical core C221 Did not tag bottom and had a total PAH concentration >68,900 ug/kg.
	21	86	PDI-SC-S086	X				15	8	No	Nearby historical core PH15-13 did not tag bottom and had a total PAH concentration >85,700 ug/kg.
RM 5.5E	22	85	PDI-SC-S085	X			No existing cores in dredge footprint	15	8	No	No existing cores in dredge footprint, one core nearby vertically bounded at 10 ft bml; Alt F dredge/cap.
	23	88	PDI-SC-S088	X				15	8	No	No existing cores in dredge footprint, one core nearby vertically bounded at 10 ft bml; Alt F dredge/cap.
	24	92	PDI-SC-S092	X				15	8	No	No existing cores in dredge footprint, one core nearby vertically bounded at 10 ft bml; Alt F dredge/cap.
RM 6W	25	98	PDI-SC-S098	X			Define vertical extent	15	8	No	Horizontally define Navigation Channel. Need core to define vertical extent. CS003 was less than 1 foot bml, with a concentration of 34,800 ug/kg. Also refine Navigation Channel extent.
	26	103	PDI-SC-S103	X			Horizontal delineation along Navigation Channel, also refine vertical extent for proximal cores	15	8	No	Horizontally define Navigation Channel. No core currently within proposed dredge footprint.
	27	109	PDI-SC-S109	X				15	8	No	Refine concentration gradient towards Navigation Channel and at depth. Closest cores ~250 ft away DGS-08C (in Navigation Channel, PAH concentration of 1,800,000 ug/kg). Downriver of LWMC11, unbounded sample with a PAH concentration of 8,400,000 ug/kg and DGS-19SC with a PAH concentration of 4,500,000 ug/kg.
	28	108	PDI-SC-S108		X	C244	Define vertical extent	15	2	No	Reoccupy C244 which is vertically unbounded, core driven ~10 ft bml with a PCB concentration of 250 ug/kg. Southern edge of proposed dredge footprint.
	29	113	PDI-SC-S113		X	C258	Refine vertical extent	15-18	2	No	Reoccupy C258 which is vertically unbounded to ~10 ft bml with a PAH concentration of 290,000 ug/kg.
RM 6.8E	30	131	PDI-SC-S131	X			Refine vertical/horizontal extent in the low spot near C291	15	8	Yes	Distance between cores is greater than 300 ft. Two of the four closest cores are unbounded vertically with PCB concentrations of 250 ug/kg and 750 ug/kg.
RM 7E	31	144	PDI-SC-S144	x			Refine horizontal and vertical extent	15	8	No	Proposed dredge area with historical cores greater than 250 ft away.
RM 7W	32	136	PDI-SC-S136	X			Refine vertical extent	15	8	No	Proposed dredge area around C311, DGS-37SC, SD072, and C316 cores are all vertically unbounded and have PAH concentrations >50,000 ug/kg and up to 570,000 ug/kg.
	33	139	PDI-SC-S139	X			Refine vertical extent	15	8	Yes	Proposed dredge area around WB-66 is unbounded vertically and horizontally and has 2,3,7,8-TCDD concentrations up to 0.0015 ug/kg.
	34	146	PDI-SC-S146	X			Define vertical extent	15	8	Yes	Proposed dredge area around C679 is unbounded vertically and has a 2,3,7,8-TCDD concentration of 0.003 ug/kg.
	35	150	PDI-SC-S150	X			Define vertical extent	15	8	Yes	Proposed dredge area around LWMC14 is unbounded vertically and has a 2,3,7,8-TCDD concentration of 0.002 ug/kg. Surrounding unbounded samples are WB-37, WB-41, and SD092 with concentrations up to 0.007 ug/kg.
	36	151	PDI-SC-S151	X			Define vertical extent	15	8	Yes	Proposed dredge area south of WB-34. WB-34 is unbounded vertically and has a 2,3,7,8-TCDD concentration of 0.001ug/kg.
	37	155	PDI-SC-S155	X			Define extent	15	8	No	No historical cores within proposed dredge footprint.
RM 7W to 8W	38	157	PDI-SC-S157		X	C690	Refine vertical extent	20	2	No	Proposed dredge area with no historical cores.
	39	163	PDI-SC-S163	X			Inside pier has no cores	15	8	No	Inside proposed dredge area has no core samples.

Table 1. Subsurface Sediment Core Rationale

Alternative F Mod Active Footprint Area	Sequential Core Count	Core Location #	Station ID	New Core Station	Re-Occupy Old Station	Old Station	Rationale	Proposed Core Depth (ft bml)	# of Samples	NAPL May Be Present	Additional Rationale
RM 8E to 9E (Swan Island Lagoon)	40	172	PDI-SC-S172	X			Refine vertical extent	15	8	No	Area between C372 and PSY18C (cores are over 400 ft apart) had PCB concentrations of ~200 ug/kg and >500 ug/kg, respectively. C372 is unbounded vertically.
	41	176	PDI-SC-S176	X			Refine vertical extent	15	8	No	Define vertical extent between C702 and C703. Additionally, provide additional coverage near pier area where there are limited historical cores.
	42	178	PDI-SC-S178	X			Refine vertical extent	15	8	No	Area between C364 and PSY20C (cores are over 600 ft apart) had max a PCB concentration of >250 ug/kg and 2,300 ug/kg, respectively.
	43	191	PDI-SC-S191	X			Refine vertical extent	15	8	No	Proposed dredge area SD133 was unbounded vertically and had a PCB concentration of 2,400 ug/kg.
	44	198	PDI-SC-S198	X			Refine vertical extent	15	8	No	Better refine vertical gradient between C379 and PSY11C (cores are over 600 ft apart) and had a max PCB concentration of >750 ug/kg and >7.5 ug/kg, respectively.
	45	203	PDI-SC-S203	X			Refine horizontal extent	15	8	No	Limited horizontal cores within proposed Swan Island Lagoon dredge footprint.
	46	213	PDI-SC-S213	X			Refine horizontal/vertical extent	15	8	No	Gradient near C397 (cores up and down river are over 250 ft apart). C397 is vertically unbounded and had a max PCB concentration of >500 ug/kg.
	47	229	PDI-SC-S229		X	C421	Refine vertical extent	15	2	No	Only one core within pier area and over 200 ft to nearest sample location.
	48	230	PDI-SC-S230	X			Refine vertical extent	15	8	No	C405 and SD141 (cores are over 300 ft apart) and both are vertically unbounded. The max PCB concentration between the two cores was >500 ug/kg.
	49	238	PDI-SC-S238	X			Refine horizontal and vertical extent	15	8	No	Cores are over 250 ft apart and vertically unbounded.
RM9.1E	50	228	PDI-SC-S228	X			Refine horizontal and vertical extent	15	8	No	No historical cores in proposed dredge footprint.
RM 8W to 8.5W	51	218	PDI-SC-S218	X			Collect bank sample near C431	15	8	No	Proposed dredge area north east of C431, edge of dredge area is over 300 ft from nearest C431 core.
	52	221	PDI-SC-S221		X	C450	Refne vertical extent, hit refusal	15	2	No	Proposed dredge area around C450 is unbounded vertically to 10 ft bml and has a PCB concentration of 2,200 ug/kg.
RM 8.75W	53	222	PDI-SC-S222	X			Refine vertical extent	15	8	No	Area west of C455; C455 has a max PCB concentration of 6,000 ug/kg.
	54	226	PDI-SC-S226	X			Refine vertical extent	15	8	No	Proposed dredge area around LWMC19 is unbounded vertically and has a PCB concentration of 2,200 ug/kg.
RM 9.8W	55	248	PDI-SC-S248	X			Define horizontal/vertical extent	15	8	No	No historical cores within proposed dredge footprint.
	56	254	PDI-SC-S254	X			Cores are vertically unbounded, but there is 10 ft of clean overburden	15	8	No	Proposed dredge area north east of C738 and C739; both cores are vertically and horizontally unbounded with max concentrations >500 ug/kg of PCB.
	57	255	PDI-SC-S255	X			Refine nearshore extent	15	8	No	Proposed dredge area west of LMWC24. LWMC24 is vertically unbounded with max concentration >750 ug/kg of PCB.
	58	256	PDI-SC-S256		X	LWMC24	Refine vertical extent, unbounded to 10 ft bml	15	2	No	LMWC24 is unbounded vertically with a max PCB concentration >750 ug/kg and southward is more than 400 ft from shoreline, no nearshore cores.
	59	257	PDI-SC-S257	X			Cores are vertically unbounded, but there is 10 ft of clean overburden	15	8	No	Gradient between C739 and LWMC24; both cores are vertically unbounded, with max concentrations > 500 ug/kg of PCB.
RM10.8E	60	263	PDI-SC-S263	X			Define horizontal/vertical extent	15	8	No	No historical cores within porposed dredge footprint.

Table 1. Subsurface Sediment Core Rationale

Alternative F Mod Active Footprint Area	Sequential Core Count	Core Location #	Station ID	New Core Station	Re-Occupy Old Station	Old Station	Rationale	Proposed Core Depth (ft bml)	# of Samples	NAPL May Be Present	Additional Rationale
Nearshore Cores (N=30) (shallow cores)											
RM 2E	61	2	PDI-SC-S002	X			Better define vertical and horizontal extent in shallow bank areas	6	3	No	Better define horizontal gradient extent towards the north end. Limited historical core data.
	62	14	PDI-SC-S014	X				6	3	No	Within a proposed dredge area and no historical core within 250 ft.
RM 3.5E	63	22	PDI-SC-S022	X				6	3	No	No existing core in proposed dredge footprint.
RM 3.8E (International Slip)	64	33	PDI-SC-S033	X				6	3	No	High concentration of unbounded cores with PCB concentrations >26,000 ug/kg (C092).
	65	34	PDI-SC-S034	X				6	3	No	No historical coverage in proposed dredge footprint.
	66	36	PDI-SC-S036	X				6	3	No	Close to hstorical cores C096 and C099. PCB concentrations range from 1,600 ug/kg to <500 ug/kg.
RM 4E	67	42	PDI-SC-S042	X				6	3	No	No historical cores within 250 ft.
RM 4.1W	68	45	PDI-SC-S045	X				6	3	No	Historical core SD017 unbounded to 4 ft depth with a PAH concentration >68,900 ug/kg.
RM 4.52	69	61	PDI-SC-S061	X				6	3	No	Spatial coverage, near historical cores T4-VC29 and T4-B411-06, which have PCB concentrations of 1,300 ug/kg and >75ug/kg, respectively.
RM 4.9W	70	64	PDI-SC-S064	X				6	3	No	No historical cores in proposed dredge area.
	71	66	PDI-SC-S066	X				6	3	No	Spatial coverage. Historical core near proposed area SGP-14 had a PAH concentration of >34,800 ug/kg and historical near core C160 was vertically unbounded to 8 ft depth.
RM 5.6E	72	82	PDI-SC-S082	X				6	3	No	Near historical core C203, was vertically unbounded to 10 ft depth and had a PCB concentration of 2,800 ug/kg and located approximately 230 ft away. Historic core C199 was vertically bounded at 6 feet with a PCB concentration greater than 75 ug/kg to 6 ft and located approximately 200 ft away.
RM 5.7W	73	95	PDI-SC-S095	X				6	3	No	Near historical core C240 is vertically unbounded to 3 ft depth bml and had a PAH concentration >128,000 ug/kg. Over 200 ft from nearest core.
RM 6.2W	74	105	PDI-SC-S105	X				6	3	No	Near historical cores SDDC24SB and SDDC25SB, vertically unbounded to 4 ft depth bml with PAH concentrations of 710,000 and 250,000 ug/kg, respectively.
RM 6.2E	75	112	PDI-SC-S112	X				6	3	No	Proposed dredge area with no historical cores within footprint.
RM 6.5W	76	117	PDI-SC-S117	X				6	3	Yes	Spatial coverage. No historical cores within 250 ft in proposed dredge footprint. Nearby historical core C136 has a 2,3,7,8-TCDD concentration >0.0006 ug/kg.
RM 6.7E (Willamette Cove)	77	121	PDI-SC-S121	X				6	3	No	Proposed dredge with no historical cores within footprint.
RM 6.8W	78	127	PDI-SC-S127	X				6	3	No	Proposed dredge with no historical cores within footprint.
RM 6.8E (Willamette Cove)	79	129	PDI-SC-S129	X				6	3	No	Proposed dredge with no historical cores within footprint.
RM 7W	80	140	PDI-SC-S140	X				6	3	No	Proposed dredge area with no historical cores within 200 ft.
	81	154	PDI-SC-S154	X				6	3	No	Nearby historical cores contain 2,3,7,8-TCDD concentrations up to 0.004 ug/kg. No shallow bank cores within 500 ft.
RM 8E to 9E (Swan Island Lagoon)	82	185	PDI-SC-S185	X				6	3	No	Spatial coverage between historical cores C364 and PSY16C which have PCB concentrations of 200 and 750 ug/kg, respectively.
	83	188	PDI-SC-S188	X				6	3	No	Spatial coverage. Nearby historical cores C392 and PSY30C have PCB concentrations of >750 ug/kg and <50 ug/kg, respectively.
	84	192	PDI-SC-S192	X				6	3	No	Nearby historical core DMMU1 was vertically unbounded to 10 ft depth with PCB concentration >250 ug/kg.
	85	219	PDI-SC-S219	X				6	3	No	No historical cores within 250 ft.
RM 8.1W	86	189	PDI-SC-S189	X				6	3	No	Proposed dredge with no historical cores within dredge footprint. Nearby historical core C431 had a PCB concentration of 1,100 ug/kg.
RM 9W	87	232	PDI-SC-	X				6	3	No	No historical core in proposed dredge footprint.
	88	245	PDI-SC-S245	X				6	3	No	Spatial nearshore coverage. Nearby historical core C477 vertically unbounded to 7 ft bml with a PCB concentration >500 ug/kg.
RM 9.6E	89	251	PDI-SC-S251	X				6	3	No	Proposed dredge location with no historical cores.
RM 10.2	90	260	PDI-SC-S260	X				6	3	No	Proposed remediation footprint with no historical cores.

Table 1. Subsurface Sediment Core Rationale

Alternative F Mod Active Footprint Area	Sequential Core Count	Core Location #	Station ID	New Core Station	Re-Occupy Old Station	Old Station	Rationale	Proposed Core Depth (ft bml)	# of Samples	NAPL May Be Present	Additional Rationale
Total # Deep Cores / Samples				46	14				393		
Total # of Shallow Cores / Samples				30					90		
Total Core Tube Length (Linear Ft)								1,015			
Total # of Subsurface Samples									483		

Notes:

Deep cores are collocated with an SMA surface sediment grab. There are a total of 60 collocated grabs (44 New Core Locations, 16 Reoccupy Core Locations).
Proposed core stations from RM 11E have been removed. The PDI study will rely on recent data collected within the SMA footprint.
Sample names will include Station ID and depth of sampling interval.
NAPL prediction based on Figures 3.2-1 and 3.2-2 from FS dated July 8, 2015.

Acronyms:

ug/kg = microgram per kilogram; bml = below mudline; E = east; ft = feet, PAH = polycyclic aromatic hydrocarbon; PCB = polychlorinated biphenyl; PDI = pre-remedial design investigation; PRP = potentially responsible party; RM = river mile; SMA = sediment management area; W = west

Table 2. Summary of Subsurface Sediment Sample Types, Numbers, and Analytes

Subsurface Sediment Core Type / Purpose	No. of Stations	No. of Samples	Analyte List (focused COCs)				
			PCB Aroclors	PAHs	PCDD/F	DDx	Grain size and TOC
Deep Core Stations	60	393	X	X	X	X	X
Nearshore (Shallow) Cores	30	90	X	X	X	X	X
Archive 1 ft Interval near bottom of core	TBD	TBD	Archive pending 2 ft results				
Total Count	**90**	**483**					

Notes:

Deep Cores are a combination of New Core Stations and Reoccupy Core Stations which range in depth from 10 to 20 feet.

Sample Collection will occur every 2 feet of depth except for reoccupy core stations.

Reoccupy Core Stations will have two samples collected (one at the historical depth and one 2 feet lower).

All Shallow~~Bank~~ Core Stations will be to a target depth of 6 feet.

Deep Core Stations may have a co-located surface sediment grab sample (0 to 30 cm target depth).

Focused COCs include: DDx, PCB Aroclors, PAHs, PCDD/Fs. Grain Size and TOC also analyzed.

Selected fine-grained samples (up to 10) will also be anayzed for Atterberg Limits.

Acronyms:

COC = contaminant of concern; DDx = sum of dichlorodiphenyltrichloroethane and its derivatives; PAHs = polycyclic aromatic hydrocarbon; PCBs = polychlorinated biphenyls; PCDD/Fs = polychlorinated dibenzo-p-dioxins and furans; TBD = to be determined; TOC = total organic carbon

Table 3. Station Identification Scheme, Mudline Elevations, and Location Coordinates

Station ID	Core Description	Mudline Elevation (CRD - Feet)[a]	Proposed Location Coordinates (NAD83 [2011]; Intl Feet)[b]		Sequential Station Count
			Easting	*Northing*	
PDI-SC-S002	Shallow Core	N/A	7617870	724983	1
PDI-SC-S004	Deep Core	-3.5	7617674	724708	2
PDI-SC-S007	Deep Core	N/A	7617494	724204	3
PDI-SC-S009	Deep Core	-36.1	7617132	723879	4
PDI-SC-S010	Deep Core	-23.9	7617252	723775	5
PDI-SC-S011	Deep Core	-8.5	7617185	723519	6
PDI-SC-S014	Shallow Core	N/A	7617131	723185	7
PDI-SC-S015	Deep Core	-33.0	7616871	722877	8
PDI-SC-S019	Deep Core	-26.8	7616724	721584	9
PDI-SC-S022	Shallow Core	N/A	7617439	718310	10
PDI-SC-S023	Deep Core	-48.7	7617275	717743	11
PDI-SC-S024	Deep Core	-38.7	7618163	717155	12
PDI-SC-S028	Deep Core	-24.5	7619022	717184	13
PDI-SC-S030	Deep Core	-13.6	7619376	717045	14
PDI-SC-S031	Deep Core	-22.4	7619579	717144	15
PDI-SC-S032	Deep Core	-9.2	7619801	717238	16
PDI-SC-S033	Shallow Core	-1.9	7619895	717023	17
PDI-SC-S034	Shallow Core	N/A	7620011	717204	18
PDI-SC-S036	Shallow Core	N/A	7618072	716752	19
PDI-SC-S038	Deep Core	N/A	7616637	715830	20
PDI-SC-S042	Shallow Core	N/A	7618436	715951	21
PDI-SC-S045	Shallow Core	N/A	7617224	714365	22
PDI-SC-S053	Deep Core	N/A	7617469	713721	23
PDI-SC-S055	Deep Core	-9.3	7619660	713673	24
PDI-SC-S061	Shallow Core	N/A	7620462	713053	25
PDI-SC-S062	Deep Core	-12.4	7618175	712584	26
PDI-SC-S064	Shallow Core	N/A	7618256	712076	27
PDI-SC-S065	Deep Core	N/A	7618588	711681	28
PDI-SC-S066	Shallow Core	N/A	7618929	711020	29
PDI-SC-S070	Deep Core	-9.7	7619684	710016	30
PDI-SC-S082	Shallow Core	N/A	7622325	708748	31
PDI-SC-S083	Deep Core	-50.6	7621575	708069	32
PDI-SC-S085	Deep Core	N/A	7622302	708578	33
PDI-SC-S086	Deep Core	-50.8	7621839	707824	34
PDI-SC-S088	Deep Core	-36.9	7622381	708290	35
PDI-SC-S092	Deep Core	N/A	7622708	708151	36
PDI-SC-S095	Shallow Core	-8.6	7622008	707161	37
PDI-SC-S098	Deep Core	-45.6	7622652	706762	38
PDI-SC-S103	Deep Core	-39.8	7623053	706373	39
PDI-SC-S105	Shallow Core	N/A	7623049	706035	40
PDI-SC-S108	Deep Core	-11.3	7623957	706997	41
PDI-SC-S109	Deep Core	-44.6	7623821	706069	42
PDI-SC-S112	Shallow Core	N/A	7624572	706744	43
PDI-SC-S113	Deep Core	-40.5	7624300	705634	44
PDI-SC-S117	Shallow Core	N/A	7624686	705196	45
PDI-SC-S121	Shallow Core	N/A	7625899	706030	46
PDI-SC-S127	Shallow Core	N/A	7625928	704408	47
PDI-SC-S129	Shallow Core	N/A	7626904	705849	48
PDI-SC-S131	Deep Core	-31.6	7626895	705603	49
PDI-SC-S136	Deep Core	N/A	7626539	703726	50
PDI-SC-S139	Deep Core	-7.4	7627058	703342	51

Table 3. Station Identification Scheme, Mudline Elevations, and Location Coordinates

Station ID	Core Description	Mudline Elevation (CRD - Feet)[a]	Proposed Location Coordinates (NAD83 [2011]; Intl Feet)[b]		Sequential Station Count
			Easting	*Northing*	
PDI-SC-S140	Shallow Core	N/A	7627140	702977	52
PDI-SC-S144	Deep Core	N/A	7628759	704114	53
PDI-SC-S146	Deep Core	-16.4	7627591	702896	54
PDI-SC-S150	Deep Core	-7.0	7627909	702475	55
PDI-SC-S151	Deep Core	-28.8	7628124	702359	56
PDI-SC-S154	Shallow Core	N/A	7628333	701890	57
PDI-SC-S155	Deep Core	N/A	7628616	701529	58
PDI-SC-S157	Deep Core	-37.9	7628992	700980	59
PDI-SC-S163	Deep Core	-25.8	7629268	700352	60
PDI-SC-S172	Deep Core	-13.1	7633011	701895	61
PDI-SC-S176	Deep Core	-43.3	7632595	701151	62
PDI-SC-S178	Deep Core	-34.4	7632913	701345	63
PDI-SC-S185	Shallow Core	N/A	7633644	701791	64
PDI-SC-S188	Shallow Core	N/A	7632478	700346	65
PDI-SC-S189	Shallow Core	N/A	7630828	698942	66
PDI-SC-S191	Deep Core	-47.5	7632893	700640	67
PDI-SC-S192	Shallow Core	N/A	7633168	700669	68
PDI-SC-S198	Deep Core	-33.3	7633962	701063	69
PDI-SC-S203	Deep Core	-34.6	7634188	700563	70
PDI-SC-S213	Deep Core	-31.8	7634983	700093	71
PDI-SC-S218	Deep Core	N/A	7633085	696851	72
PDI-SC-S219	Shallow Core	-24.3	7635270	699677	73
PDI-SC-S221	Deep Core	-28.8	7633359	696916	74
PDI-SC-S222	Deep Core	-13.4	7633418	696810	75
PDI-SC-S226	Deep Core	N/A	7633678	696609	76
PDI-SC-S228	Deep Core	-17.1	7635600	697287	77
PDI-SC-S229	Deep Core	N/A	7635857	699177	78
PDI-SC-S230	Deep Core	-23.0	7636127	699520	79
PDI-SC-S232	Shallow Core	N/A	7634221	696225	80
PDI-SC-S238	Deep Core	-14.1	7636448	698736	81
PDI-SC-S245	Shallow Core	N/A	7635255	695640	82
PDI-SC-S248	Deep Core	-20.4	7636288	695194	83
PDI-SC-S251	Shallow Core	N/A	7637607	696102	84
PDI-SC-S254	Deep Core	-23.4	7637333	694600	85
PDI-SC-S255	Deep Core	N/A	7637134	694051	86
PDI-SC-S256	Deep Core	N/A	7637282	694038	87
PDI-SC-S257	Deep Core	-16.8	7637494	694352	88
PDI-SC-S260	Shallow Core	N/A	7639609	692691	89
PDI-SC-S263	Deep Core	N/A	7642066	691479	90

General Notes:

1. Conversion From CRD to NAVD88: Elevation (CRD) +5.38≈ NAVD88 (Geoid12b)
2. N/A = not available

Notes:

a) Vertical Datum: CRD (Columbia River Datum; Feet); based on 2009 NOAA bathymetry

b) Horizontal Projection: NAD83 (2011), State Plane Coordinate System (SPCS) Oregon North Zone (Intl Feet)

Sample names will include Station ID and depth of sampling interval.

Table 4. Field Quality Control Sample Requirements

QA/QC Sample Type	Frequency
Temperature Blanks	1 per cooler
Field Duplicates	1 per 20 samples
Field Equipment Rinsate Blanks	5 percent or 1 per week

Acronyms:
QA/QC = quality assurance/quality control

Table 5. Summary of Estimated Number of Field Quality Control Samples

Subsurface Sediment Sample Type	No. of Samples	Estimated Number of Field Weeks	Field Duplicates	Field Equipment Rinsate Blanks
Deep Core Stations	393	19.7	20	20
Nearshore (Shallow) Core Stations	90	3.0	5	3
Total Count	**483**	**22.7**	**25**	**23**

Notes:

Estimated number of field weeks for one vessel; two vessels are planned to be in the field.

Field Duplicates will each be collected at a rate of 1 per 20 samples.

Rinsate Blanks will be collected at a rate of 1 per 20 samples or 1 per week or piece of equipment.

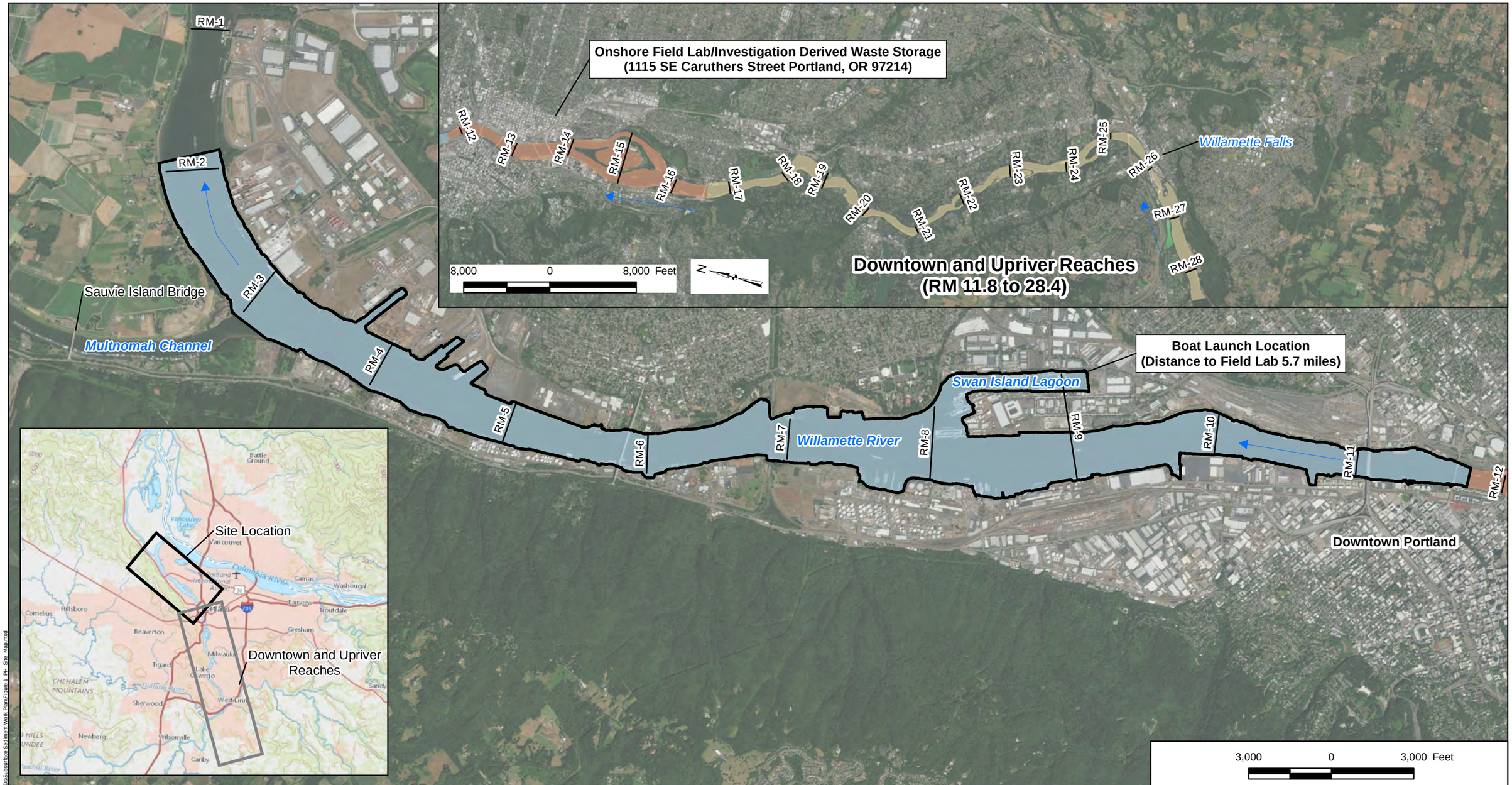
Table 6. Analysis Method, Sample Containers, Preservation, Holding Times, and Sample Volume

Sediment Parameter	Method	Container		Preservation	Holding Time	Minimum Sample Size (wet weight grams)
		Type	*Size*			
PCBs Aroclors	EPA 8082A	WMG	8 oz	Refrigerate, 0 to 6ºC Deep Frozen (-10ºC)	1 year, 1 year	100
PCDD/PCDFs	EPA 1613B	Amber Glass Jar	8 oz	Refrigerate, 0 to 6ºC Deep Frozen (-10ºC)	1 year, 1 year [a]	100
PAHs	EPA 8270SIM	Amber Glass Jar	8 oz	Refrigerate, 0 to 6ºC Deep Frozen (-10ºC)	14 days, 1 year	100
DDx	EPA 1699M			Refrigerate, 0 to 6ºC Deep Frozen (-10ºC)	1 year	100
Grain size	ASTM D7928 / D 6913	G or P	16 oz	NA	NA	100 to 150
Atterberg Limits	ASTM D4318	P	16 oz	NA	NA	500
Total organic carbon	EPA 9060	WMG	4 oz	Refrigerate, 0-6°C	28 days	25
Total solids	EPA 160.3	WMG				

General Notes:
Refrigerate preservation times consistent with PSEP protocols for Washington State.
Frozen preservation times provided from PSEP 1986.
Method detection limits presented in the project QAPP.
Selected fine-grained samples will be analyzed for Atterberg Limits.
Footnotes:
a) stored in darkness

Acronyms:
ºC = degrees Celsius; DDx - sum of dichlorodiphenyltrichloroethane and its derivatives; G = glass; oz = ounce; P = plastic; PAHs - polycyclic aromatic hydrocarbon; PCBs = polychlorinated biphenyls; PCDD/Fs = polychlorinated dibenzo-p-dioxins and furans; PSEP = Puget Sound Estuary Protocol; QAPP = Quality Assurance Project Plan; WMG = wide-mouth glass

FIGURES



Legend

- Flow Direction
- River Mile Marker
- Superfund Site Boundary (RM 1.9 to 11.8)

Study Area

- Site Area (RM 1.9 to 11.8)
- Downtown Reach (RM 11.8 to 16.6)
- Upriver Reach (RM 16.6 to 28.4)

Note:
1. Aerial Imagery provided by ESRI Basemaps 2016

Portland Harbor Site Map

Portland Harbor Superfund Site
PDI Subsurface Sediment Coring FSP

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Figure 1

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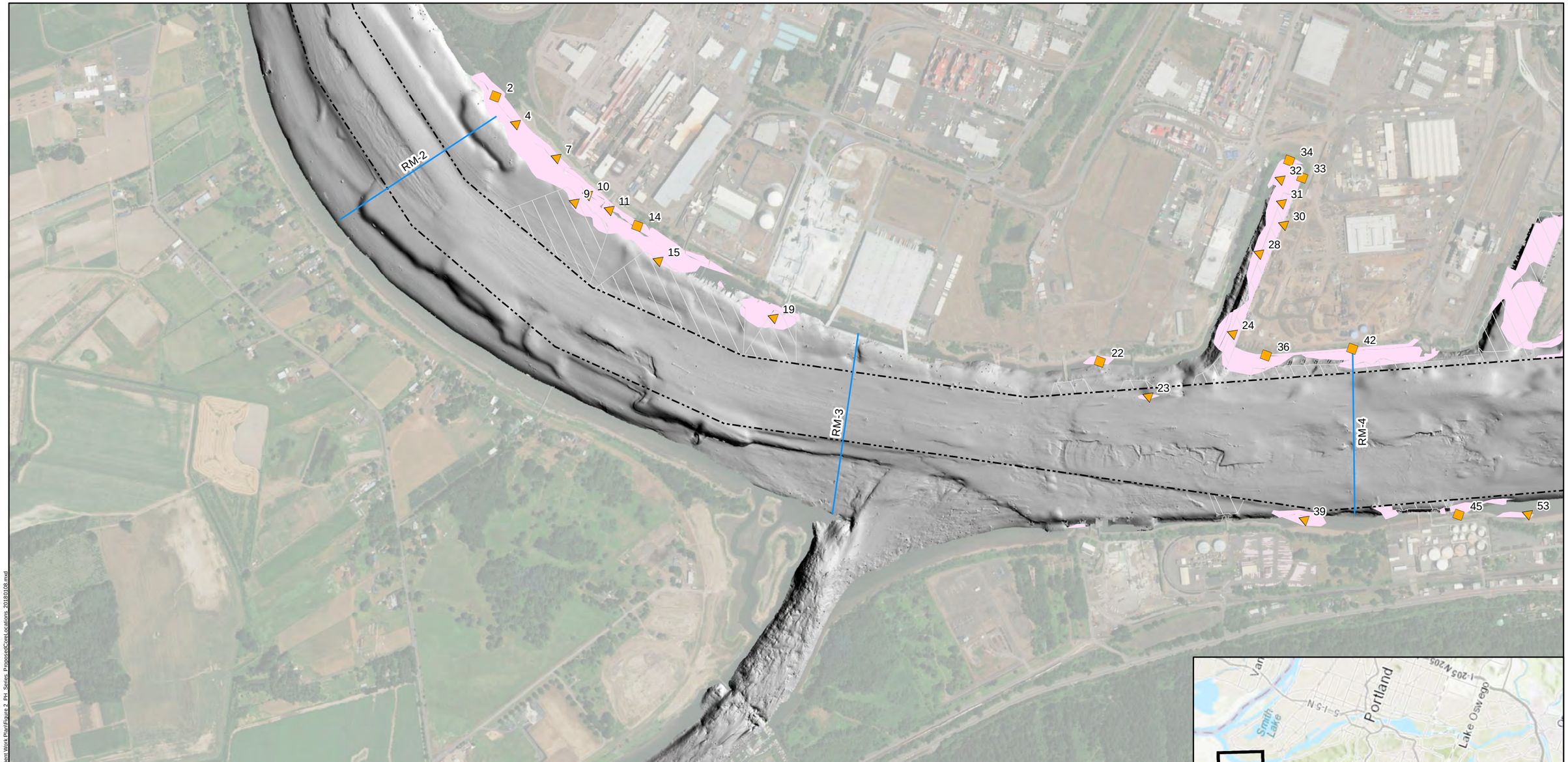

Legend

- Proposed Deep Core Location (n = 60)
- Proposed Shallow Core Location (n = 30)
- Alternative F Mod SMA Footprint
- Capped Area (Existing)
- Potential FMD\Berthing Area
- Superfund Site Boundary (RM 1.9-11.8)
- Navigation Channel

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Core numbering is not sequential because it matches sequence surface grab ID scheme from downstream to upstream.
Only Subsurface Deep Cores and Shallow Cores shown.
3. n - sample count, RM - river mile, SMA - sediment management area.

N

1,000 500 0 1,000 2,000 Feet

Proposed Subsurface Sediment Sampling Locations RM 1.9 to 4

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Figure 2a

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Legend

- Proposed Deep Core Location (n = 60)
- Proposed Shallow Core Location (n = 30)
- Alternative F Mod SMA Footprint
- Capped Area (Existing)
- Potential FMD\Berthing Area
- Superfund Site Boundary (RM 1.9-11.8)
- Navigation Channel

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Core numbering is not sequential because it matches sequence surface grab ID scheme from downstream to upstream.
Only Subsurface Deep Cores and Shallow Cores shown.
3. n - sample count, RM - river mile, SMA - sediment management area.

N

1,000 500 0 1,000 2,000 Feet

Proposed Subsurface Sediment Sampling Locations RM 4 to 6

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PDI Subsurface Sediment Coring FSP

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Figure **2b**

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Legend

- Proposed Deep Core Location (n = 60)
- Proposed Shallow Core Location (n = 30)
- Alternative F Mod SMA Footprint
- Capped Area (Existing)
- Potential FMD\Berthing Area
- Superfund Site Boundary (RM 1.9-11.8)
- Navigation Channel

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Core numbering is not sequential because it matches sequence surface grab ID scheme from downstream to upstream.
Only Subsurface Deep Cores and Shallow Cores shown.
3. n - sample count, RM - river mile, SMA - sediment management area.

N

1,000 500 0 1,000 2,000 Feet

Proposed Subsurface Sediment Sampling Locations RM 6 to 8

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PDI Subsurface Sediment Coring FSP

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Figure 2c

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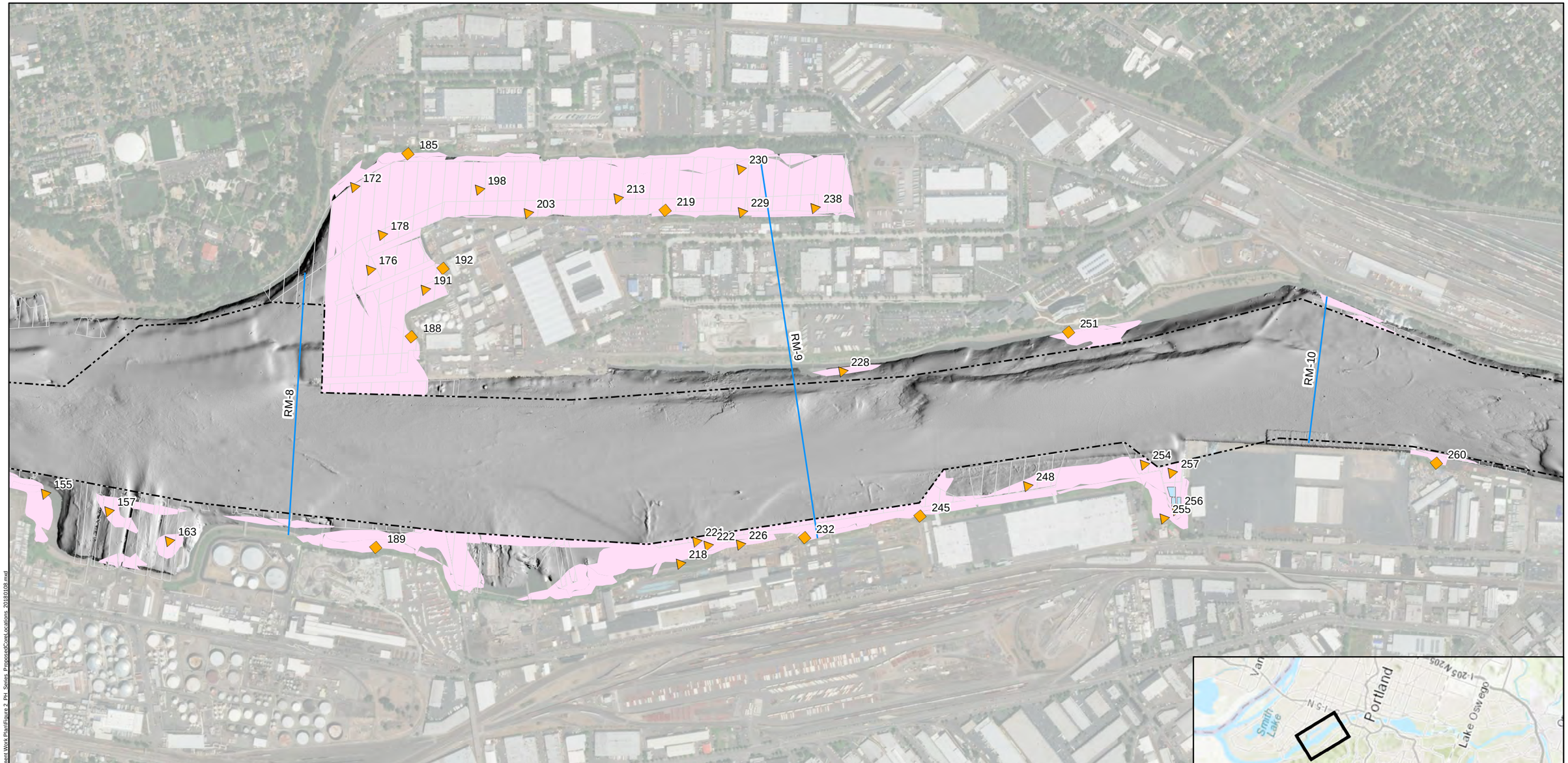

Legend

- Proposed Deep Core Location (n = 60)
- Proposed Shallow Core Location (n = 30)
- Alternative F Mod SMA Footprint
- Capped Area (Existing)
- Potential FMD\Berthing Area
- Superfund Site Boundary (RM 1.9-11.8)
- Navigation Channel

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Core numbering is not sequential because it matches sequence surface grab ID scheme from downstream to upstream.
Only Subsurface Deep Cores and Shallow Cores shown.
3. n - sample count, RM - river mile, SMA - sediment management area.

N

1,000 500 0 1,000 2,000 Feet

Proposed Subsurface Sediment Sampling Locations RM 8 to 10

Portland Harbor Superfund Site
PDI Subsurface Sediment Coring FSP

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Figure 2d

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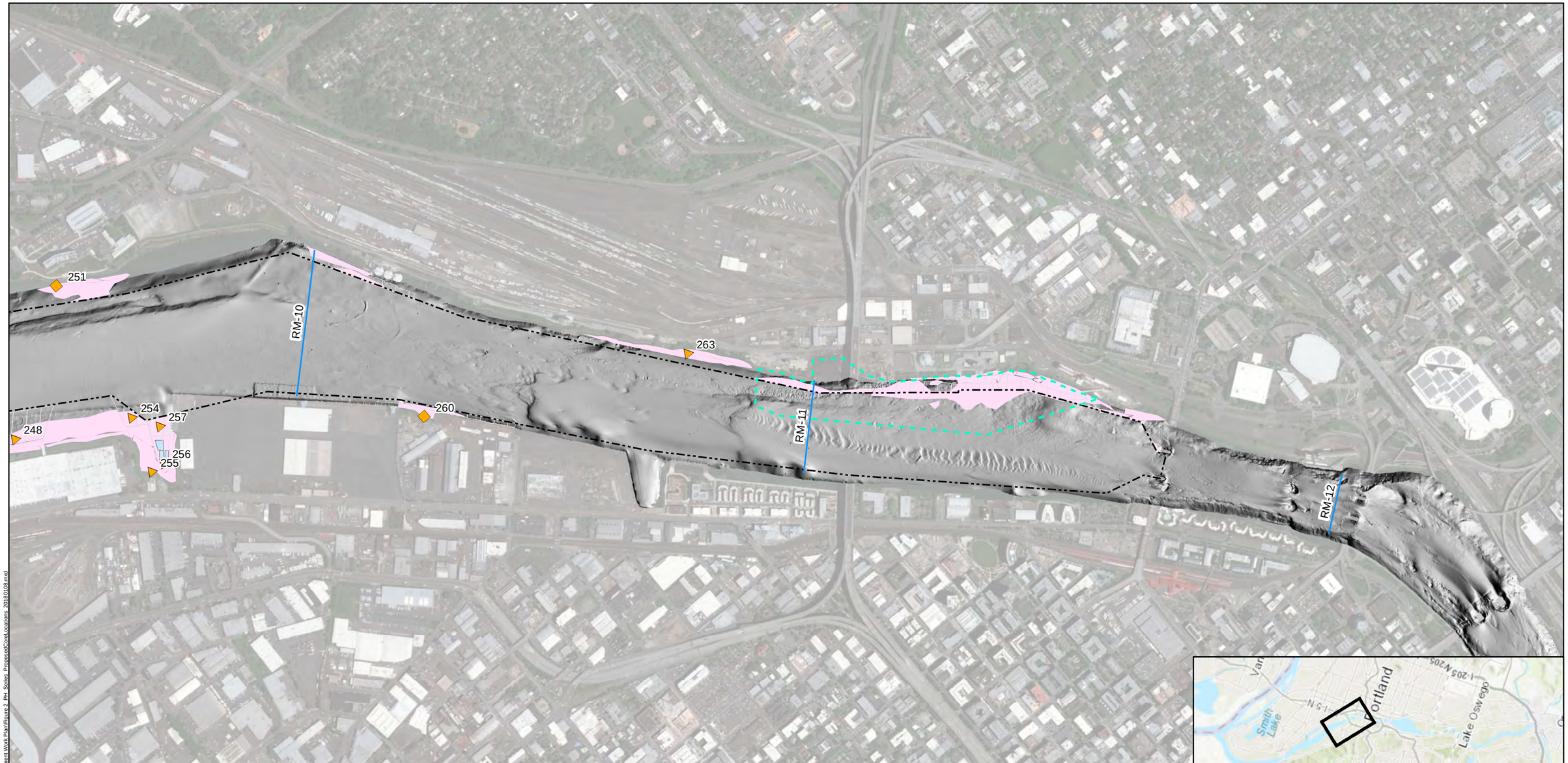

Legend

- Proposed Deep Core Location (n = 60)
- Proposed Shallow Core Location (n = 30)
- Alternative F Mod SMA Footprint
- Capped Area (Existing)
- Potential FMD\Berthing Area
- Superfund Site Boundary (RM 1.9-11.8)
- Navigation Channel
- Approximate RM 11E Early Action Area

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Core numbering is not sequential because it matches sequence surface grab ID scheme from downstream to upstream.
Only Subsurface Deep Cores and Shallow Cores shown.
3. n - sample count, RM - river mile, SMA - sediment management area.

N

1,000 500 0 1,000 2,000 Feet

Proposed Subsurface Sediment Sampling Locations RM 10 to 11.8

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PDI Subsurface Sediment Coring FSP

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Figure 2e

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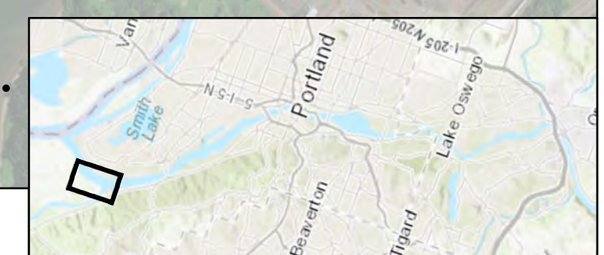

Legend

- Proposed Deep Core Location (n = 60)
- Proposed Shallow Core Location (n = 30)
- FS Subsurface Core Location
- FS Surface Sediment Sample
- Post RI/FS Subsurface Surface Sediment Location (2013 to 2016)
- Post RI/FS Surface Sediment Sample Location (2013 to 2016)
- Capped Area (Existing)

Alternative F Mod Technology Assignment

- Dredge
- Dredge in Nav-FMD
- Dredge with Cap
- Cap
- EMNR

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Core numbering is not sequential because it matches sequence surface grab ID scheme from downstream to upstream.
Only Subsurface Deep Cores and Shallow Cores shown.
4. Alternative F Mod technology assignments are hand digitized based on georeferenced imagery and may not exactly match ROD footprint at finer scales
5. Record of Decision for Alt F Mod footprint (EPA 2016).
6. n - sample count, RM - river mile.
7. References:
FS samples obtained from USEPA, 2016.
Post RI/FS samples compiled from: GSI Water Solutions and Hart Crowser, 2008; GSI Water Solutions and Hart Crowser, 2010; GSI Water Solutions Inc., 2014; Kleinfelder, 2015; NewFields, 2016; and Geosyntec, 2016.

N

500 250 0 500 1,000 Feet

Proposed Subsurface Sediment Sampling Locations and Historical Locations
RM 1.9 to 3.3

Portland Harbor Superfund Site
PDI Subsurface Sediment Coring FSP

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Figure **3a**

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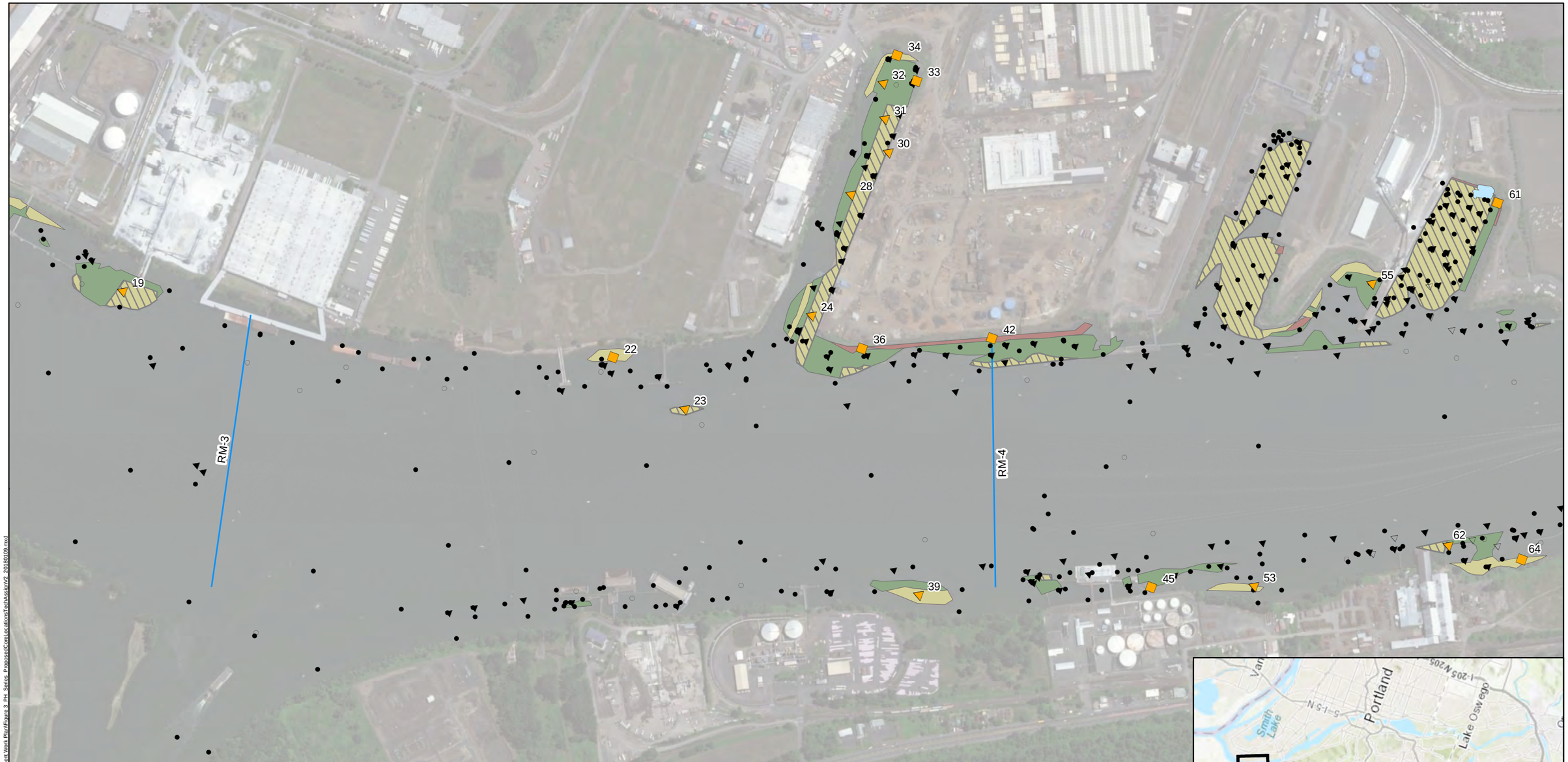

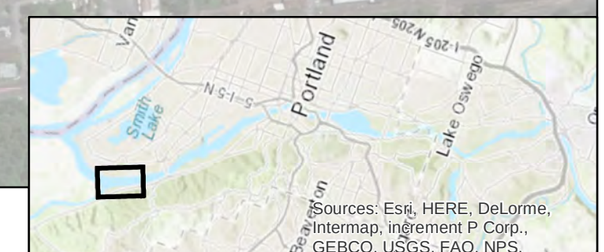

Legend

- Proposed Deep Core Location (n = 60)
- Proposed Shallow Core Location (n = 30)
- FS Subsurface Core Location
- FS Surface Sediment Sample
- Post RI/FS Subsurface Surface Sediment Location (2013 to 2016)
- Post RI/FS Surface Sediment Sample Location (2013 to 2016)
- Capped Area (Existing)

Alternative F Mod Technology Assignment

- Dredge
- Dredge in Nav-FMD
- Dredge with Cap
- Cap
- EMNR

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Core numbering is not sequential because it matches sequence surface grab ID scheme from downstream to upstream.
Only Subsurface Deep Cores and Shallow Cores shown.
4. Alternative F Mod technology assignments are hand digitized based on georeferenced imagery and may not exactly match ROD footprint at finer scales
5. Record of Decision for Alt F Mod footprint (EPA 2016).
6. n - sample count, RM - river mile.
7. References:
FS samples obtained from USEPA, 2016.
Post RI/FS samples compiled from: GSI Water Solutions and Hart Crowser, 2008; GSI Water Solutions and Hart Crowser, 2010; GSI Water Solutions Inc., 2014; Kleinfelder, 2015; NewFields, 2016; and Geosyntec, 2016.

N

500 250 0 500 1,000 Feet

Proposed Subsurface Sediment Sampling Locations and Historical Locations
RM 3.3 to 4.2

Portland Harbor Superfund Site
PDI Subsurface Sediment Coring FSP

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Figure **3b**

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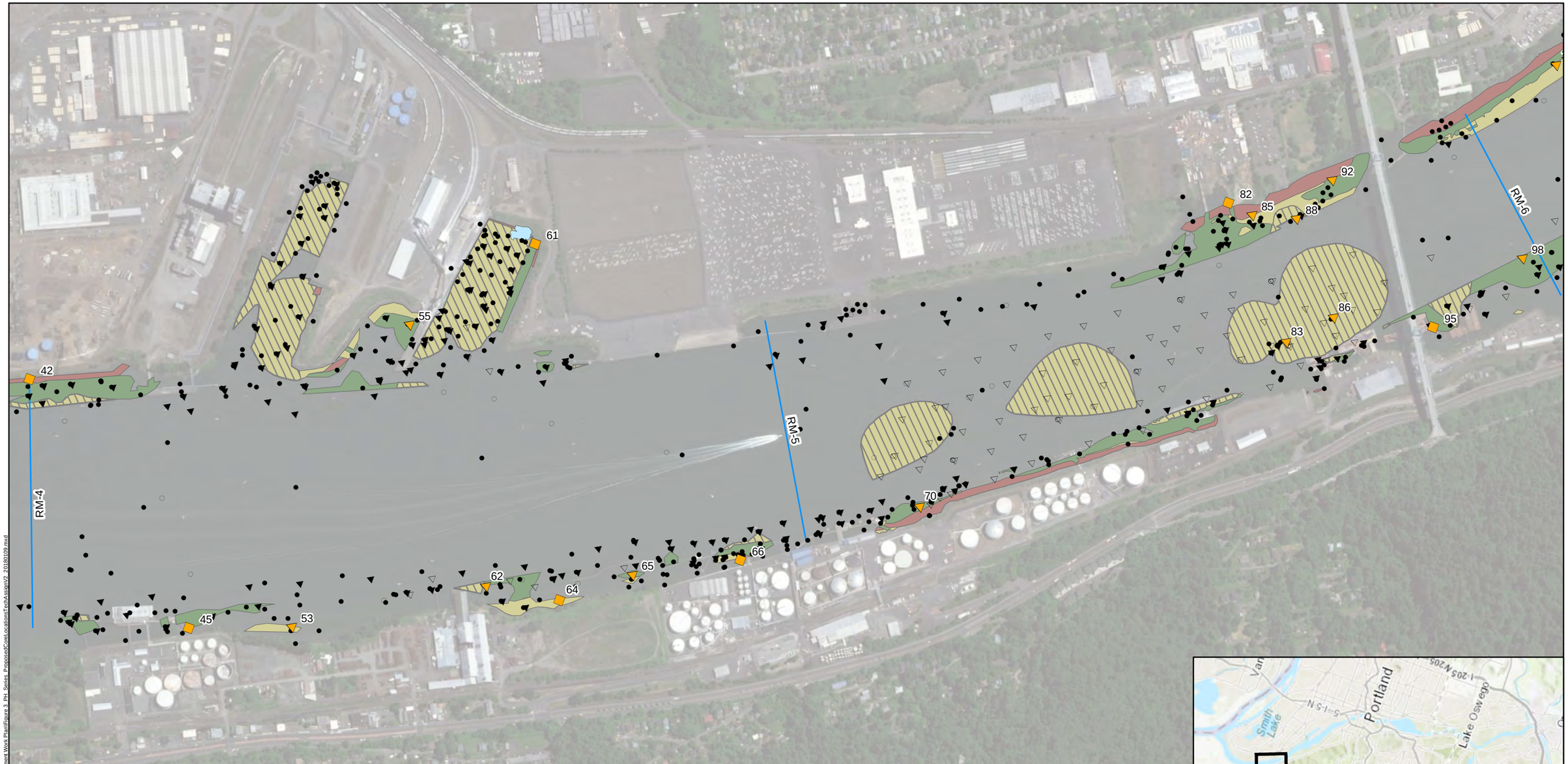

Legend

- Proposed Deep Core Location (n = 60)
- Proposed Shallow Core Location (n = 30)
- FS Subsurface Core Location
- FS Surface Sediment Sample
- Post RI/FS Subsurface Surface Sediment Location (2013 to 2016)
- Post RI/FS Surface Sediment Sample Location (2013 to 2016)
- Capped Area (Existing)

Alternative F Mod Technology Assignment

- Dredge
- Dredge in Nav-FMD
- Dredge with Cap
- Cap
- EMNR

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Core numbering is not sequential because it matches sequence surface grab ID scheme from downstream to upstream.
Only Subsurface Deep Cores and Shallow Cores shown.
4. Alternative F Mod technology assignments are hand digitized based on georeferenced imagery and may not exactly match ROD footprint at finer scales
5. Record of Decision for Alt F Mod footprint (EPA 2016).
6. n - sample count, RM - river mile.
7. References:
FS samples obtained from USEPA, 2016.
Post RI/FS samples compiled from: GSI Water Solutions and Hart Crowser, 2008; GSI Water Solutions and Hart Crowser, 2010; GSI Water Solutions Inc., 2014; Kleinfelder, 2015; NewFields, 2016; and Geosyntec, 2016.

N

500 250 0 500 1,000 Feet

Proposed Subsurface Sediment Sampling Locations and Historical Locations
RM 4.2 to 5.8

Portland Harbor Superfund Site
PDI Subsurface Sediment Coring FSP

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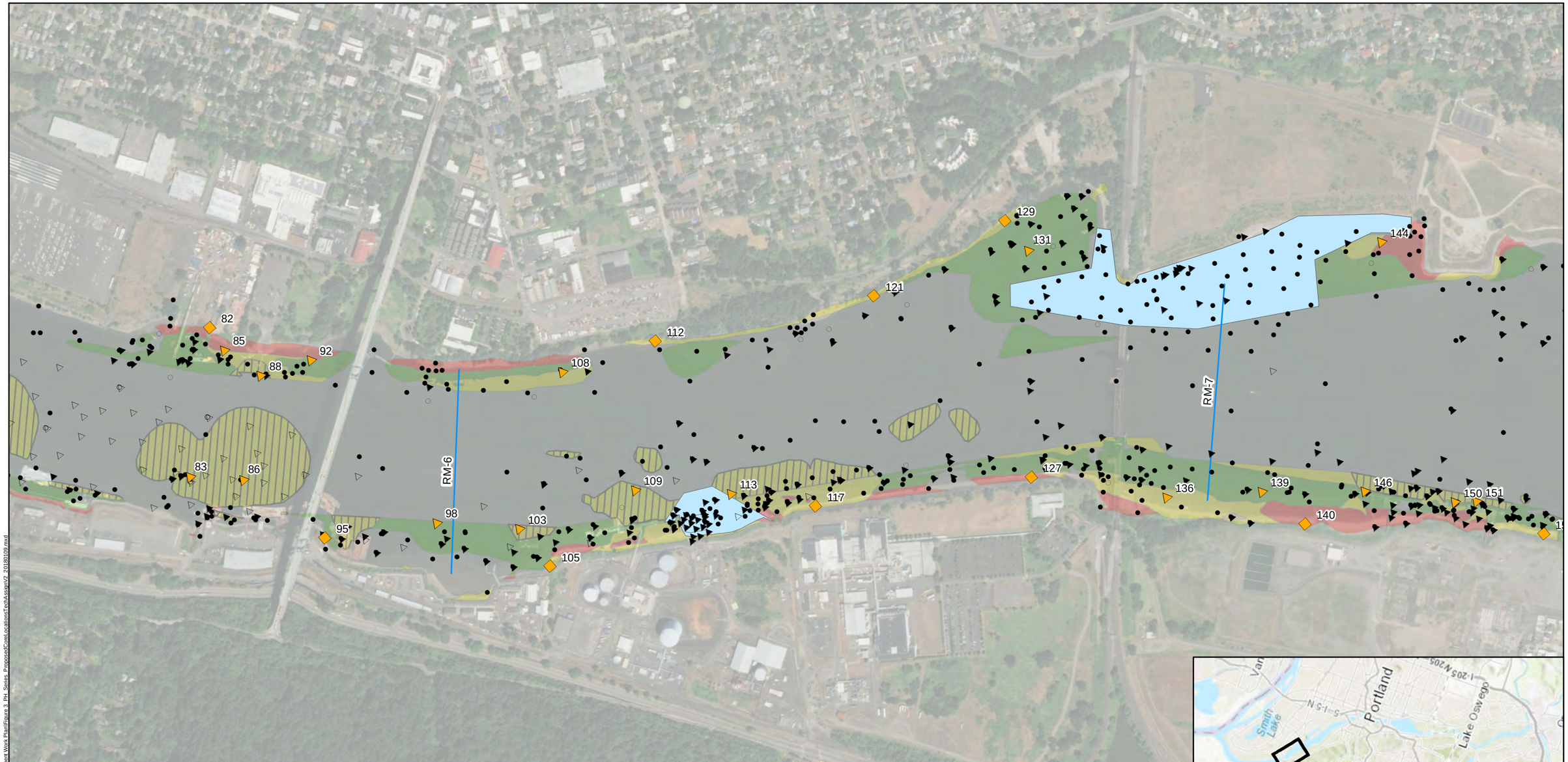
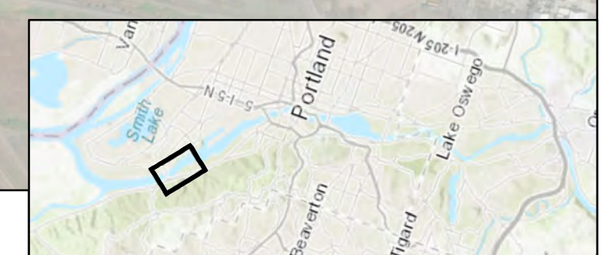
Figure **3c**

Path: P:\Projects\Portland Pre-Design\PN\G0767A\90\GIS and CADM\Gis\Subsurface Sediment Work Plan\Figure 3_PH_Series_ProposedCoreLocationsTechAssignV2_20180109.mxd





Legend

- Proposed Deep Core Location (n = 60)
- Proposed Shallow Core Location (n = 30)
- FS Subsurface Core Location
- FS Surface Sediment Sample
- Post RI/FS Subsurface Surface Sediment Location (2013 to 2016)
- Post RI/FS Surface Sediment Sample Location (2013 to 2016)
- Capped Area (Existing)

Alternative F Mod Technology Assignment

- Dredge
- Dredge in Nav-FMD
- Dredge with Cap
- Cap
- EMNR

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Core numbering is not sequential because it matches sequence surface grab ID scheme from downstream to upstream.
Only Subsurface Deep Cores and Shallow Cores shown.
4. Alternative F Mod technology assignments are hand digitized based on georeferenced imagery and may not exactly match ROD footprint at finer scales
5. Record of Decision for Alt F Mod footprint (EPA 2016).
6. n - sample count, RM - river mile.
7. References:
FS samples obtained from USEPA, 2016.
Post RI/FS samples compiled from: GSI Water Solutions and Hart Crowser, 2008; GSI Water Solutions and Hart Crowser, 2010; GSI Water Solutions Inc., 2014; Kleinfelder, 2015; NewFields, 2016; and Geosyntec, 2016.

N

500 250 0 500 1,000 Feet

Proposed Subsurface Sediment Sampling Locations and Historical Locations
RM 5.8 to 7.0

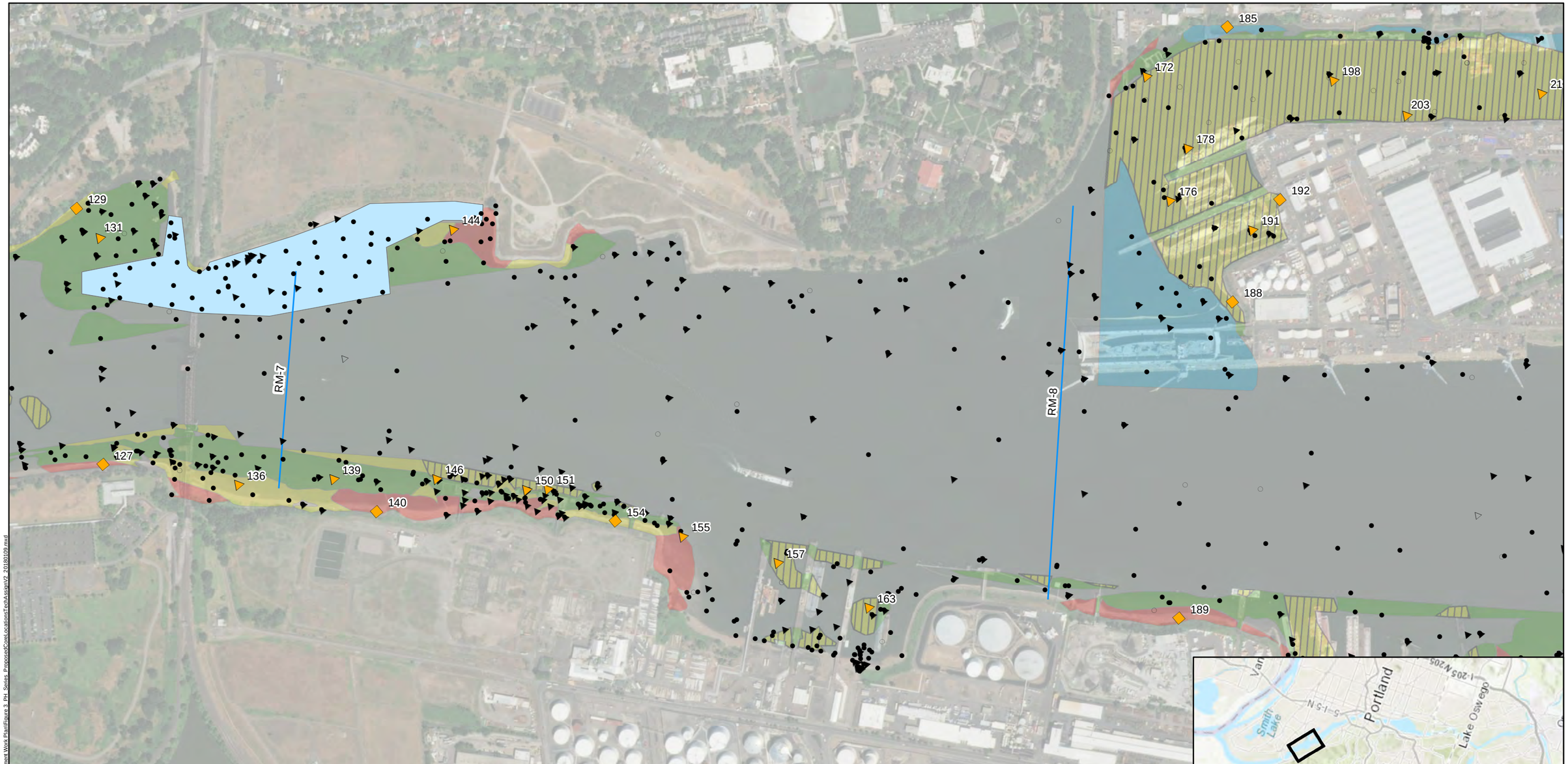
Portland Harbor Superfund Site
PDI Subsurface Sediment Coring FSP

AECOM Geosyntec consultants

Figure **3d**

MI/SEA | January 18, 2018

Path: P:\Projects\Portland Pre-Design\PN\G0767A\900\GIS and CAD\MXDs\Subsurface Sediment Work Plan\Figure 3_Pt1_Series_ProposedCoreLocationsTechAssistnV2_20180109.mxd



Legend

- Proposed Deep Core Location (n = 60)
- Proposed Shallow Core Location (n = 30)
- FS Subsurface Core Location
- FS Surface Sediment Sample
- Post RI/FS Subsurface Surface Sediment Location (2013 to 2016)
- Post RI/FS Surface Sediment Sample Location (2013 to 2016)
- Capped Area (Existing)

Alternative F Mod Technology Assignment

- Dredge
- Dredge in Nav-FMD
- Dredge with Cap
- Cap
- EMNR

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Core numbering is not sequential because it matches sequence surface grab ID scheme from downstream to upstream.
Only Subsurface Deep Cores and Shallow Cores shown.
4. Alternative F Mod technology assignments are hand digitized based on georeferenced imagery and may not exactly match ROD footprint at finer scales
5. Record of Decision for Alt F Mod footprint (EPA 2016).
6. n - sample count, RM - river mile.
7. References:
FS samples obtained from USEPA, 2016.
Post RI/FS samples compiled from: GSI Water Solutions and Hart Crowser, 2008; GSI Water Solutions and Hart Crowser, 2010; GSI Water Solutions Inc., 2014; Kleinfelder, 2015; NewFields, 2016; and Geosyntec, 2016.

N

500 250 0 500 1,000 Feet

Proposed Subsurface Sediment Sampling Locations and Historical Locations
RM 7.0 to 8.2

Portland Harbor Superfund Site
PDI Subsurface Sediment Coring FSP

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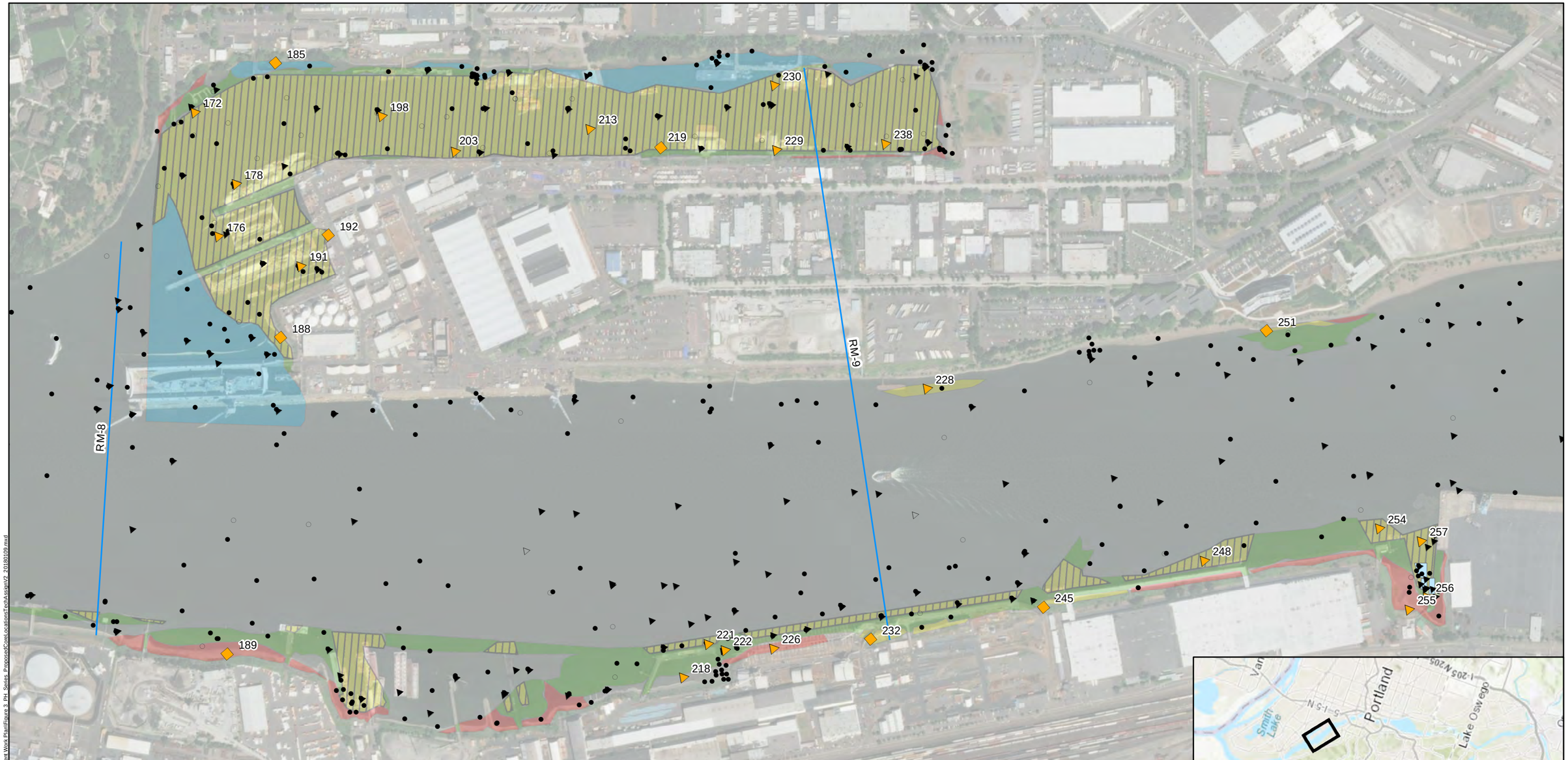
Figure 3e

MI/SEA | January 18, 2018

Path: P:\Projects\Portland Pre-Design PNG0767A\900 GIS and CAD\MXDs\Subsurface Sediment Work Plan\Figure 3_PH_Series_ProposedCoreLocationsTechAssignV2_20180109.mxd



Legend

- Proposed Deep Core Location (n = 60)
- Proposed Shallow Core Location (n = 30)
- FS Subsurface Core Location
- FS Surface Sediment Sample
- Post RI/FS Subsurface Surface Sediment Location (2013 to 2016)
- Post RI/FS Surface Sediment Sample Location (2013 to 2016)
- Capped Area (Existing)

Alternative F Mod Technology Assignment

- Dredge
- Dredge in Nav-FMD
- Dredge with Cap
- Cap
- EMNR

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Core numbering is not sequential because it matches sequence surface grab ID scheme from downstream to upstream.
Only Subsurface Deep Cores and Shallow Cores shown.
4. Alternative F Mod technology assignments are hand digitized based on georeferenced imagery and may not exactly match ROD footprint at finer scales
5. Record of Decision for Alt F Mod footprint (EPA 2016).
6. n - sample count, RM - river mile.
7. References:
FS samples obtained from USEPA, 2016.
Post RI/FS samples compiled from: GSI Water Solutions and Hart Crowser, 2008; GSI Water Solutions and Hart Crowser, 2010; GSI Water Solutions Inc., 2014; Kleinfelder, 2015; NewFields, 2016; and Geosyntec, 2016.

N

500 250 0 500 1,000 Feet

Proposed Subsurface Sediment Sampling Locations and Historical Locations
RM 8.2 to 9.5

Portland Harbor Superfund Site
PDI Subsurface Sediment Coring FSP

AECOM Geosyntec consultants

MI/SEA | January 18, 2018

Figure 3f

Path: P:\Projects\Portland Pre-Design PN 60767A\900 GIS and CAD\MXDs\Subsurface Sediment Work Plan\Figure 3_PH_Series_ProposedCoreLocationsTechAssign\V2_20180109.mxd

Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS,

Legend

- Proposed Deep Core Location (n = 60)
- Proposed Shallow Core Location (n = 30)
- FS Subsurface Core Location
- FS Surface Sediment Sample
- Post RI/FS Subsurface Surface Sediment Location (2013 to 2016)
- Post RI/FS Surface Sediment Sample Location (2013 to 2016)
- Capped Area (Existing)

Alternative F Mod Technology Assignment

- Dredge
- Dredge in Nav-FMD
- Dredge with Cap
- Cap
- EMNR
- Approximate RM 11E Early Action Area

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Core numbering is not sequential because it matches sequence surface grab ID scheme from downstream to upstream.
Only Subsurface Deep Cores and Shallow Cores shown.
4. Alternative F Mod technology assignments are hand digitized based on georeferenced imagery and may not exactly match ROD footprint at finer scales
5. Record of Decision for Alt F Mod footprint (EPA 2016).
6. n - sample count, RM - river mile.
7. References:
FS samples obtained from USEPA, 2016.
Post RI/FS samples compiled from: GSI Water Solutions and Hart Crowser, 2008; GSI Water Solutions and Hart Crowser, 2010; GSI Water Solutions Inc., 2014; Kleinfelder, 2015; NewFields, 2016; and Geosyntec, 2016.

N

500 250 0 500 1,000 Feet

Proposed Subsurface Sediment Sampling Locations and Historical Locations
RM 9.5 to 10.6

Portland Harbor Superfund Site
PDI Subsurface Sediment Coring FSP

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Figure 3g

MI/SEA | March 23, 2018

Path: P:\Projects\Portland Pre-Design PN G0767A\900 GIS and CAD\MXDs\Subsurface Sediment Work Plan\Figure 3_PH_Series_ProposedCoreLocationsTechAssignV2_20180109.mxd

Legend

- Proposed Deep Core Location (n = 60)
- Proposed Shallow Core Location (n = 30)
- FS Subsurface Core Location
- FS Surface Sediment Sample
- Post RI/FS Subsurface Surface Sediment Location (2013 to 2016)
- Post RI/FS Surface Sediment Sample Location (2013 to 2016)
- Capped Area (Existing)

Alternative F Mod Technology Assignment

- Dredge
- Dredge in Nav-FMD
- Dredge with Cap
- Cap
- EMNR
- Approximate RM 11E Early Action Area

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Core numbering is not sequential because it matches sequence surface grab ID scheme from downstream to upstream.
Only Subsurface Deep Cores and Shallow Cores shown.
4. Alternative F Mod technology assignments are hand digitized based on georeferenced imagery and may not exactly match ROD footprint at finer scales
5. Record of Decision for Alt F Mod footprint (EPA 2016).
6. n - sample count, RM - river mile.
7. References:
FS samples obtained from USEPA, 2016.
Post RI/FS samples compiled from: GSI Water Solutions and Hart Crowser, 2008; GSI Water Solutions and Hart Crowser, 2010; GSI Water Solutions Inc., 2014; Kleinfelder, 2015; NewFields, 2016; and Geosyntec, 2016.

N

500 250 0 500 1,000 Feet

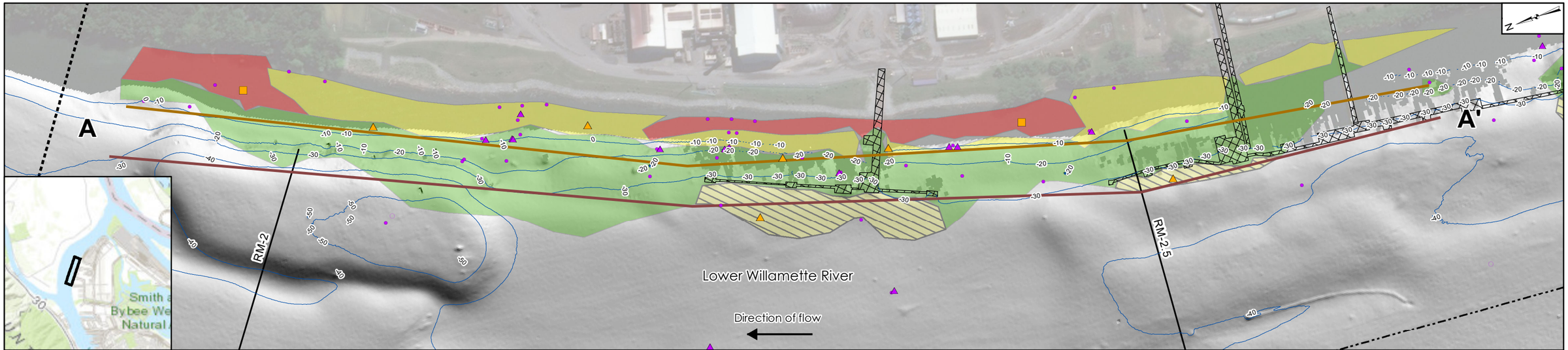
Proposed Subsurface Sediment Sampling Locations and Historical Locations
RM 10.6 to 11.8

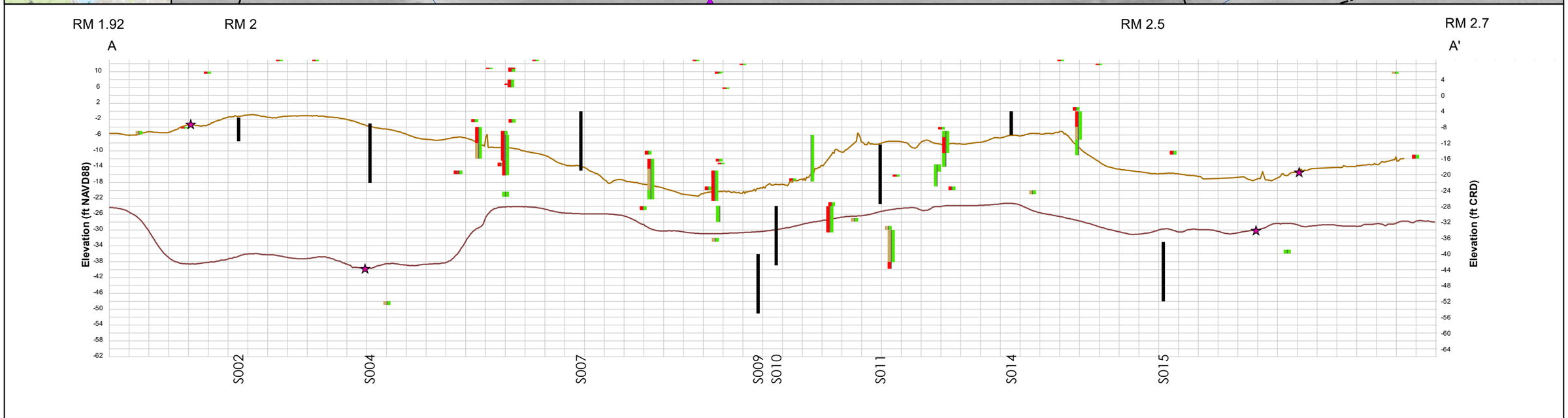
Portland Harbor Superfund Site
PDI Subsurface Sediment Coring FSP

AECOM | Geosyntec consultants

MI/SEA	March 23, 2018	Figure 3h

Path: P:\Projects\Portland Pre-Design PN\07/67A\900 GIS and CAD\MXDs\Subsurface Sediment Work Plan\Figure 3_PH_Series_ProposedCoreLocationsTechAssign\V2_20180109.mxd





Plan View

- Proposed PDI Shallow Core Location (n = 30)
- Proposed PDI Core Locations (n = 60)
- Post RI/FS Core Location (2013 to 2016)
- Post RI/FS Surface Sediment Sample Location (2013 to 2016)
- RIFS Subsurface Sediment Sample
- RIFS Surface Sediment Sample

ROD Alt F Mod SMA Footprint

- Dredge
- Dredge in Nav-FMD
- Dredge with Cap
- Cap

- Overwater Structures
- Navigation Channel
- Bathymetric Contour (10 ft CRD 2009)
- Superfund Site Boundary (RM 1.9 to 11.8)
- River Mile Marker

EPA Record of Decision (ROD) Table 17		
Focused COC in Sediment	Clean-up Level (µg/kg)	RAL (µg/kg)
PCB	9	75
PAH	13,000	23,000

Side View

PCB (µg/kg)

- ≤ 9
- > 9 - 75
- > 75

PAH (µg/kg)

- ≤ 13,000
- > 13,000 - 23,000
- > 23,000

- Shallow Mudline
- Approximate Toe of Slope Mudline
- Proposed Core Location and Grab RI Core Location and Depth
- Edge of Alt F Mod SMA Footprint

PCB (Left) PAH (Right)

Notes:
µg/kg - micrograms per kilogram
ft CRD - feet Columbia River Datum
FMD - Future maintenance dredge area
PAH - Polycyclic aromatic hydrocarbon
PCB - Polychlorinated biphenyls
PDI - Pre-remedial design investigation
RAL - Remedial Action Level

1. Samples and cores are projected within 300 feet offset of section line.
2. Add 5.38 to convert CRD elevations to NAVD88.
3. Existing cores that are projected on the cross section may appear above or below the mudline elevation line(s); these are artifacts of the projection. The mudline elevations in the lower panel are drawn from the bathymetric contours in the upper panel.
4. Aerial Imagery provided by ESRI Basemaps 2017.

10X Vertical Exaggeration
0 200 400 800 Feet

Section A - A'

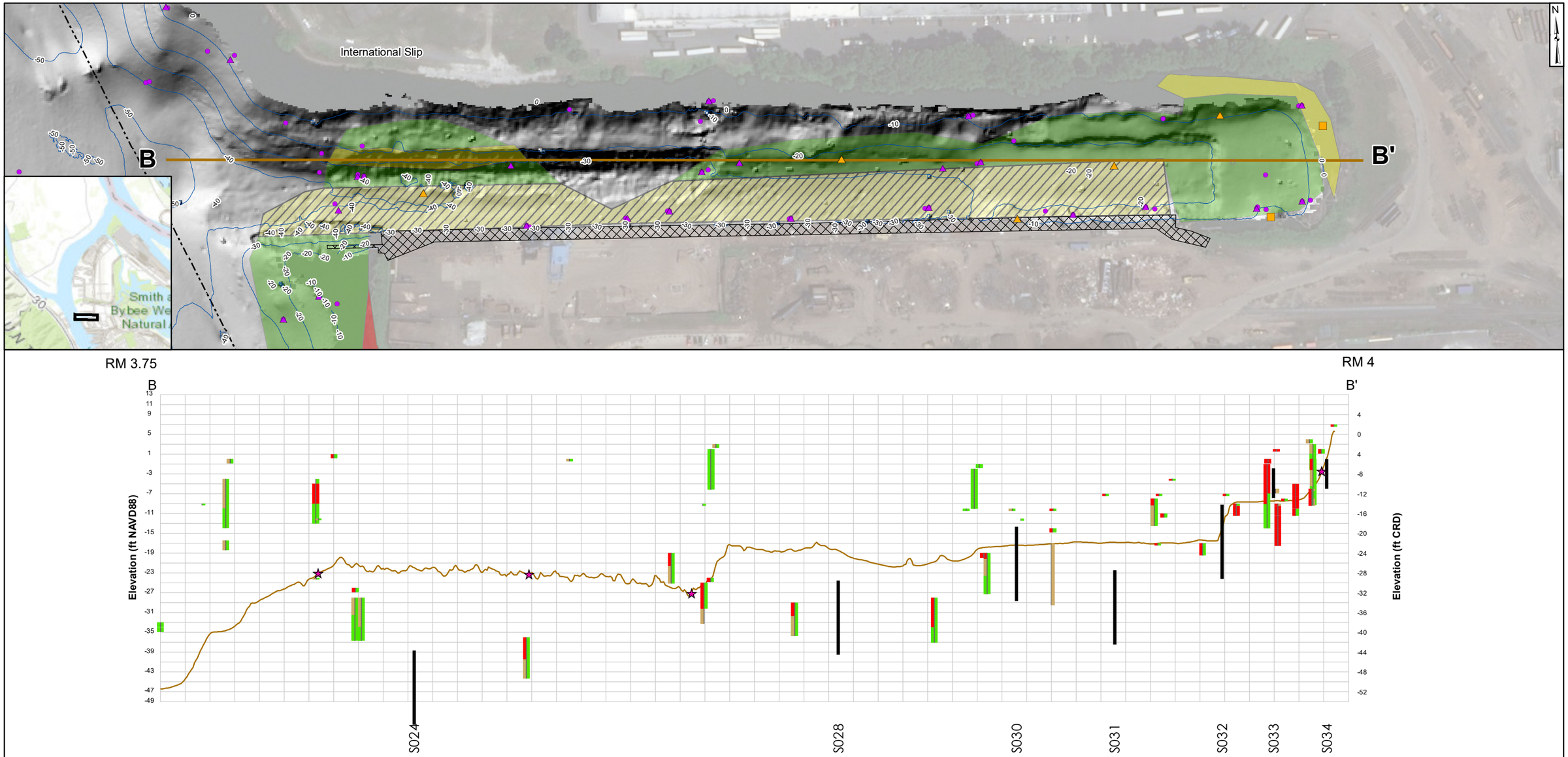
Portland Harbor Superfund Site
PDI Subsurface Sediment Core FSP

AECOM Geosyntec consultants

SS/JR 18-Jan-2018

Figure 4a

Path: P:\GIS\PortlandHarbor\Work\anGIS\XSP\HSS_XSection_A.mxd



Plan View

- Proposed PDI Shallow Core Location (n = 30)
- Proposed PDI Core Locations (n = 60)
- Post RI/FS Core Location (2013 to 2016)
- Post RI/FS Surface Sediment Sample Location (2013 to 2016)
- RIFS Subsurface Sediment Sample
- RIFS Surface Sediment Sample

ROD Alt F Mod SMA Footprint

- Dredge
- Dredge in Nav-FMD
- Dredge with Cap
- Cap

- Overwater Structures
- Navigation Channel
- Bathymetric Contour (10 ft CRD 2009)
- Superfund Site Boundary (RM 1.9 to 11.8)
- River Mile Marker

Side View

PCB (µg/kg)

- ≤ 9
- > 9 - 75
- > 75

PAH (µg/kg)

- ≤ 13,000
- > 13,000 - 23,000
- > 23,000

- Mudline
- Proposed Core Location and Grab RI Core Location and Depth
- Edge of Alt F Mod SMA Footprint
- PCB (Left) / PAH (Right)

EPA Record of Decision (ROD) Table 17		
Focused COC in Sediment	Clean-up Level (µg/kg)	RAL (µg/kg)
PCB	9	75
PAH	13,000	23,000

Notes:
µg/kg - micrograms per kilogram
ft CRD - feet Columbia River Datum
FMD - Future maintenance dredge area
PAH - Polycyclic aromatic hydrocarbon
PCB - Polychlorinated biphenyls
PDI - Pre-remedial design investigation
RAL - Remedial Action Level

1. Samples and cores are projected within 300 feet offset of section line.
2. Add 5.38 to convert CRD elevations to NAVD88.
3. Existing cores that are projected on the cross section may appear above or below the mudline elevation line(s); these are artifacts of the projection. The mudline elevations in the lower panel are drawn from the bathymetric contours in the upper panel.
4. Aerial Imagery provided by ESRI Basemaps 2017.

10X Vertical Exaggeration
0 100 200 400 Feet

Section B - B'

Portland Harbor Superfund Site
PDI Subsurface Sediment Core FSP

AECOM Geosyntec consultants

SS/JR 18-Jan-2018

Figure 4b

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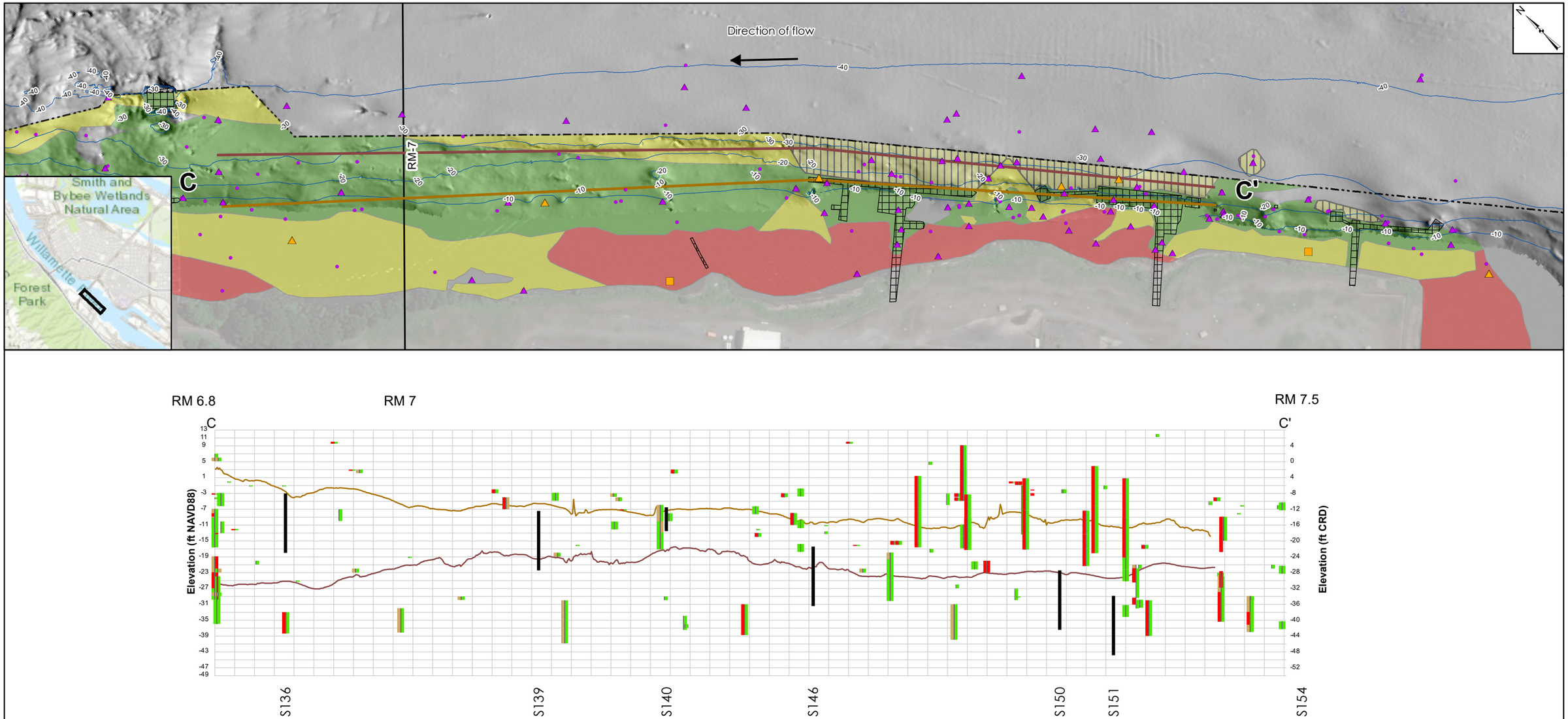

Plan View

- Proposed PDI Shallow Core Location (n = 30)
- Proposed PDI Core Locations (n = 60)
- Post RI/FS Core Location (2013 to 2016)
- Post RI/FS Surface Sediment Sample Location (2013 to 2016)
- RIFS Subsurface Sediment Sample
- RIFS Surface Sediment Sample

ROD Alt F Mod SMA Footprint

- Dredge
- Dredge in Nav-FMD
- Dredge with Cap
- Cap

- Overwater Structures
- Navigation Channel
- Bathymetric Contour (10 ft CRD 2009)
- Superfund Site Boundary (RM 1.9 to 11.8)
- River Mile Marker

EPA Record of Decision (ROD) Table 17		
Focused COC in Sediment	Clean-up Level (µg/kg)	RAL (µg/kg)
PCB	9	75
PAH	13,000	23,000

Side View

PCB (µg/kg)

- ≤ 9
- > 9 - 75
- > 75

PAH (µg/kg)

- ≤ 13,000
- > 13,000 - 23,000
- > 23,000

- Shallow Mudline
- Approximate Toe of Slope Mudline
- Proposed Core Location and Grab RI Core Location and Depth

PCB (Left) PAH (Right)

Notes:
µg/kg - micrograms per kilogram
ft CRD - feet Columbia River Datum
FMD - Future maintenance dredge area
PAH - Polycyclic aromatic hydrocarbon
PCB - Polychlorinated biphenyls
PDI - Pre-remedial design investigation
RAL - Remedial Action Level

1. RIFS cores are projected within 300 feet offset of section line.
2. Add 5.38 to convert CRD elevations to NAVD88.
3. Existing cores that are projected on the cross section may appear above or below the mudline elevation line(s); these are artifacts of the projection. The mudline elevations in the lower panel are drawn from the bathymetric contours in the upper panel.
4. Aerial Imagery provided by ESRI Basemaps 2017.

10X Vertical Exaggeration
0 200 400 800 Feet

Section C - C'

Portland Harbor Superfund Site
PDI Subsurface Sediment Core FSP

AECOM Geosyntec consultants

SS/JR 18-Jan-2018

Figure 4c

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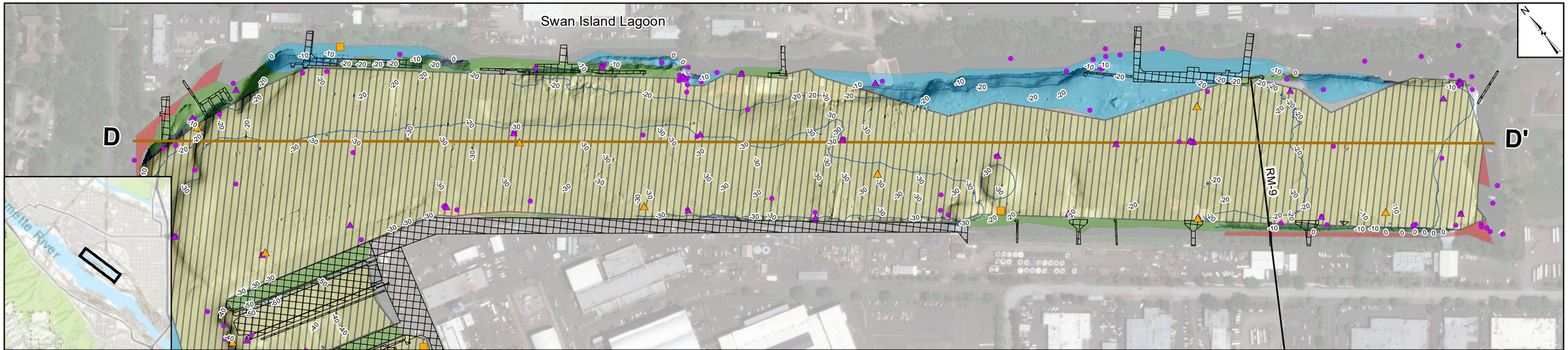

Plan View

- Proposed PDI Shallow Core Location (n = 30)
- Proposed PDI Core Locations (n = 60)
- Post RI/FS Core Location (2013 to 2016)
- Post RI/FS Surface Sediment Sample Location (2013 to 2016)
- RIFS Subsurface Sediment Sample
- RIFS Surface Sediment Sample

ROD Alt F Mod SMA Footprint

- Dredge in Nav-FMD
- Dredge with Cap
- Cap
- EMNR

- Overwater Structures
- Navigation Channel
- Bathymetric Contour (10 ft CRD 2009)
- Superfund Site Boundary (RM 1.9 to 11.8)
- River Mile Marker

Side View

PCB (µg/kg)

- ≤ 9
- > 9 - 75
- > 75

PAH (µg/kg)

- ≤ 13,000
- > 13,000 - 23,000
- > 23,000

- Mudline
- Proposed Core Location and Grab RI Core Location and Depth
- Edge of Alt F Mod SMA Footprint

PCB (Left) PAH (Right)

EPA Record of Decision (ROD) Table 17		
Focused COC in Sediment	Clean-up Level (µg/kg)	RAL (µg/kg)
PCB	9	75
PAH	13,000	23,000

Notes:
µg/kg - micrograms per kilogram
ft CRD - feet Columbia River Datum
FMD - Future maintenance dredge area
PAH - Polycyclic aromatic hydrocarbon
PCB - Polychlorinated biphenyls
PDI - Pre-remedial design investigation
RAL - Remedial Action Level

1. RIFS cores are projected within 300 feet offset of section line.
2. Add 5.38 to convert CRD elevations to NAVD88.
3. Existing cores that are projected on the cross section may appear above or below the mudline elevation line(s); these are artifacts of the projection. The mudline elevations in the lower panel are drawn from the bathymetric contours in the upper panel.
4. Aerial Imagery provided by ESRI Basemaps 2017.

10X Vertical Exaggeration
0 200 400 800 Feet

Section D - D'

Portland Harbor Superfund Site
PDI Subsurface Sediment Core FSP

AECOM Geosyntec consultants

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Figure 4d

Path: P:\GIS\PortlandHarbor\Workplan\GIS\XS\PHSS_XSection_D.mxd

APPENDIX A

Equipment Checklist, Field Forms, and Sediment Logging Keys

A-1. Equipment Checklist

A-2. Field Forms

A-3. Summary of the ASTM Visual-Soil Classification Method and Sediment Sample Logging Key

APPENDIX A-1

Equipment Checklist

Appendix A-1 Portland Harbor PDI
Sediment Sampling Equipment List

Safety Equipment
GPS - Boat
Cell phones (fully charged)
VHF radios
Rescue rope in throw bag
Air horns and/or whistles
Waterproof flashlight
Secondary "kicker" motor or alternative propulsion
Bailer or bilge pump/emergency pump
Length of rope for securing boat
USCG approved Type III or V PFD or life jacket
Type 4 throwable ring or cushion
Type BC fire extinguisher (10 pound) if extra fuel is carried in portable containers.
Anchor with appropriate length of line
First-Aid Kit and AED
Oil booms
PID
Bottled water
Snacks
Float plan

PPE
Boots, waterproof, steel-toed
Gloves, nitrile, heavy outer
Gloves, nitrile, thin inner
Hard hats
Hearing protection
Rain slicks
Safety glasses/goggles
Butcher apron or Tyvek for decon
Warm/dry clothes

Sample Handling
Vibracore sampler, core and tubes [1]
Hydraulic power grab sampler [2]
Bowls, large, stainless
Spoons, small, stainless
Spoons, large, stainless
Bottleware, sample analyses specific
Sample labels
core caps [1]
core catchers [1]
Duct tape
Scribe tool [1]
Core carrying box [1]
Coolers

Tools
Hacksaw and Circular saw [1]
Cutting knife or Shearing Tool [1]
Extension cord and power strip [1]
Drywall blade, 6"
Ruler (12 inch/30 cm)
Measuring tape (with 1/10 inch increments) [1]
Rubber mallet [1]
Screwdrivers (Phillips, flat)
Siphon tubes [2]
Utility knife
Weighted Lead line Tape (for water depth)
Peristaltic pump or siphone tube
Small spoons or divider plates, stainless
Field Torvane [1]
Pocket Penetrometer [1]

Supplies
Handheld GPS, fully charged
Camera
Gas for boat, if applicable
Keys for boat, if applicable
White board, white board markers
Bags, plastic zip, gallon-size
Bags, plastic zip, quart-size
Duct tape, electrical tape, and packing tape
Plastic sheeting
Ice
Logs, field [3]
Field books
Paper towels
Pens, ballpoint, permanent [3]
Sharpies, small and large
Trash bags
Zip ties
4" pipe clamps

Decon Equipment
Brushes, long-handled
Brushes, short-handled
Detergent, laboratory (e.g., Alconox)
Methanol/hexane in dispensing bottle (optional)
Nitric acid, 10% in dispensing bottle (optional)
5 gallon buckets, or similar
Aluminum foil
Water, distilled in dispensing bottle

Plans

Field Sampling Plan [3]
Maps
Health and Safety Plan
Quality Assurance Program Plan

Notes:

1= Subsurface Coring specific equipment
2= Surface grab sampling specific
3=Write-in-Rain waterproof paper/pens recommended

last revised July 10, 2018

APPENDIX A-2

Field Forms

Portland Harbor PDI Sediment Core Collection Log

Location ID: _____

Date: _____

Vessel (circle one):	R/V Tieton R/V Cayuse
Weather Conditions:	
Depth Sounding Method:	AirMar Echo Sounder (Bow Mounted)
Gauge Source (circle one):	NOAA PRT03 USGS 14211720
Gauge Height and Datum:	ft CRD, Measurement Time:
Water Depth (ft):	
Horizontal Datum:	*NAD 1983 Oregon State Plane North (Intl ft)*
Proposed Coordinates:	Northing: Easting:

Sampling Personnel:	Notes: Sampler:	
Subcontractor _____ and Personnel:	Deckhand: Captain:	
Sampling Equipment:	Vibracore, 4-in OD	
Sample Type (circle one):	Nearshore Core	Deep Core
Analytical Suite:	Four focused COCs	
Core Tube Length:		
Target Drive Depth:		

EPA Oversight During Sample Collection? No Yes

If Yes, name of person: _____

Notes: ft = feet

Core Condition: Good, Fair, Poor

Core Location and Attempts

Attempt #	Radius from Target (ft)	Time	Actual Coordinates Northing:	Actual Coordinates Easting:	Penetration Depth (ft)	Recovery Length (ft)	Recovery (%)	Condition ✓	Drive Description (free fall, fingers inverted, vibration needed to drive/extract, debris encountered, refusal, etc.)	Accepted? (Y/N)

Additional Comments (co-located grab, revisit station, access, NAPL suspected, target depth for bottom of contamination etc)

Visual Drawing Inside Tube:
(headspace and sediment)

Total Core Tube Length (ft):

If core sectioned in field for transport:

Section:	Length (ft):	Description at Cuts:
A =		
B =		
C =		
D =		
Catcher:		

Last revised july 10, 2018

Portland Harbor PDI Sediment Core Processing Log

Core Location #:_____
Core Collection Date:___/____/____

Processing Date:	
Core Station ID:	
Analytical Suite:	four focused COCs
Core Tube Type:	

Core Processing Personnel:	
Core Tube Length:	
Core % Recovery:	

Sediment Description

	Recovered Length (ft)	Compaction (%)	**PID Reading & Geotech**	**Size % - G**	**Size % - S**	**Size % - F**	**Description** (moisture, density, color, grain size, sheen/odor, biota/debris)	**Insitu Actual Depth** (ft)	**Sample Depth** (ft)	**Subsample #**	**Summary Sketch**
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											

*Use line weights indicated in logging key to illustrate major/minor contacts.
percent compaction = recovery depth / drive depth

Primary Sample Information			**QA/QC Report**			
Subsample ID	**Time**	**Containers**	**Sample ID**	**Time**	**Type**	**Containers**

EPA Oversight During Sample Processing? No Yes **Person?**

Additional Comments

APPENDIX A-3

Summary of the ASTM Visual-Soil Classification Method and Sediment Sample Logging Key

MAJOR DIVISION			GROUP SYMBOL	LETTER SYMBOL	GROUP NAME
COARSE GRAINED SOILS CONTAINS MORE THAN 50% FINES	**GRAVEL AND GRAVELLY SOILS** MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVEL WITH 5% FINES		GW	Well-graded GRAVEL
				GP	Poorly graded GRAVEL
		GRAVEL WITH BETWEEN 5% AND 15% FINES		GW-GM	Well-graded GRAVEL with silt
				GW-GC	Well-graded GRAVEL with clay
				GP-GM	Poorly graded GRAVEL with silt
				GP-GC	Poorly graded GRAVEL with clay
		GRAVEL WITH ≥ 15% FINES		GM	Silty GRAVEL
				GC	Clayey GRAVEL
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SAND WITH 5% FINES		SW	Well-graded SAND
				SP	Poorly graded SAND
		SAND WITH BETWEEN 5% AND 15% FINES		SW-SM	Well-graded SAND with silt
				SW-SC	Well-graded SAND with clay
				SP-SM	Poorly graded SAND with silt
				SP-SC	Poorly graded SAND with clay
		SAND WITH ≥ 15% FINES		SM	Silty SAND
				SC	Clayey SAND
FINE GRAINED SOILS CONTAINS MORE THAN 50% FINES	SILT AND CLAY	LIQUID LIMIT LESS THAN 50		ML	Inorganic SILT with low plasticity
				CL	Lean inorganic CLAY with low plasticity
				OL	Organic SILT with low plasticity
		LIQUID LIMIT GREATER THAN 50		MH	Elastic inorganic SILT with moderate to high plasticity
				CH	Fat inorganic CLAY with moderate to high plasticity
				OH	Organic SILT or CLAY with moderate to high plasticity
HIGHLY ORGANIC SOILS				PT	PEAT soils with high organic contents

Notes

1. Sample descriptions are based on visual field and laboratory observations using classification methods of ASTM D2488. Where laboratory data are available, classifications are in accordance with ASTM D2487.
2. Same percentage distribution and group name method applies to fine-grained soils and % of sand and gravel it contains.
3. Fines are material passing the U.S. Std. #200 Sieve.

AECOM Geosyntec consultants

PDI Portland Harbor Superfund Site
Pre-Remedial Design and Baseline Sampling
Portland, OR

Appendix A-3: Summary of the ASTM Visual-Soil Classification Method

Portland Harbor PDI Sediment
Sample Logging Key

Visual Sediment Descriptions consist of the following:

- Moisture content
- Density/consistency (estimated based on visual observation)
- Color (Munsell Number)
- Major/Minor Contituents
- Amount and shape of minor constituents and major constituent structure
- Sheen and odor
- Redox potential discontinuity

Example: wet, soft, olive green (GLEY 1, 5/10Y) clayey SILT, little sand, moderate shell fragments, and trace twigs and rootlets. Silt texture is uniform, slightly compressible, massive, blocky, and of low plasticity. Slight odor and trace sheen. RPD 1 cm.

Sediment Description

Estimated based on visual observations

Terminology: ***Moisture Content***

Dry	Little perceptible moisture
Damp	Some perceptible moisture, probably below optimum
Moist	Probably near optimum moisture content, no visible water
Wet	Visible free water, probably above optimum

"Density": Visual Core Drive Penetration

SAND or GRAVEL		SILT or CLAY
Estimated Density	**Visual Observation during drive**	**Consistency**
Very loose	freefall	Very soft
Loose	easy penentration	Soft
Medium dense	moderate penentration	Medium stiff
Dense	hard/slow penentration	Stiff
Very dense	refusal	Very Stiff/Hard

MAJOR and Minor Constituent % (by weight)

Core Logs	Percent	Field Logs
Trace (clay, silt, etc.)	0–5	not identified
Few (clay, silt, etc.)	5-15	Slightly clayey, Slightly silty, etc.
Little (clay, silt, etc.) Clayey,	15-30	Clayey, silty, sandy, gravelly
silty, sandy, gravelly	30-50	Very clayey, Very silty, etc.
GROUP NAME	> 50	GROUP NAME

Structure

Stratified	Alternating layers of varied material/color at least 1/4" thick
Laminated	Alternating layers of varied material/color at least 1/4 mm thick
Blocky	Cohesive soil that can be broken down into smaller lumps
Spongy	Organic and compressible nature
Lensed	Inclusion of thin discontinuous layers of different sediment
Homogenous/Massive	Same color and appearance throughout
Fibrous	Stringy or rope like structure
Seam Layer	1/16 to 1/2" thick
Interbedded	greater than 1/2" thick
Rolls Easily	Multiple beds within a unit
Angular	Play-dough like (plasticity observation) Sharp edges
Subangular	Rounded edges
Subrounded	Well-rounded edges
Rounded	Smoothed, no edges

Other Minor Constituents: % (by volume)

(i.e., shells, wood, organics, plastic, non-native debris)

Trace	0-5
Scattered	5-10
Moderate	10-30
Substantial	30-50
GROUP NAME	> 50

Odor Descriptions add "like"

none
trace
slight
moderate
strong

Sheen Test- % coverage

S.T. = Sheen test visual analysis	
none, trace	<2
slight sheen	2-15
moderate sheen	15-40
moderate to heavy	40-70
heavy	>70

Sheen Test- Visual Description

rainbow	multicolored
metallic	metallic gray-colored
florets	semi-circular and multicolored
streaks	long and flowing shape

Other Sediment Descriptions Used

Agglomerate	Fused-appearance, often vesicular
Clast/inclusion	Non-fused appearance
Xenoclasts	Clasts that have been moved
Fresh	No visible sign of decomposition or discoloration
Winnowed	Loss of fines
Slumped	Settled but intact
Pockets/balls	Semicircular to circular inclusion/deposit
Chunky	Mass of unidentified material

Sediment Core Log Guidelines

----------	color or minor change
————	major sediment change
————	depositional change

Core Acceptance Guidelines

1. Desired drive/penetration depth is reached.
2. Core recovery is greater than 80%.
3. Core tube appears intact (no signs of blocking, bending).
4. Minimal sediment loss out the top or bottom (minimal winnowing).

Grab Acceptance Guidelines

1. No or minimal excess water leaking from the jaws of the sampler.
2. No excessive turbidity in the overlaying water of the sampler.
3. Sampler did not over-penetrate.
4. Sediment surface appears to be intact with minimal disturbance.
5. Program-specific penetration (30 centimeters) has been achieved.

NOTES:

*Classification of sediment on core logs is based on visual field observations.
Classification notes should not be construed to imply laboratory testing unless presented herein. Unified Soil Classification System ASTM D-2487 and Visual-manual classification method ASTM D-2488 for the description and identification of soils were used as an identification guide.

APPENDIX B

Standard Operating Procedures

B-1. Hydrocarbon Field Screening by Sheen Test and Field Description Key for Potential NAPL in Sediments

B-2. RI Round 2 FSP Excerpts – Surface Sediment Sampling and Processing, Sediment Core Collection and Processing, Sample Handling and Storage, and General Core Photography Procedures (Integral 2004)

B-3. Horizontal and Vertical Station Control (revised June 2018)

B-4. RI Round 2 FSP Excerpt of PID Field Headspace Screening (Integral 2004) and PID Calibration Procedures

B-5. Core Photography Procedures for Sediment Coring

B-6. Management of Investigation-Derived Waste

APPENDIX B-1

Hydrocarbon Field Screening by Sheen Test and Field Description Key for Potential NAPL in Sediments

Appendix B-1
Standard Operating Procedure
Hydrocarbon Field Screening by Sheen Test

1.0 Purpose and Applicability

The Standard Operating Procedure (SOP) for sheen test describes a procedure to visually estimate areas of possible hydrocarbon impacts in soil or sediment. In addition, screening results can be used to aid in the selection of soil/sediment samples for chemical analysis. The field screening method includes a visual examination and water jar screening test.

Visual screening consists of inspecting the soil/sediment for stains, nonaqueous-phase liquids (NAPL), and/or sheens indicative of residual hydrocarbons. Visual screening is most effective at detecting heavy hydrocarbons, such as creosote, free-phase NAPL or high hydrocarbon concentrations. Water sheen screening from a representative soil/sediment sample is a more sensitive method at detecting the presence of hydrocarbons.

2.0 Responsibilities

The project manager is responsible for ensuring that a properly designed sampling program is prepared prior to any sample collection. The field sampling coordinator will have the responsibility to oversee and ensure that all sampling is performed in accordance with the project-specific sampling program and this SOP. In addition, the field sampling coordinator must ensure that all field workers are fully apprised of this SOP.

3.0 Health and Safety

This section presents the potential hazards associated with this technique. The site-specific Health & Safety Plan (HASP) will take precedence over this document. Note that sample collection usually requires Level D personal protection unless there is a potential for airborne or dermal exposures to site contaminants.

Health and safety hazards include but are not limited to the following:

- Dermal exposure to potentially contaminated media: proper personal protective equipment (PPE) is used to mitigate dermal contact including the impact of splashes of water or media to skin and/or eyes;
- Inhalation exposure when handling impacted media: respiratory protection should follow the procedures outlined in the project Site-Specific HASP; and
- Broken glass, in the event that a glass jar is used: use care when handling glassware.

4.0 Supporting Materials

The following materials must be on hand in sufficient quantity to ensure that proper screening procedures may be followed:

- Approximately one cubic-inch of media to be screened;
- 4 of 8 oz. wide-mouth, clear glass jar;
- Stirring devise (i.e. spoon);
- Squirt bottle; and
- Supply of distilled water.

5.0 Methods and Procedures

The strategy used to collect soil/sediment samples in the field for sheen testing will depend on the nature/grain size of the material and the type of hydrocarbon. Discrete samples may be collected from specific depths where NAPL is likely to occur. When lithology is course-grained material over fine-grained material, then a sample should be collected just above this interface where NAPL may be pooling above the "aquitard". Similarly, where fine-grained material overlies a coarse-grained layer with suspected impacts, the sample should be collected just below the contact. When lithology is fine-grained, then a sample should be collected near the contact with the coarse-grained layer. Alternatively, when lithology is finely bedded (< 1-inch thick), then homogenized samples may be collected over a larger depth interval to gain an "average" observation.

If the sample is being collected from inside a sediment core tube, the tube should be cut open longitudinally along the length of the core tube to prevent additional smearing. Make sure the interior of the sediment is exposed as a "fresh surface". Be sure to discard any material along the inside side-walls of the core tube; this is called the "smear zone". The smear zone may mask the true stratigraphy of a subsurface core sample. Then, use a spoon to scrap material across the "fresh" surface of the depth interval of interest, and place into sample jars for further observation. Once the sample volume is collected (approximately 1 oz or more depending upon grain size) the sample is examined and tested as described below.

Visual Examination

In the field, observe sediment core tubes or soil samples for evidence of NAPL. Look at the material and note color and type/nature of occurrence. Observe the exterior and interio sidewalls of the sampling container for signs of staining. If wet, observe the nature of liquid. Among gravels, observe the surface of the gravel for signs of sheen and/or NAPL.

Water Sheen Test

Water sheen screening involves placing soil/sediment in a clear glass jar or a black plastic pan partially filled with water, and observing the water surface for signs of a sheen. The volume of soil/sediment required for observation is approximately one cubic inch, or 10 mls, or about one tablespoon of media. For practical application in the field or lab, place about one cubic inch of soil/sediment (roughly 1 oz) in a 4 to 8 oz jar filled ¼-full with water. For larger volumes, use about 2 oz of material in an 8 oz wide-mouth glass jar filled ¼-full with water. Even larger volumes are needed for gravel. A plastic baggy may be substitute for a glass jar if field conditions require. Crush the material in the jar using a stirring devise (i.e., spoon), and shake the sealed jar vigorously for 30 seconds and allow the material to settle. Observe the water surface and sidewalls of the jar for signs of sheen, LNAPL, and DNAPL. Quantify the amount of sheen and blebs in the water surface using the following sheen classification:

No Sheen	No visible sheen on water surface
Slight Sheen	Light, colorless, dull sheen; spread is irregular, not rapid; sheen dissipates rapidly
Moderate Sheen	Light to heavy sheen, may have some color/iridescence; spread is irregular to flowing, may be rapid; few remaining areas without sheen on water surface
Heavy Sheen	Heavy sheen with color/iridescence; spread is rapid; entire water surface may be covered with sheen; visible droplets of immiscible liquids (i.e. NAPL)

Quantify the spatial coverage of sheen and size/diameter NAPL blebs if observed. The color is often described as rainbow or metallic for sheens and dark brown to black for blebs, droplets, and staining. Observe the sidewalls of the jar and estimate the thickness of LNAPL on the water surface and the thickness of DNAPL accumulated at the bottom of the jar. Record visual signs of staining on jar sidewalls and stirring devise.

Field screening results will be recorded on the field logs forms or in a field notebook. Field screening results are site-specific and location-specific. Factors that may affect the performance of this method include: operator experience (experimentation may be required before routine screening is started) ambient air temperature, soil type, soil moisture, organic content, and type of hydrocarbon. Headspace screening may be collected to help correlate results and observations.

6.0 Quality Assurance/Quality Control

Not applicable.

7.0 Documentation

Documentation may consist of all or part of the following:

- Field sampling forms;
- Field log book; and
- Chain-of-custody forms.

Field records should contain sufficient detail to provide a clear understanding of how and where samples were collected. All documentation shall be placed in the project files and retained following completion of the project.

Appendix B-1

Field Description Key for Potential NAPL in Sediment

The intent of this field description key is to provide field personnel with guidelines for logging and observing sediment conditions associated with potential presence of Non-Aqueous Phase Liquid (NAPL) in a consistent and factual manner.

VISUAL DESCRIPTORS

The range of conditions that could exist in sediments include:

- **NAPL** (Non-Aqueous Phase Liquid) – a separate phase liquid that may be lighter than water (LNAPL) or denser than water (DNAPL). NAPL can have varying consistency (viscosity) and can range from non-viscous to highly viscous (taffy-like). NAPL observations should be accompanied by applicable olfactory with smell (see descriptors below) and other visual observations (e.g., color and viscosity). The visual appearance of NAPL should be noted using descriptors below as appropriate. If NAPL is identified, then a sheen or shake test should be completed as described in this SOP in the Hydrocarbon Field Screening by Sheen Test portion.
    - **Free Product –** the entirety of the pore space for a sample interval is saturated with NAPL. Care should be taken to ensure that the saturation described is not related to water in the sample. Depending on the viscosity, NAPL saturated materials may freely drain from a soil sample and should be documented accordingly.
    - **Present–** In some cases, NAPL may be present in the pore spaces, or some of the pore spaces, but not coating the soil grains. The NAPL occurrence may be greater than blebs but not freely draining (saturated) and not hydraulically continuous. In these cases, the appearance/abundance of the NAPL should be noted.
    - **Blebs or Globules–** discrete, multi-shaped NAPL in or on the soil matrix. Include additional descriptors to the extent practicable such as the approximate size (typically ranging in size from 0.01 to 0.05 inches in diameter) and quantity (number of blebs or qualitative estimate) to the extent practical.
    - **Coated –** soil grains are coated with NAPL – there is <u>not</u> sufficient NAPL present to saturate the pore spaces. Use modifiers such as light, moderate or heavy to indicate the degree of coating.
    - **Semi-solid NAPL–** NAPL that is present as a super viscous liquid and appears in a solid or semi-solid phase. The magnitude of the observed solid NAPL should be described (discrete granules, tarry balls, taffy-like, or a solid layer).
- **Sheen –** iridescent sheen. The sheen characteristics need to be described in the field log, including the color, and iridescent sheens need to be distinguished from bacterial sheens which tend to break up at angles on the water surface; whereas a non-bacterial sheen will be continuous and will not break up. Sheens can be described as:
    - Discontinuous sheen (i.e., spotty, streaks, florets) within a section of core and does not fill sediment pore spaces.

- Continuous sheen (i.e., covering an area greater than 1 square inch) within a section of core but does not fill pore spaces. Describe percent cover.

- **Stained** – visible, unnatural discoloration of the soil, with no visible NAPL.

Other Visual Impacts and Descriptors

In many cases, observed NAPL may be associated with a particular stratigraphic layer (e.g, sand lamination, woody debris layer, gravel lense), gas bubble, or void; NAPL distribution in relation to stratigraphy must be described. What does the material look like immediately above and below the area with suspected NAPL (e.g, clay). Impacts should be described using other visual descriptors as well, as applicable. Descriptors may include, but not be limited to, color, consistency, thickness, viscosity, water content, associated stratigraphy, presence shell or wood fragments or other debris, does NAPL flow out of the core tube, does it appear more or less viscous than water, results of jar sheen test, etc. Also note the staining of sampling equipment, and interior and exterior side-walls of the sampling tube, especially if entrainment of NAPL up the side-walls is suspected as an artifact of sample collection.

OLFACTORY DESCRIPTORS

Field personnel will not conduct olfactory testing as part of sample processing, because vapor inhalation is a potential health and safety risk. However, if incidental odors are noted by field personnel during regular sample processing activities, field personnel will record this observation in the field forms. General descriptors that could be used are the following:

- Note odors similar to mothballs, driveway sealer, highway paving oil, sewage or other odors that are acrid, burnt, or sulfur-like, etc.
- Other odors that are not believed to be natural should also be identified with descriptors such as organic, ammonia, sweet, chemical etc., as applicable.
- Use modifiers such as strong, moderate or slight to indicate intensity of the observed odor.
- In instances where multiple odors are present, a combination of descriptors should be used to clearly identify where these co-mingled impacts are present.

However, olfactory descriptions are more subjective than visual inspections. Visual inspection may be aided by a PID, ultraviolet (UV) fluorescence examination, shake test, or similar device, to monitor and record organic odors and suspected NAPL in the field. One may also consider collecting a sample of the suspected NAPL to assess physical characteristics and potential mobility.

Last revised by AGF and Geosyntec on 1/18/18
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APPENDIX B-2

RI Round 2 FSP Excerpts – Surface Sediment Sampling and Processing, Sediment Core Collection and Processing, Sample Handling and Storage, Chain of Custody Procedures, and General Core Photography Procedures (Integral 2004)

SURFACE SEDIMENT SAMPLING AND PROCESSING

The purpose of this standard operating procedure (SOP) is to define and standardize the methods for collecting surface sediment samples from freshwater or marine environments. For the purpose of this SOP, surface sediments are defined as those from 0 to at most 30 cm below the sediment-water interface. The actual definition of surface sediments is typically program-specific and is dependent on the purpose of the study and the regulatory criteria (if any) to which the data will be compared.

This SOP utilizes and augments the procedures outlined in Puget Sound Estuary Program (PSEP 1996) guidelines. A goal of this SOP is to ensure that the highest quality, most representative data be collected, and that these data are comparable to data collected by different programs that follow PSEP guidelines.

SUMMARY OF METHOD

Sediment samples for chemical and toxicity analysis are collected using a surface sediment sampling device (e.g., grab sampler). If a sample meets acceptability guidelines, overlying water is siphoned off the surface and the sediment is described in the field log. Sediment samples for chemical analysis may be collected directly from the sampler (e.g., volatile organic compounds and sulfides) or sediment from the sampler may be homogenized using decontaminated, stainless-steel containers and utensils prior to being placed in sample jars. Sediment from several sampler casts may also be composited.

SUPPLIES AND EQUIPMENT

A generalized supply and equipment list is provided below. Additional equipment may be required depending on project requirements.

- Sampling device:
  Grab sampler or box corer

- Field equipment:
  Siphoning hose
  Stainless-steel bowls or containers
  Stainless-steel spoons, spatulas, and/or mixer
  Decontamination supplies
  (Alconox™ detergent, 0.1 N nitric acid, methanol dionized water)
  Personal protective equipment for field team
  (rain gear, safety goggles, hard hats, nitrile gloves)
  First Aid kit
  Cell phone

Sample containers
Bubble wrap
Sample jar labels
Clear tape
Permanent markers
Pencils
Coolers
Ice

- Documentation

  Waterproof field logbook
  Field sampling plan
  Health and safety plan
  Correction forms
  Request for change forms
  Waterproof sample description forms

PROCEDURES

EQUIPMENT DECONTAMINATION

The basic procedure used most commonly in Integral field projects to decontaminate field sampling equipment is as follows:

1. Rinse with tap or vessel water.
2. Wash with brush and Alconox™ detergent.
3. Rinse with tap or vessel water.
4. Rinse with distilled water.
5. Rinse with 0.1 N Nitric acid (optional - if metals analysis is to be performed).
6. Rinse with methanol or hexane (optional - if organics analysis is to be performed or adhering petroleum residue present).
7. Rinse with distilled water.
8. Cover with aluminum foil (dull side down).

This procedure may be modified depending on site-specific requirements, as described in PSEP (1986). For example, if sampling is in areas known to be uncontaminated or only slightly contaminated, the solvent and/or acid rinses may be eliminated. Conversely, if creosote or other petroleum-based residue is encountered, a hexane rinse may be added.

Decontamination with acid or solvents should always be performed outdoors using appropriate protective equipment, including, at a minimum, chemical-resistant gloves (e.g., nitrile) and goggles. All decontamination liquids that include solvents or acids should be contained in tightly sealed buckets or other containers for disposal in an approved onshore facility. Alternatively, low-vapor pressure solvents may be evaporated in a well-ventilated open area away from the work zone.

SEDIMENT SAMPLE COLLECTION

To collect sediment for chemical and biological analyses, a sampler that obtains a quantifiable volume of sediment with minimal disturbance of the sediments must be employed. Additionally, the sampler should be composed of a material such as stainless steel or aluminum, or have a non-contaminating coating such as Teflon™. Samplers capable of providing high-quality sediment samples include grab-type samplers (van Veen, Smith-McIntyres, Young grab, power-grab and ponar grab) and box cores (Soutar, mini-Soutar, Gray-O'Hara, spade core). Some programs require a sampler that collects from a specific area (e.g., 0.1 m^2). Most sampling devices are typically a standard size; however, some non-standard sizes are available to meet the requirements of specific programs. Grab samplers, especially the van Veen grab, are the most commonly used samplers to collect surface sediment. Power grab samplers are often used for programs requiring collection of sediment deeper than 10 cm or in areas with debris.

A hydraulic winch system should be used to deploy the sampler at a rate not exceeding 1 m/sec to minimize the bow wake associated with sampler descent. Once the sampler hits the bottom, the jaws are slowly closed and the sampler is brought to the deck of the vessel at a rate not exceeding 1 m/sec to minimize any washing and disturbance of the sediment within the sampler. At the moment the sampler hits the bottom, the time, depth, and location of sample acquisition are recorded in the field logbook.

Once onboard, the sampler is secured, any overlying water is carefully siphoned off, and the sample is inspected to determine acceptability. Criteria used to determine acceptability are those detailed in PSEP (1986), except when noted in the project-specific field sampling plan (FSP). These criteria include but are not limited to:

- There is minimal or no excessive water leakage from the jaws of the sampler.
- There is no excessive turbidity in the water overlying the sample.
- The sampler is not over-penetrated.

- The sediment surface appears to be intact with minimal disturbance.
- The program-specified penetration depths are attained.

If the sample meets acceptability criteria, the sample is recorded and observations entered into a sample description form or log. Once the sample has been characterized, the sediment is then sub-sampled for chemical and biological analyses.

SAMPLE PROCESSING

Sediment for chemical and/or toxicity analyses is removed from the sampler using a stainless-steel spoon. Depending on programmatic goals, the upper 2 to 30 cm of sediment are removed. To prevent possible cross contamination, sediments touching the margins of the sampler are not used.

Samples for volatile compounds (either organics or sulfides) are collected using a decontaminated stainless-steel spoon while sediment is still in the sampler. These sediments are not homogenized. The volatile organics sample jar should be tightly packed with sediment (to eliminate obvious air pockets) and filled so that there is no headspace remaining in the jar. Alternatively, if there is adequate water in the sediment, the container may be filled to overflowing so that a convex meniscus forms at the top, and the cap carefully placed on the jar. Once sealed, there should be no air bubbles. The sulfides sample is preserved with 0.2 N zinc acetate.

The remaining sediment is then placed into a pre-cleaned, stainless-steel bowl. Typically, sediment from a minimum of three separate casts of the sampler is composited at each station. Once a sufficient amount of sediment has been collected, the sediment is homogenized until it is of uniform color and has obtained a smooth consistency. It is then dispensed into pre-cleaned sample jars for the various chemical or biological analyses. Sample jars for biological analyses should be filled to the top with sediment to minimize available headspace. This procedure will minimize any oxidation reactions within the sediment. Sample jars for chemical analysis may be frozen for storage, leaving enough headspace left in the container to allow for expansion of the sediment upon freezing. After dispensing the sediment, the containers are then placed into coolers with ice and are either shipped directly to the analytical laboratories or transported to a storage facility.

CHAIN-OF-CUSTODY

Field

The cruise leader or other designated field sample custodian is responsible for all sample tracking and chain-of-custody procedures until sample custody is transferred to the laboratory. Custody procedures in the field are as follows:

1. Record all field and sample collection activities (including sample identification number, collection time and date) in the field logbook. While being used in the field, the logbook remains with the field team at all times. Upon completion of the sampling effort, the logbook should be reproduced and then kept in a secure area.
2. Complete a chain-of-custody form whenever samples are being transferred or removed from the custody of field sampling personnel. A sample form is provided in Appendix B. Record each individual sample on the form. Include additional information to assist in sample tracking such as collection date and time, number of containers, and sample matrix. The chain-of-custody may also serve as the sample analysis request form, with the required analysis indicated for each individual sample.
3. Sign the form and ensure that the samples are not left unattended unless secured.
4. Store, pack, or ship samples as described in the following section. Place the original completed chain-of-custody form in a sealed plastic bag inside the shipping container. A copy is retained by the shipping party.
5. Complete a separate custody form for each individual shipping container or a single form for all samples in multiple shipping containers in a single shipment, with the number of containers noted on the custody form.
6. Attach completed custody seals to any shipping container that will be sent to the laboratory by delivery service or courier. Delivery personnel are not required to sign the custody form if custody seals are used. Custody seals are used to detect unauthorized tampering with the samples. Gummed paper or tape should be used so that the seal must be broken when the container is opened. The laboratory sample custodian (or other sample recipient) will establish the integrity of the seals.

7. The laboratory custodian (or other sample recipient) acknowledges receipt of the samples by signing, dating, and noting the time of transfer on the chain-of-custody form. The condition of the samples and any problems or irregularities (e.g., cracked or broken jars, loose lids, evidence of tampering) should also be recorded. Return a copy of the completed custody form to the project manger or designated sample coordinator.

Laboratory

The laboratory will designate a sample custodian who is responsible for receiving samples and documenting their progress through the laboratory analytical process. Each custodian will ensure that the chain-of-custody and sample tracking forms are properly completed, signed, and initialed on transfer of the samples. Specific laboratory chain-of-custody procedures should be in writing, included in the laboratory QA plan, and approved prior to beginning sampling and analysis. Laboratory custody procedures should include the following:

- A designated laboratory person initiates and maintains a sample tracking log that will follow each sample through all stages of laboratory processing and analysis.
- The laboratory tracking log includes, at a minimum, the sample number, location and type of storage, date and time of each removal, and signature of the person removing or returning the sample.
- The final disposition of the sample is recorded.

CHAIN-OF-CUSTODY QUALITY CONTROL PROCEDURES

Complete and correct chain-of-custody is essential to ensure and demonstrate sample integrity. Errors in entering information or transferring custody can result in analytical or data reporting errors. Inaccuracies or errors in sample tracking and custody records can compromise data usability, particularly as legal evidence.

Quality control procedures include the following:

- Allow adequate time to take accurate and complete field records and to carefully complete chain-of-custody forms.
- When possible, work in pairs or more to complete the chain-of-custody form and check for accurate information entry.

- Complete all custody records in ink; errors should be neatly crossed out and corrected and initialed by the person making the change.
- Immediately notify the project manager of any deviation from required custody procedures.

PACKING AND SHIPPING SAMPLES

Environmental samples are packed in a manner to reduce the chance of sample breakage, ensure sample integrity, and prevent material leakage and potential exposure to hazardous materials in the event of breakage. Samples are placed in sealed plastic bags and packed in a sturdy container with adequate packing material to prevent breakage. Ice or dry ice may be included to maintain sample storage conditions. Samples are transported by field personnel or shipped via courier or common carrier. Shipping procedures are in accordance with U.S. Department of Transportation regulations (49 CFR 173.6 and 49 CFR 173.24).

All preserved samples should be shipped as soon as possible after completion of sampling. This minimizes the number of people handling samples and protects sample quality and security.

Sample Packing

Upon completion of final sample inventory by the field sample custodian and completion of chain-of-custody, samples are packed as follows:

1. If not already done after sample collection, wipe the outside of each sample container and lid with a disposable cloth to remove any soil or sediment adhering to the outside of the jar and place each container in a sealed plastic bag (e.g., ziplock).
2. Wrap each glass sample container in bubble wrap or place it in a bubble wrap plastic bag. [Note: When samples are being transported by field personnel directly from the field site to the laboratory (thereby ensuring careful handling), this step is recommended but may be omitted. However, this step is required when a courier or delivery service is transporting the samples.]
3. Line the shipping container with heavy-duty plastic bags (e.g., garbage bags) and bubble wrap. Use a leak-proof, sturdy container that can withstand rough treatment during shipping. If ice chests or coolers are used, the drain should be securely plugged and sealed with duct tape.

4. Place the samples tightly in the shipping container:
   - Use dividers or bubble wrap to separate all glass containers
   - Fill any empty space in the shipping cooler or box with packing material so that the jars are held securely.

5. Place the original completed chain-of-custody form in a sealed plastic bag and place it inside the shipping container. If using a cooler or ice chest, the form should be securely taped to the inside of lid.
6. For liquid samples, absorbent material (e.g., vermiculite) should be placed in the container in sufficient quantity such that all liquid could be absorbed.
7. Tie or seal the bag lining the shipping container.
8. If required to meet sample storage requirements, fill the ice chest with crushed or block ice, blue ice (refrigerated samples, 4°C) or dry ice (frozen samples). A temperature blank (provided by the laboratory) should be packed in each cooler.
9. If samples for volatile organics analysis (VOA) are included in the shipping container, two VOA trip blanks (provided by the analytical laboratory) should also be packed in the cooler.
10. Seal shipping container securely with packing or duct tape.
11. If the shipping container will be transported by anyone other than the person who completed and signed the chain-of-custody form, attach completed custody seals so that the shipping container cannot be opened without breaking the seal.
12. Attach a *This End Up* label to each side of the shipping container to ensure that jars are transported in an upright position. A *Fragile* label may also be attached to reduce rough handling of the samples.
13. Label the shipping container with all appropriate information (name of project, time and date, responsible person and company name, address and phone) to enable positive identification.

Sample Shipping

Packed containers may be delivered to the laboratory or storage facility by field personnel, courier, or common carrier (FedEx, UPS). However, any outside carrier or courier service must provide a delivery receipt. The carrier or courier must also ensure delivery time if holding time and storage conditions are critical.

Unless arranged in advance, shipping charges should be prepaid by sender to avoid confusion and possible rejection of the package by the laboratory.

The adequacy of handling and shipping procedures is reflected in the condition of the samples upon receipt by the laboratory:

- No jars are cracked or broken.
- There is no evidence of sample leakage.
- Measuring the temperature of the temperature black indicates that correct storage conditions have been maintained.

The sample custodian or other designated person is responsible for confirming that copies of all shipping documents, completed in full and correctly, are on file at Integral.

QUALITY CONTROL PROCEDURES

Field quality control (QC) samples that may be collected during surface sediment sampling are the same as for any field sampling program. The types and frequency of field QC sample collection are project-specific and will be described in the project field sampling plan. The most commonly collected field QC sample are described below (PSEP 1996):

- **Field Blank**. A field blank is a sample of analyte-free water that is supplied by the laboratory. The field blank is generated by transferring the analyte-free water to another laboratory-supplied sample container while at the field sampling location. Field blank results are used to measure and document any possible onsite contamination.

- **Field Split Sample**. A field split sample consists of aliquots of the same homogenized sediment sample that are equally distributed in two sets of sample containers. These samples may be analyzed identically or analyzed by different laboratories to evaluate repeatability of sample handling and analytical procedures, sample heterogeneity, and analytical procedures.

- **Field Replicate**. A field replicate consists of a second sample that is collected using the same sampling methodology used to obtain the first sample. It is collected at the same sampling location and as soon after the original sample as possible. Analysis of the field replicate allows evaluation of the repeatability of field sampling methodologies, as well as the heterogeneity of the sample matrix. Statistical analysis of multiple replicates may also be used to calculate the likely range of an analyte concentration at a given sampling location.

REFERENCES

PSEP. 1996. Puget Sound Estuary Program: Recommended Protocols for Measuring Selected Environmental Variables in Puget Sound. Final Report. TC-3991-04. Prepared for U.S. Environmental Protection Agency, Region 10 and Puget Sound Estuary Program, Seattle, WA. Tetra Tech and HRA, Inc., Bellevue, WA.

SEDIMENT CORE COLLECTION AND PROCESSING

Sediment cores are collected to evaluate chemical and/or biological characteristics of surface and subsurface sediments at depths that greatly exceed those achieved by grab or other surface samplers. The purpose of this SOP is to define and standardize procedures for the collection of samples from surface and subsurface sediment cores. Additionally, this SOP will help ensure that the highest quality, most representative data are collected, and that these data are comparable to data from other programs. This SOP is based on the procedures outlined in Puget Sound Estuary Program guidelines (PSEP 1996).

SUMMARY OF METHOD

Sediment cores are collected using some type of coring device, including gravity corers, piston corers, vibracorers and diver-driven cores. Actual operations will vary depending on the equipment selected. Selection of the most appropriate corer usually depends on may factors, including but not limited to:

- The quantity of sample required
- The penetration depth required
- The sediment type (e.g. rocky, soft, compact)
- Vessel availability and capability (i.e. size, lifting capacity etc.).

Regardless of the coring method, the core tube should be constructed of a non-contaminating material such as stainless steel or aluminum, or should use a liner constructed of a non-contaminating material (e.g., polycarbonate).

Once the sediment core is collected, it is extruded or split so that the sediment can be sampled, processed, and transported to the analytical laboratory.

Supplies and Equipment

A generalized supply and equipment list is provided below. Additional equipment may be required depending on project requirements.

- Sampling device:

  Corer
  Core tubes
  Core tube liners (optional)
  Core tube caps

- Field equipment:

  Aluminum foil
  Duct tape
  Hack saw
  Indelible ink pen

Pipe cutter
Circular saw (if splitting tube longitudinally)
Plunger (if necessary)
Table or tray
Ice (if storing cores)
Stainless-steel bowls
Stainless-steel spoons, spatulas, and/or mixer
Personal protective equipment for field team
(rain gear, safety goggles, hard hats, nitrile gloves) First Aid kit
Cell phone
Sample containers
Bubble wrap
Clear tape
Permanent markers
Pencils
Coolers

- Documentation

  Core description forms or log book
  Waterproof field logbook
  Field sampling plan
  Health and safety plan
  Correction forms
  Request for change forms
  Waterproof sample description forms

CORE COLLECTION PROCEDURES

CORER DEPLOYMENT

Gravity and piston corers utilize inertia as the primary driving force to achieve the desired penetration depth. The degree of penetration can be altered by either adjusting the number of weights at the top of the tube or by changing the vertical distance that the core tube is allowed to free-fall. During descent, the corer should be lowered under power to its predetermined free-fall distance above the bottom. The lowering should be halted when this vertical distance equals the difference between the meter wheel reading and the fathometer reading.

If the device is equipped with a trip-weight or a small gravity trip-corer, the free-fall distance will equal the length of the core tube plus the vertical distance between the core cutter and the trip-weight suspended beneath it. When the trip-weight contacts the bottom, it relaxes the tension on the release mechanism and

the core tube free-falls into the sediment. Consistent penetration depths can be obtained with this method, as the free-fall distance is independent of winch control and changing bottom depth.

The vibracorer uses a hydraulic system that vibrates and drives a length of aluminum tubing into the sediment. A continuous sediment sample is retained within the tubing with the aid of a stainless-steel core cutter/catcher. Coring can continue until the total sample depth is reached.

CORE RETRIEVAL

The core is extracted from the substrate and pulled onto the sampling vessel using the vessel winch or crane. The amount of pull that is required depends on the coring device and its contents, plus the amount of frictional force against the surface of the core tube that must be overcome. The frictional force depends on the sediment type (e.g. clay-based material requires more pull) and the depth penetrated (PSEP 1996). During core extraction, the wire strain should be steady and continuous, with the vessel held stationary directly above the coring device. Once the core is extracted from the bottom, the winch speed may be increased to about 4 ft/sec.

The core is brought on board the vessel. While the tube is still vertical, overlying water may be siphoned off the top of the core tube. Recovery is estimated to accurately determine the true depth from which the sediments were collected and the location of those sediments within the core barrel. In most cases, recovery is estimated by comparing the length of the sediment core material to the overall penetration depth (as indicated by traces of sediment material on the outer surface of the core tube). The ratio of penetration depth to core material length is calculated to determine the compaction of the sediment during coring. Alternatively, some vibracorers are equipped with a transducer to measure penetration depth. A second transducer is mounted directly above the core tube to determine the height of the sediment column within the core barrel. Recovery can be estimated from the difference between the two transducer readings. Recoveries typically range between 50 and 90 percent.

Continuous core lengths (such as those obtained by a vibracorer) may be sectioned into smaller lengths for ease of handling and/or to represent the desired sampling intervals. The core tube is placed on a secure surface and tightly anchored. Beginning at the top of the core tube, sample sections are marked on the outside of the core tube in indelible ink. Before the tube is cut, a label identifying the station and core section is securely attached to the outside of the casing at the <u>top</u> of each section, and wrapped with transparent tape to prevent loss or damage of the label. (Note that care should be taken when measuring core sections to

consider core compaction.) Core sections may then be cut using a manual, heavy-duty pipe cutter.

After the tube is cut, sediment at the end of each tube section cut is visually classified for qualitative sample characteristics. Changes from the top to the bottom of each section of the tube are noted and recorded in the field log or core description forms. If the core section will be stored or transported, the core ends are then covered with aluminum foil, a protective cap, and duct tape to prevent leakage. Ideally, the core sections should be stored upright in a container chilled with ice to approximately 4°C. Empty tubing should be removed to help ensure that each section is full of sediment. This limits disturbance during storage and transport. If necessary, cores should be stored securely in a manner consistent with chain-of-custody procedures. Typically, cores remain in the custody of field staff until sampling is completed and sample jars transported to the analytical laboratory (see SOPs for Surface Sediment Sampling).

CORE PROCESSING PROCEDURES

SEDIMENT CORE EXTRUSION

Cores should be split or extruded and processed within 24 hours of collection, either onboard the vessel or at an onshore sample processing facility. The sediment may be removed from the core tube by either extrusion or longitudinal sectioning (i.e., splitting). Extrusion is done by tilting the core tube until the sediment core slides out onto a clean, aluminum-foil-covered table or tray. Vibration or tapping of the core tube may aid extrusion. If the sediment core does not slide out easily, a plunger may be used to push the sediment out of the tube. The plunger should be cleaned and covered with clean aluminum foil each time it is used. Once the tube is extruded, a thin (0.25 to 0.5 cm) outer layer of the sediment core is scrapped away using a decontaminated, stainless-steel knife (see SOP for Surface Sediment Sampling. This outer material may be used for sediment grain-size determination if sediment volume is of concern, but should not be used for any chemical analyses.

In longitudinal core splitting, the core tube or liner is split with a circular saw to expose the sediment core, or the core material can be run across a splitting knife as it is extruded. If a core tube liner is used, care should be taken to scrap the surface of the sediment core to remove any shavings of liner material.

SEDIMENT SAMPLE PROCESSING

Regardless of how the sediment core is obtained and prepared, the procedures for record keeping, sediment processing and sampling techniques are as follows:

1. Immediately following core extrusion or splitting, collect samples for volatile compounds (either organics or sulfides) using a

decontaminated,stainless-steel spoon. The volatile organics sample jar should be tightly packed (to eliminate obvious air pockets) and filled so that there is no head-space remaining in the jar. Alternatively, if there is adequate water in the sediment, the container may be filled to overflowing so that a convex meniscus forms at the top, and the cap carefully placed on the jar. Once sealed, there should be no air bubbles. The sulfides sample is preserved with 0.2 N zinc acetate.

2. Record core sediment characteristics on a core description form (see attached). Observations should include stratification of color and sediment composition, odor, biological organisms, foreign objects etc.
3. Place remaining core sediment in a decontaminated, stainless-steel bowl (see SOP for Surface Sediment Sampling) and mix thoroughly with a stainless-steel spoon, spatula or mixer until uniform color and texture are achieved. Large rocks or wood pieces may be omitted from the final laboratory sample, but should be noted in the log or description form.
4. If sediment from multiple core sections will be composited, cover the bowl with clean foil and set the bowl aside (refrigerate or keep cool on ice) while handling additional cores. Once all the required sediment has been placed in the bowl, thoroughly mix until uniform color and texture are achieved.
5. Transfer aliquots of homogenized sediment to labeled sample containers provided by the analytical laboratory. Labels should include, at minimum, the company name, project name, sample identifier, date and time of collection, and the initials of sampling personnel.
6. Pack and transport samples as described in the SOP for Surface Sediment Sampling. If samples will be stored, follow procedures specified in the project sampling plan.

QUALITY CONTROL PROCEDURES

Field quality control (QC) samples that may be collected during sediment coring are the same as for any field sampling program. The types and frequency of field QC sample collection are project-specific and will be described in the field sampling plan. The most commonly collected field QC sample are described below (PSEP 1996):

- **Field Blank**. A field blank is a sample of analyte-free water that is supplied by the laboratory. The field blank is generated by transferring the analyte-free water to another laboratory-supplied sample container while at

the field sampling location. Field blank results are used to measure and document any possible onsite contamination.

- **Field Split Sample**. A field split sample consists of aliquots of the same homogenized sediment sample that are equally distributed in two sets of sample containers. These samples may be analyzed identically or analyzed by different laboratories to evaluate repeatability of sample handling and analytical procedures, sample heterogeneity, and analytical procedures.

- **Field Replicate**. A field replicate consists of a second sample that is collected using the same sampling methodology used to obtain the first sample. It is collected at the same sampling location and as soon after the original sample as possible. Analysis of the field replicate allows evaluation of the repeatability of field sampling methodologies, as well as the heterogeneity of the sample matrix. Statistical analysis of multiple replicates may also be used to calculate the likely range of an analyte concentration at a given sampling location.

Additional types of QC samples are described in the SOP for Surface Sediment Sampling.

REFERENCES

PSEP. 1996. Puget Sound Estuary Program: Recommended Protocols for Measuring Selected Environmental Variables in Puget Sound. Prepared for U.S. Environmental Protection Agency, Region 10, and Puget Sound Estuary Program Seattle, WA. Tetra Tech and HRA, Inc., Bellevue, WA

As noted in Table 2-3, sampling of selected stations will be monitored for the retrieval or disturbance of items of archaeological significance.

Sample Handling and Storage

Cores will be processed concurrently with core collection. Every effort will be made to process the cores within 24 hours of collection. Cores awaiting processing will be sealed tightly at both ends and stored upright in a refrigerator. If core collection outpaces processing such that significant delays in core processing appear likely, core collection will be suspended to allow the core processing to catch up. The field laboratory will be equipped with a core-cutting table, core-processing tables, a decontamination area, and a storage area with appropriate refrigeration. Appropriate lighting will be installed in the core processing area in order to collect consistent, high quality photographs of the opened cores. Once the field laboratory is located, care will be taken to create a core-processing area that minimizes the potential for outside contamination.

Each core tube will be fixed to the core-cutting table and cut along the long axis using a circular saw. The tube is rotated 180° and cut again. After each core is cut, the entire core tube will be moved to a stainless-steel sampling tray and opened. Each sediment core will then be systematically logged, described, and photographed.

After each core is cut open, an experienced geologist will describe the sediment on a core log (see Appendix D). The qualifications of key personnel for the subsurface sampling effort are presented in Appendix C.

The following information will be recorded for each core:

- Physical sediment description (i.e., sediment type, density/consistency, color)
- Odor (e.g., hydrogen sulfide, petroleum)
- Visual stratification and lenses
- Vegetation
- Debris
- Evidence of biological activity (e.g., detritus, shells, tubes, bioturbation, live or dead organisms)
- Presence of oil sheen
- Other distinguishing characteristics or features.

The visual description of sediment lithology (dominant grain sizes) will be the primary criteria for determining sample intervals (i.e., lithologic units) in the cores.

For consistency, core descriptions and terms used will follow the criteria below, which are modified from methods presented in ASTM D 2488-00 (ASTM 2000).

1. Visual estimates of the grain-size percentages of sediment units within each core will be recorded on the core logs so that the total sum will add up to 100%. Estimates of gravel, sand, and fines (silt and clay) content will generally be made to the nearest quartiles:

   - 0% to 25%
   - >25% to 50%
   - >50% to 75%
   - >75% to 100%.

   The sediment may also be described narratively on the log based on the estimated grain-size percentages. The dominant constituent grain size will be the primary unit descriptor, with the abundance of other grain sizes present described using the following terms:

   - The grain-size adjective (e.g., gravelly, sandy, silty, or clayey), if estimated to constitute more than 25% of the sediment
   - *With*, for example, sand with silt, silt with sand, etc. if estimated to constitute less than 25% of the sediment
   - *Trace*, if estimated less than 5% of the sediment (and not included in the total 100%).

2. For other features observed, such as organics or debris, additional descriptive terms may include:

   - *Mostly*, if estimated to comprise 50% or more of the unit
   - *Some*, if estimated to comprise more than 25% to 50% of the unit
   - *Little*, if estimated to be 25% of the unit or less
   - *Trace*, if estimated less than 5% (and not included in the total 100%).

3. Consistency will be described using the following terms:

   - Density: *loose*, if easily penetrated with a sampling spoon, or *dense*, if penetration is more difficult.
   - Consistency: *very soft*, if present as an ooze that holds no shape
     soft, if saggy
     stiff, if it holds a shape
     very stiff, if penetration with a spoon is low
     hard, if no penetration with a spoon is possible.

4. Other observations (e.g., obvious anthropogenic material, dramatic color changes) may also be used to define or help define sample intervals.

The boundaries of lithologic units will be determined primarily by changes in the top two dominant grain sizes estimated visually (e.g., a change from a silty sand to a gravelly sand or to a sandy silt).

With the exception of subsampling for volatile organics (i.e.,VOCs and TPH-G), the cores will be photographed after being described and before any sediment is removed for processing. It is important for each core section to be photographed with adequate lighting from a standard measured distance from the core. Digital photographs will be used later in the production of digital core logs.

Sediment subsampling methods for Round 2A subsurface cores will follow the approach described in Section 2.2.2. Subsampled sediment will be placed into a decontaminated stainless-steel bowl. Adequate volumes of sediment will be collected for all required analyses (see Table 4-1).

Except for sample volumes collected for volatile analytes, sediment from each subsample will be individually mixed in the decontaminated, stainless-steel bowl to a uniform color and texture using a decontaminated, stainless-steel spoon. The sediment will be stirred periodically while individual samples are taken to ensure that the mixture remains homogeneous. Care will be taken to not include sediment that is in direct contact with the aluminum tube. In addition, the cutting of the aluminum tube can introduce metal shavings to the core sediment;care will be taken to avoid mixing these shavings into the homogenate. Pre-labeled jars for chemical testing will be filled with the homogenized sediment.

The types and number of field QC samples for subsurface sediment samples will follow the same guidelines prescribed for surface sediment samples. If additional volumes of sediment are required to perform all analyses in addition to QC analyses, an additional core may need to be collected from the same location and subsampled and homogenized accordingly.

Sample handling and storage procedures will follow those described for surface sediment samples in Section 4.6.2 with the following exception. When required, sediment subsamples for volatile organics will be collected from within appropriate intervals following the opening of the core and designation of the lithologic units. This process will minimize the release of volatile organics caused by mixing. Rinsate blanks will be performed at the same frequency (5%) as performed for the surface sediment sampling program.

4.6.4 Subsurface Sediment Sample Field Screening

In addition to visual observation, headspace screening using a photoionization detector (PID) and/or flame ionization detector (FID) may be used on all sample intervals to aid in the selection of samples to be analyzed.

periodically for at least 30 seconds at the beginning and end of the development period.

3. The PID/FID probe tip will be inserted into the container within the headspace, with care taken to avoid taking sediment or moisture into the probe.

4. The highest reading (excluding possible erratic readings) on the meter will be recorded for the sample.

5. The deepest sample interval showing a response during headspace screening will be submitted in the initial round of analyses.

4.7 WASTE DISPOSAL

Any excess water or sediment remaining after processing will be returned to the river in the vicinity of the collection site. Any water or sediment spilled on the deck of the sampling vessel will be washed into the surface waters at the collection site before proceeding to the next station.

All disposable materials used in sample processing, such as paper towels and disposable coveralls and gloves, will be placed in heavyweight garbage bags or other appropriate containers. Disposable supplies will be removed from the site by sampling personnel and placed in a normal refuse container for disposal at a solid waste landfill. Phosphate-free, detergent-bearing, liquid wastes from decontamination of the sampling equipment will be washed overboard or disposed of into the sanitary sewer system. Waste solvent rinses will be held in sealed plastic buckets and disposed of into the sanitary sewer. Oily or other obviously contaminated investigation-derived waste will be placed in appropriate containers, and a waste determination will be made before it is disposed of at an appropriate facility.

4.8 SAMPLE HANDLING AND TRANSPORT

Since samples collected in support of CERCLA activities may be used in litigation, their possession must be traceable from the time of sample collection through laboratory and data analysis to introduction as evidence. To ensure samples are traceable, the following procedures will be followed.

4.8.1 Chain-Of-Custody Procedures

Samples are in custody if they are in the custodian's view, stored in a secure place with restricted access, or placed in a container secured with custody seals. A chain-of-custody record will be signed by each person who has custody of the samples

and will accompany the samples at all times. Copies of the chain-of-custody will be included in laboratory and QA/QC reports.

Example chain-of-custody forms are provided in Appendix D. At minimum, the form will include the following information:

- Site name
- Field task leader's name and team members responsible for collection of the listed samples
- Collection date and time of each sample
- Sampling type (e.g., composite or grab)
- Sampling station location
- Number of sample containers shipped
- Requested analysis
- Sample preservation information
- Name of the carrier relinquishing the samples to the transporter, noting date and time of transfer and the designated sample custodian at the receiving facility.

The field task leader, as the designated field sample custodian, will be responsible for all sample tracking and chain-of-custody procedures for samples in the field. The sample custodian will be responsible for final sample inventory and will maintain sample custody documentation. The custodian will complete chain-of-custody forms prior to removing samples from the sampling vessel. Upon transferring samples to the laboratory sample custodian, the field task leader will sign, date, and note the time of transfer on the chain-of-custody form.

The original chain-of-custody form will be transported with the samples to the laboratory. Each laboratory will also designate a sample custodian, who will be responsible for receiving samples and documenting their progress through the laboratory analytical process. Each custodian will ensure that the chain-of-custody and sample tracking forms are properly completed, signed, and initialed upon transfer of the samples.

Chemistry samples will be shipped to the laboratory in ice chests sealed with custody seals. Each ice chest will have three seals, one on the front of the chest and one on each side. The laboratory sample custodian will establish the integrity of the seals at the laboratory.

Upon receipt of the samples at the laboratory, the laboratory sample custodian will inventory the samples by comparing sample labels to those on the chain-of-custody

document. The custodian will enter the sample number into a laboratory tracking system by project code and sample designation. The custodian will assign a unique laboratory number to each sample and will be responsible for distributing the samples to the appropriate analyst or for storing samples in an appropriate secure area. Specific laboratory chain-of-custody procedures are described in the laboratory QA plans for each of the designated labs (SEA 2002b).

4.8.2 Sample Shipping

The analytical laboratories will supply sample coolers and packing materials. Upon completion of final inventory by the field sample custodian, individual sample containers will be placed into a sealed plastic bag. Samples will then be packed in a cooler lined with a large plastic bag. Glass jars will be packed to prevent breakage and separated in the shipping container by bubble wrap or other shock-absorbent material. Ice in sealed plastic bags or "blue ice" will then be placed in the cooler to maintain a temperature of approximately 4ºC.

When the ice chest is full, the chain-of-custody form will be placed into a zip-locked bag and taped on the inside lid of the cooler. A temperature and a trip blank will be added to each cooler. Each ice chest will be sealed with three chain-of-custody seals. On each side of the cooler a *This End Up* arrow label will be attached; a *Fragile* label will be attached to the top of the cooler. Coolers will be transported to the laboratory by courier or overnight shipping service. These packaging and shipping procedures are in accordance with U.S. Department of Transportation regulations as specified in 49 CFR 173.6 and 49 CFR 173.24.

The coolers will be clearly labeled with sufficient information (i.e., name of project, time and date container was sealed, person sealing the cooler, and company name and address) to enable positive identification.

4.9 QUALITY CONTROL PROCEDURES

Quality control requirements will be instituted during sampling, laboratory analysis, and data management to ensure that the data quality objectives are met. Detailed information on QA/QC procedures, limits, and reporting are described in detail in the approved project QAPP (SEA 2002b). Field QC requirements are described in the following sections. If quality control problems are encountered, they will be brought to the attention of the CERCLA Project Coordinator. Corrective actions, if appropriate, will be implemented to meet the project's data quality objectives.

4.9.1 Field QC Samples

Field QC samples are used to assess within-station variability (e.g., replicates), evaluate the effectiveness of sample homogenization and within-sample variability

APPENDIX B-3

Horizontal and Vertical Station Control (revised June 2018)

STANDARD OPERATING PROCEDURE
HORIZONTAL AND VERTICAL SURVEY CONTROL

Introduction

This Standard Operating Procedure (SOP) has been developed for the Pre-Remedial Design Sampling and Baseline Investigations (PDI) at the Portland Harbor Superfund Site located in Portland, Oregon to confirm accurate positioning of vessels and samples during sample collection activities. The survey control requirements described in this SOP are specifically for environmental sample collection and will generally comply with map-grade precision and accuracy in contrast to the geodetic-grade precision and accuracy performed for the Bathymetric Survey conducted by David Evans and Associates (DEA). However, the same survey control points and geodetic parameters will be used in both surveys for consistency, and a portion of the quality assurance/quality control (QA/QC) process will involve consultation with DEA Oregon Professional Land Surveyor (PLS) staff to review the map-grade data collected for the environmental sample collection.

The organization of this SOP is as follows:

- Methodology Overview
- Project Geodetic Parameters
- Survey Accuracy, Precision, and Control
- Primary Equipment
- Hand-Held GPS Operation
- Vessel Navigation and Equipment Operation
- Data Processing and QA/QC Procedures

Tables, figures, and attachments are presented at the end of the SOP.

Methodology Overview

Horizontal (Map) Data Collection

A combination of vessel-mounted and hand-held GPS receivers will be used to navigate to sampling locations and to collect map location coordinates (Northings, Eastings) for those sampling locations. The vessel-mounted GPS receivers will be the primary tool used for navigation to the pre-planned sampling locations in a GIS file, which will be pre-loaded into the vessel navigational system. The hand-held GPS devices will be used as a backup and confirmation of vessel position only if there are problems with the vessel GPS navigation system or if there is no specific vessel navigation system (i.e., smaller boats). Since the inception of field work, the vessel GPS coordinates have been consistently verified and deemed to be sufficient to meet position and accuracy requirements for the project. The hand-held GPS devices will primarily be used for studies involving small vessels. These devices will also have the pre-loaded basemap content depicting planned sampling locations.

The vessel GPS will operate in two modes, collecting both a separate continuous data stream of positional information (line file) and recording GPS soundings (target file) when a sample is specifically

collected. The sample location target file will be recorded when the sampling device is in position for the grab (e.g., when sampler is on the river bottom). The specific Location ID associated with the sample will also be recorded in the GPS device log. Field personnel will be required to write that same Location ID on their field data collection forms at the same time. Both the continuous and episodic dataset will be timestamped to allow comparison of the two types of data. This data will be recorded and maintained on the vessel, and will also be exported from the vessel navigation system and archived to project servers on a daily basis.

The hand-held GPS devices will be operated independently of the vessel's systems and will be used to record a location sounding wherever a sample is collected only for studies unable to use the vessel GPS navigation system. The sample location sounding will be recorded approximately at the same time as when the vessel GPS measurement is collected (e.g., when sampler is in position). The specific Location ID associated with the sample will also be recorded on the GPS device. Field personnel will write this Location ID on the field forms only if the vessel measurement described earlier cannot be collected for some reason (e.g., equipment failure). These measurements will also be timestamped. The data from the hand-held GPS devices will be wirelessly synchronized to a "cloud" web service in near real-time; the data from the "cloud" will also downloaded and saved to project servers daily.

Vertical Data Collection

Vertical (elevation) data is also required for water levels, sample collection depth below surface water, and bottom (mudline) depth location for some types of sample locations. For increased precision and accuracy, it is proposed that bottom (mudline) depth locations (e.g., for sediment cores) be calculated from the bathymetric surface to be developed by the hydrographic survey performed by DEA (since the data will be collected within a few months of each other). The NAVD88 elevation will be calculated from the intersection of the surface map location coordinates collected as described earlier, projected vertically down to the bathymetric surface (United States Army Corps of Engineers [USACE], 2004). The elevation from the intersection of the bathymetric surface will be used as the final or "best" elevation for the sample.

In contrast, for depth measurements that require less precision (e.g., water levels, depth to samples below water surface), the onboard vessel sonar will be used to record depth and then subsequently calculate elevation. All depths will be recorded relative to the water surface and time tagged to correct with time tagged gauge data for obtaining riverbed elevations. The elevation will be calculated to NAVD88 datum. To correct elevations, gauge data from the Northwest River Forecast Center will be downloaded for gauge PRT03, which is representative of the former Morrison gauge which has been moved. This gauge does not report NAVD88 elevations but rather reports a value that is 0.3 feet above Columbia River Datum (CRD). Corrections from CRD to NAVD88 differ moving down the river from the gauge due to the fact that NAVD88 is a reference normal to gravity (water does not flow if the elevation is unchanging), and CRD is a gradient datum that follows the lower water surface. In Portland Harbor, the difference between CRD and NAVD88 (Geoid12b) ranges from 0.00 feet CRD = -5.16 feet NAVD88 (Geoid12b) at Willamette River river mile (RM) 2.0, to 0.00 feet CRD = -5.41 feet NAVD88 (Geoid12b) at Willamette River RM 12.8 (approximate location of PRT03 Gauge). Accordingly, a correction to the Willamette Gauge in Portland would be -5.41+0.3 or -5.11 feet at RM 12.8. An approximation would be to subtract 5 feet from the gauge reading for the full length of the

study area, but precision will vary depending on tides and river gradient.

For sample locations requiring vertical information, depth will be recorded by field staff on their data collection forms relative to the water surface, and these values will be loaded to the project database as described in the Data Quality Management Plan (DQMP). Final calculated NAVD88 elevation data (feet) will also be entered into a separate data field in the project database after completion of spatial analysis, calculations, and QA/QC. DEA will provide support during the QA/QC process to verify proper calculation of NAVD88 elevation data.

Location Position Recording in Project Database

Discrete Samples

When discrete samples are collected, the Location ID and the location coordinates (Northing/Easting) will be recorded on the GPS device(s) and the field data collection form(s). The location coordinates will be based on the vessel GPS instantaneous target measurement. This target measurement will be the location coordinate pair loaded initially to the project database. After the field event is completed, the target measurement will be compared to the line file (vessel continuous GPS measurement) to confirm that the coordinate pair loaded to the project database is appropriate. If analysis reveals precision or accuracy issues, the loaded location coordinate pair in the project database may be updated and edited with a better value derived from the line file. In general, the hand-held GPS devices will be used as a backup and confirmation of vessel position only if there are problems with the vessel GPS navigation system or an independent navigation system is not available on the vessel. These coordinates will be loaded to the project database only if there is a significant problem with the vessel GPS (e.g., equipment failure) or if there is no vessel GPS.

Composite Samples

When composite samples are collected, location coordinates will also be recorded as both target measurements and continuous measurements using the vessel GPS. The continuous GPS measurements will be recorded during the entire compositing event, and instantaneous target measurements will be collected when the sampler is in position for each individual composite grab. At each compositing location, a target measurement will be recorded in the vessel GPS along with the Location ID with an “a,” “b,” or “c” suffix. These measurements will be recorded on the field forms in the same manner (e.g., there will be three sets of location coordinates, lithologic descriptions, etc.).

When the location data is loaded to the project database, a single set of location coordinates will be recorded in the project database with a Location ID that excludes the “a,” “b,” or “c” suffix. As a presumed middle time point, the “b” set of coordinates will be loaded with the primary Location ID to the project database. After the field event is completed, the target measurement associated with the “b” location composite will be compared to the line file (vessel continuous GPS measurement) to assess vessel position and the timeframe of the entire sampling event to confirm if the coordinate pair loaded to the project database is appropriate. The goal will be to finalize the location coordinate information in the project database based on the most representative position based on this analysis. Similar to discrete sample collection, a hand-held GPS device and related data will only be loaded to the project database if there is a significant problem with operation of the vessel GPS or if the vessel does not have a GPS.

Finally, after field data are collected and surveys are completed, as defined in the DQMP, the location coordinate data will be joined with the tabular data collected by the field teams and loaded to the project database.

Project Geodetic Parameters

The geodetic parameters to be used for the PDI field studies will be as follows:

Horizontal Datum: North American Datum of 1983 (2011)
Projection: State Plane Coordinate System (SPCS) Oregon North Zone
Vertical Datum: North American Vertical Datum of 1988 (NAVD88) Geoid12b
Units: International Feet

Survey Accuracy, Precision, and Control

The anticipated horizontal accuracy of environmental sampling associated with vessel and hand-held GPS devices is a range of 1 to 5 meters (target 1 to 2 meters for the DGPS unit itself). This should be consistent with RI target accuracy (Integral 2002) and best practices (Puget Sound Estuary Protocols [PSEP] 1998 and US Environmental Protection Agency [EPA] 2008).

The anticipated vertical accuracy of final elevation calculations derived from vessel sonar systems is anticipated to be 1.0 meter.

Table 1 summarizes the survey control locations used in the DEA Bathymetric Survey, which will be used for the environment sample collection work described in this SOP. Figure 1 shows the PH2 piling at Fred Devine boat dock, and Figure 2 shows the approximate locations of the survey control references. Attachment 1 contains detailed survey sheets of the control points: Raindeer, PH1 and PH2, and 2100.

Primary Equipment

- Trimble® SPS 461 GPS with dual antennas (vessel GPS)
- A-frame assembly, sampling winch (vessel boom)
- Trimble® R1 (hand held GPS), tethered to Bluetooth® capable smartphone or tablet, ESRI Collector software with Trimble® GNSS Status middleware
- GPS owner's manual
- Writing tools (pencils, Sharpie®)
- Field logbook
- Spare batteries and/or battery charger
- Compass
- Tape measure

Hand-Held GPS Operations

For ease of use, the project team will utilize smartphones tethered to the Trimble® R1 GNSS Receiver via a Bluetooth® connection. The smartphone will be configured with Trimble's middleware software called GNSS Status to convert and stream NMEA satellite data to the smartphone for real-time

correction and display to a simple electronic data collection form developed on the ESRI Collector platform. The form will contain a limited number of data fields, including location, study name and operator, date, and notes or comments. This form is not intended to duplicate the content and scope of the field data collection forms, but rather clearly link the GPS data to those forms via the unique Location ID. There are metadata fields available as well from these GPS records, such as estimated horizontal accuracy.

Collected data recorded onto the phone will be transmitted wirelessly via a synchronization process invoked when data is "saved" to the device. The data will be pushed to AECOM Online's Portal and ArcGIS Server for storage of "corrected" location coordinates, Location ID, and other information captured when the GPS sounding is recorded. The sampling event will be trackable in near-real-time as samples are collected on the ArcGIS Portal Interface. Either dedicated, experienced GPS-operators will be collecting the measurements on the smartphones, or, due to the very simple nature of the interface, field personnel will be trained to use the devices. Initial training sessions were already successfully conducted March 19-20, 2018 on use of the smartphone GPS interface. These handheld devices were successfully used for the first 2 weeks of field work. For some studies, such as the smallmouth bass tracking study, these handhelds may be used as the primary GPS due to smaller vessel configuration.

Vessel Navigation and Equipment Operation

Vessel positioning will be conducted through the marine navigation and hydrographic software package HYPACK. This software package allows the visualization of the vessel over navigable charts, the processing of satellite corrections, stored hardware, and vessel parameters, as well as the storing of physical target locations during sampling activities. HYPACK version 2017 will be used for this project.

Vessel position is measured using a Trimble SPS 461 GPS dual antenna receiver. The dual antennas provide precise vessel positioning via both satellite and differential radio corrections along with heading correction to 0.09 degree. GPS data is output through a serial connection into computer running the HYPACK software, for vessel positioning and target collection.

At each sampling location, depth to mudline will be measured using an onboard fathometer (with lead line as confirmation as needed) immediately prior to or during the sampling. Water depths are measured at each station using an Airmar ss510 survey sonar at the sampling point and confirmed daily with a lead line with reference to water surface. Vertical measurements will be recorded to the nearest 0.1 foot. Water depths will be converted to elevations in NAVD88 based on the river stage at the time of sampling as recorded at the closest available tide gage.

Data Processing and QA/QC Procedures

All GPS devices will be subject to a position check to confirm the accuracy of the on-vessel GPS and hand-held GPS devices and to validate the positions derived from each GPS receiver. Correctors being applied as needed, resulting in a position that is within specified positioning accuracy of the DEA published position for control monument PH1 and PH2. At the start and end of each field day, the PH2 benchmark location will be visited by boat to perform a position check. At the piling serving as the control monument, the on-vessel GPS calibrated to the top of A-frame assembly will be maneuvered as close to the benchmark piling as possible to record a point. The GPS-derived position

of the sampling vessel is compared with the known horizontal location; results will be recorded in HYPACK to confirm that accuracy is within +/- 2 meters. For handheld GPS, field staff will occupy the PH1 at the Swan Island boat launch parking lot. Using the R1 and phone/tablet combination GPS setup, the field staff will hold the R1 above PH1 and wait for a satellite "fix," and when ready, the staff will record the GPS location in Collector. This GPS location will be compared to the known coordinates to confirm the accuracy is within +/- 2 meters. The survey control monuments act as a known location to allow for corrected station location coordinates during post-processing of data as needed. If a need arises to locate another benchmark, there are several USGS control points near the project area and near the AECOM project warehouse. Experienced GPS operators on the project team will be involved in all aspects of field data collection events to troubleshoot devices and assist in daily review of extracted geospatial datasets. Additional details on QA/QC procedures can be found on the DQMP.

References

AECOM (AECOM Technical Services) and Geosyntec (Geosyntec Consultants, Inc.). 2018. Data Quality Management Plan Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling. Portland Harbor Superfund Site. 22 February.

Integral (Integral Consulting). 2002. Round 1 Field Sampling Plan. Prepared for the Lower Willamette Group (LWG) for submittal and approval by EPA Region 10. June 14.

EPA (United States Environmental Protection Agency). 2008. National Geospatial Data Policy. August 24.

PSEP. 1998. Recommended Guidelines for Station Positioning in Puget Sound. Prepared for United States EPA Region 10 and the Puget Sound Water Quality Action Team. September.

USACE (United States Army Corps of Engineers). 2004. Engineering and Design Hydrographic Surveying Manual, EM 1110-2-1003, U.S. Army Corps of Engineers, April 2004

Attachments

PH Control Points of 2100, Portland Harbor (PH1 and PH2), and Raindeer survey monuments, as well as figures presenting PH2.

Table 1. Benchmark Monument Coordinates and Description

Designation	Approx. Location	Description	NAD83 (2011), Oregon SPCS North (ft)		NAVD88 Elevation (ft)
			Northing	Easting	
DEMSI-BASE	Columbia River	Fixed antenna with height at antenna reference point	718172.70	7654431.05	73.58
DEMSI- CHECK	Columbia River	Fixed antenna with height at antenna reference point	718170.73	7654419.84	71.67
RAINDEER	RM 2	USACE Brass Cap	722443.24	7614886.64	35.44
Portland Harbor (PH1)	Swan Island Boat Ramp	1/2" Iron Rod with red plastic cap stamped "DEA Control" Point is 0.3 feet south of the back of curb at the Swan Island Boat Ramp, 10.5 feet north of a cyclone fence, and 60 feet east of a light post	698702.46	7637426.37	33.38
Portland Harbor 2 (PH2)	Fred Devine Boat Dock	Reference point is 0.2 feet SE of the SE side of a 1-1/2 foot steel pile. This is the furthest SE pile at the end of the Fred Devine Diving and Salvage Company dock in the Swan Island Lagoon. This pile is to be used for daily position checks for sediment sampling operations. Pile is for position only and not elevation.	700967.87	7634507.67	NA
2100	RM 13	5/8" bolt on SW corner of screen wall at DEA office 2100 SW River Parkway, Portland, OR	678400.01	7645190.81	159.51

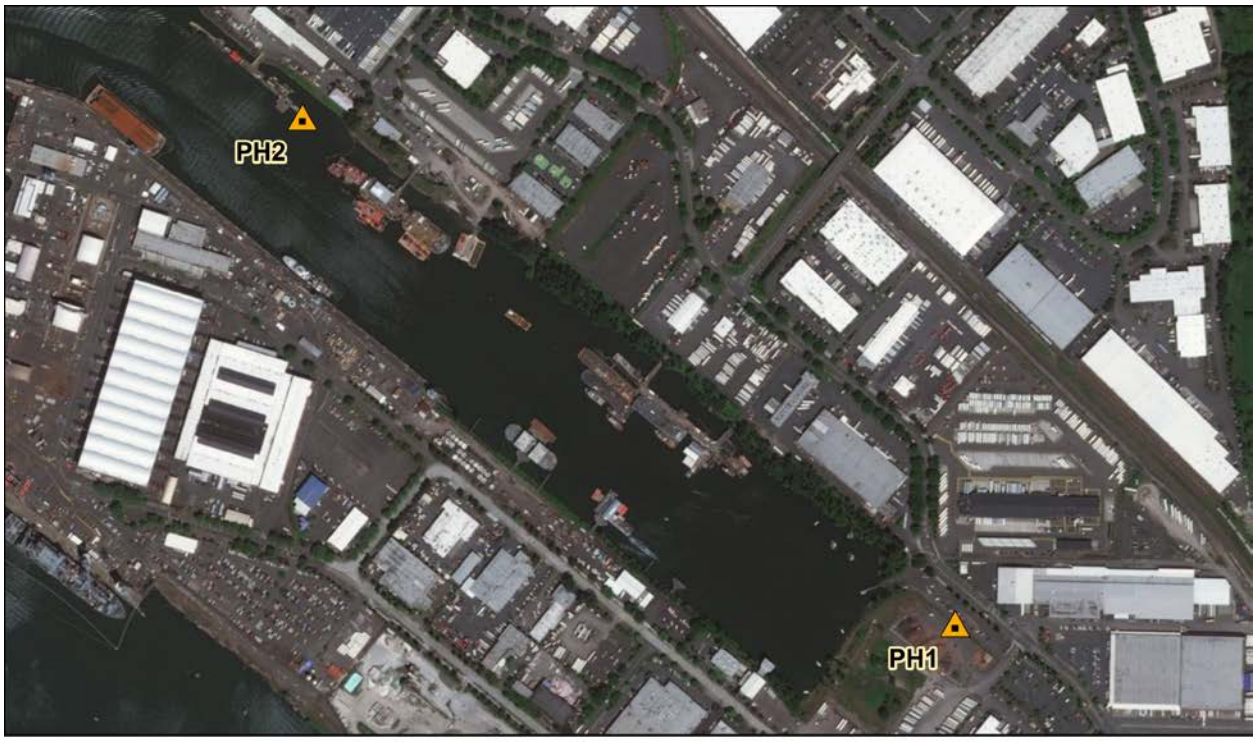
General Notes:

1. The two DEMSI and the 2100 stations are transceiver beacon stations in upland areas (Green Shade).
2. PH1 is located at the Swan Island boat ramp parking lot and accessible by foot.
3. PH2 is located at a piling at the boat dock where project-related vessels will be docked and is accessible by boat.
4. Raindeer station is located adjacent to the river and accessible by foot (for the hand-held GPS).

Acronyms:

DEA = David Evans and Associates; ft = feet; NAD83 = North American Datum of 1983; NAVD88 = North American Vertical Datum of 1988; PH = Portland Harbor; RM = river mile; USACE = US Army Corps of Engineers; SPCS = State Plane Coordinate System

Figure 1. Photograph of Piling PH2, at the end of the Fred Devine Boat Dock. Piling was captured in DEA bathymetric survey. Photo is facing northwest.



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

N 0 250 500 1,000 Feet

PH2 is located on the SE corner of the Fred Devine Boat Dock, where Gravity's boats berth every night.

PH1 is located on the SW side of the Swan Island Boat Launch parking lot, where field crews park to meet the boats at the launch dock.

Figure 2. Locations of control monuments PH1 and PH2 at Swan Island Boat Launch and Fred Devine Boat Dock, respectively.

NOTE: This form intended for field use. Unsolicited data submitted to NGS must be converted to bluebook format.

GPS STATION OBSERVATION LOG
April 16, 2003

Station Designation: (check applicable:__ FBN__ CBN__ PAC__ SAC __BM) 2100		Station PID, if any:	Date (UTC): 06-Mar-18
General Location: DEA Office 2100 SW River Parkway, Portland	Airport ID, if any:	Station 4-Character ID:	Day of Year: 065
Project Name: Portland Harbor - AETR00000034	Project Number: GPS-	Station Serial # (SSN):	Session ID:(A,B,C etc)

NAD83 Latitude o ' "	NAD83 Longitude o ' "	NAD83 Ellipsoidal Height meters	Agency Full Name: David Evans and Associates, Inc.
Observation Session Times (UTC): Sched. Start _____ Stop _____ Actual Start 18:55 Stop 23:00	Epoch Interval= 1 Seconds Elevation Mask = 10 Degrees	NAVD88 Orthometric Ht. meters GEOID99 Geoid Height meters	Operator Full Name: David T. Moehl Phone #: ( ) (360) 314-3200 e-mail address: dtm@deainc.com

Receiver Brand & Model: Trimble SPS855
P/N: 69855-60
S/N: 5506R0075
Firmware Version: 5.30
❒ CamCorder Battery, ❒ 12V DC, ✓ 110V AC, ❒ Other

Antenna Code*, Brand & Model: Trimble Zephyr 3 Base
P/N: 115000-10
S/N: 3121179869
Cable Length, meters: 10
Vehicle is Parked n/a meters ____(direction) from antenna.

Antenna plumb before session?	(✓ / N)	Circle
Antenna plumb after session?	(✓ / N)	Yes or No
Antenna oriented to true North?	(Y / N✓)	-If no,
Weather observed at antenna ht.	(Y / N✓)	explain
Antenna ground plane used?	(Y / N✓)	"
Antenna radome used?	(Y / N✓)	If yes,
Eccentric occupation (>0.5 mm)?	(Y / N✓)	describe.
Any obstructions above 10°?	(Y / N✓)	Use
Radio interference source nearby	(Y / N✓)	Vis. form

Tripod or Antenna Mount: Check one:
❒ Fixed-Leg Tripod, ❒ Collapsible-leg tripod ✓ Fixed Mount
Brand & Model: Bolt
P/N:
S/N:
Last Adjustment date:

Psychrometer (if used) Brand & Model:
P/N:
S/N:
Last Calibration or check Date:

** ANTENNA HEIGHT **	Before Session Begins: Meters	Feet	After Session Ends: Meters	Feet
A= Datum point to Top of Tripod (Tripod Height)	0.000		0.000	
B=Additional offset to ARP if any (Tribrach/Spacer)	0.000		0.000	
H= Antenna Height = A + B = Datum Point to Antenna Reference Point (ARP)	0.000	0.00	0.000	0.00

Meters = Feet x (0.3048)
Height Entered Into Receiver = 0.000 meters.
Note &/or sketch **ANY** unusual conditions. Be **Very Explicit** as to where and how Measured!

Barometer (if used) Brand & Model:
S/N:

Weather Data	Weather Codes	Time (UTC)	Dry-Bulb Temp Fahrenheit	Dry-Bulb Temp Celsius	WetBulb Temp Fahrenheit	WetBulb Temp Celsius	Rel. % Humidity	Atm. Pressure inches Hg	Atm. Pressure millibar
Before	00000	18:55							
Middle									
After	00000	23:00							

Remarks, Comments on Problems, Sketches, Pencil Rubbing, etc:

5/8" bolt found on the southeast corner of the VAC screen wall on DEA office roof at 2100 SW River Parkway, Portland, OR. The geodetic antenna was screwed tight to the top of the double nut on the 5/8" bolt. The antenna height = zero to the antenna reference point (bottom of antenna mount).

Weather codes are required. Weather data are optional but encouraged. *Antenna code comes from ant_info file furnished by project coordinator.

Data File Name(s): 00750650.T02
(Standard NGS Format = aaaaddds.xxx)
where aaaa=4-Character ID, ddd=Day of Year, s=Session ID, xxx=file dependant extension

Updated Station Description: ❒ Attached ❒ Submitted earlier
Visibility Obstruction Form: ❒ Attached ❒ Submitted earlier
Photographs of Station: ✓ Attached ❒ Submitted earlier
Pencil Rubbing of Mark: ❒ Attached

LOG CHECKED BY: Jon Dasler

Table of Weather Codes	CODE	PROBLEM	VISIBILITY	TEMPERATURE	CLOUD COVER	WIND
	0	did not occur	Good, over 15 miles	Normal, 32° F- 80° F	Clear, below 20%	Calm, under 5mph (8km/h)
	1	did occur	Fair, 7-15 miles	Hot, over 80°F (27 C)	Cloudy, 20% to 70%	Moderate, 5 to 15 mph
	2	- not used -	Poor, under 7 miles	Cold, below 32° F (0 C)	Overcast, over 70%	Strong, over15 mph (24km/h)
Examples:	00000 = No problem, good visibility, normal temp, clear, calm wind			12121 = Problems, poor visibility, hot, overcast, moderate wind		

Photo of Monument 2100

Photo of Monument 2100

GNSS Setup on 2100

NOTE: This form intended for field use. Unsolicited data submitted to NGS must be converted to bluebook format.

GPS STATION OBSERVATION LOG
April 16, 2003

Station Designation: (check applicable:__ FBN__ CBN__ PAC__ SAC __BM) Portland Harbor 1 (PH1)		Station PID, if any:	Date (UTC): 06-Mar-18
General Location: Swan Island Boat Launch	Airport ID, if any:	Station 4-Character ID:	Day of Year: 065
Project Name: Portland Harbor - AETR00000034	Project Number: GPS-	Station Serial # (SSN):	Session ID:(A,B,C etc)

NAD83 Latitude: o ' "
NAD83 Longitude: o ' "
NAD83 Ellipsoidal Height: meters
NAVD88 Orthometric Ht.: meters
GEOID99 Geoid Height: meters

Agency Full Name: David Evans and Associate, Inc.
Operator Full Name: David T. Moehl
Phone #: ( ) (360) 314-3200
e-mail address: dtm@deainc.com

Observation Session Times (UTC):
Sched. Start _____ Stop _____
Actual Start 19:30 Stop 21:32

Epoch Interval= 1 Seconds
Elevation Mask = 10 Degrees

Receiver Brand & Model: Trimble SPS985
P/N: 82500-60
S/N: 5616F59510
Firmware Version: 5.30
❒ CamCorder Battery, ❒ 12V DC, ❒ 110V AC, ✓ Other

Antenna Code*, Brand & Model: Trimble SPS985 Internal
P/N:
S/N:
Cable Length, meters: n/a
Vehicle is Parked 10 meters N (direction) from antenna.

Antenna plumb before session?	(✓ / N)	Circle
Antenna plumb after session?	(✓ / N)	Yes or No
Antenna oriented to true North?	(Y / N✓)	-If no,
Weather observed at antenna ht.	(Y / N✓)	explain
Antenna ground plane used?	(Y / N✓)	"
Antenna radome used?	(Y / N✓)	If yes,
Eccentric occupation (>0.5 mm)?	(Y / N✓)	describe.
Any obstructions above 10°?	(Y / N✓)	Use
Radio interference source nearby	(Y / N✓)	Vis. form

Tripod or Antenna Mount: Check one:
✓ Fixed-Leg Tripod, ❒ Collapsible-leg tripod ❒ Fixed Mount
Brand & Model: Seco fixed height
P/N:
S/N: 5115-00-FLY
Last Adjustment date: 2018-03-05

Psychrometer (if used) Brand & Model:
P/N:
S/N:
Last Calibration or check Date:

** ANTENNA HEIGHT **	Before Session Begins: Meters	Feet	After Session Ends: Meters	Feet
A= Datum point to Top of Tripod (Tripod Height)	2.000		2.000	
B= Additional offset to ARP if any (Tribrach/Spacer)	0.000		0.000	
H= Antenna Height = A + B = Datum Point to Antenna Reference Point (ARP)	2.000	6.56	2.000	6.56

Meters = Feet x (0.3048)
Height Entered Into Receiver = 2.000 meters.
Note &/or sketch **ANY** unusual conditions. Be **Very Explicit** as to where and how Measured!

Barometer (if used) Brand & Model:
S/N:

Weather Data	Weather Codes	Time (UTC)	Dry-Bulb Temp Fahrenheit	Dry-Bulb Temp Celsius	WetBulb Temp Fahrenheit	WetBulb Temp Celsius	Rel. % Humidity	Atm. Pressure inches Hg	Atm. Pressure millibar
Before	00000	19:30							
Middle									
After	00000	21:32							

Remarks, Comments on Problems, Sketches, Pencil Rubbing, etc:

Control point is a 1/2" iron rod with red plastic cap stamped "DEA CONTROL" set 0.1' below natural grade. Control point is 0.3' south of the back of curb, 10.5' north of a cyclone fence and 60' easterly of the 2nd light post east of the boat ramp. See detached sketch and photos.

Weather codes are required. Weather data are optional but encouraged. *Antenna code comes from ant_info file furnished by project coordinator.

Data File Name(s): 95100650.T02
(Standard NGS Format = aaaaddds.xxx)
where aaaa=4-Character ID, ddd=Day of Year, s=Session ID, xxx=file dependant extension

Updated Station Description: ❒ Attached ❒ Submitted earlier
Visibility Obstruction Form: ❒ Attached ❒ Submitted earlier
Photographs of Station: ✓ Attached ❒ Submitted earlier
Pencil Rubbing of Mark: ❒ Attached

LOG CHECKED BY: Jon Dasler

Table of Weather Codes

CODE	PROBLEM	VISIBILITY	TEMPERATURE	CLOUD COVER	WIND
0	did not occur	Good, over 15 miles	Normal, 32° F- 80° F	Clear, below 20%	Calm, under 5mph (8km/h)
1	did occur	Fair, 7-15 miles	Hot, over 80°F (27 C)	Cloudy, 20% to 70%	Moderate, 5 to 15 mph
2	- not used -	Poor, under 7 miles	Cold, below 32° F (0 C)	Overcast, over 70%	Strong, over15 mph (24km/h)

Examples: 00000 = No problem, good visibility, normal temp, clear, calm wind 12121 = Problems, poor visibility, hot, overcast, moderate wind

Sketch of Monument PH1

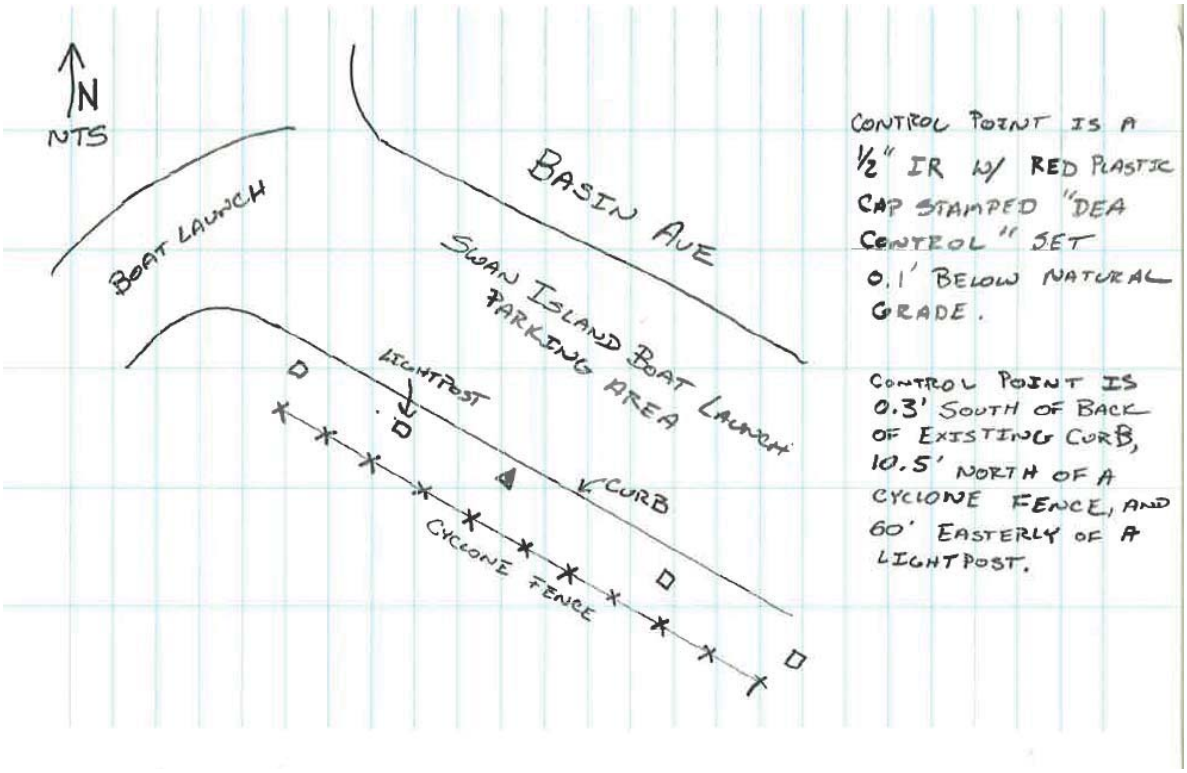


Photo of Monument PH1

GNSS Setup on PH1

NOTE: This form intended for field use. Unsolicited data submitted to NGS must be converted to bluebook format.

GPS STATION OBSERVATION LOG
April 16, 2003

Station Designation: (check applicable:__ FBN__ CBN__ PAC__ SAC __BM) Portland Harbor 2 (PH2)		Station PID, if any:	Date (UTC): 20-Apr-18
General Location: Fred Devine Boat Dock	Airport ID, if any:	Station 4-Character ID:	Day of Year: 111
Project Name: Portland Harbor - AETR00000034	Project Number: GPS-	Station Serial # (SSN):	Session ID:(A,B,C etc)

NAD83 Latitude o ' "	NAD83 Longitude o ' "	NAD83 Ellipsoidal Height meters	Agency Full Name: David Evans and Associate, Inc.
Observation Session Times (UTC): Sched. Start _____ Stop _____ Actual Start 19:45 Stop 19:49	Epoch Interval= 1 Seconds Elevation Mask = 10 Degrees	NAVD88 Orthometric Ht. meters GEOID99 Geoid Height meters	Operator Full Name: David T. Moehl Phone #: ( ) (360) 314-3200 e-mail address: dtm@deainc.com

Receiver Brand & Model: Trimble SPS985	Antenna Code*, Brand & Model: Trimble SPS985 Internal	Antenna plumb before session? (Y / N) ✓ Circle
P/N: 82500-60	P/N:	Antenna plumb after session? (Y / N) ✓ Yes or No
S/N: 5616F59510	S/N:	Antenna oriented to true North? (Y / N) ✓ -If no,
Firmware Version: 5.30	Cable Length, meters: n/a	Weather observed at antenna ht. (Y / N) ✓ explain
❒ CamCorder Battery, ❒ 12V DC, ❒ 110V AC, ✓ Other	Vehicle is Parked n/a meters ____(direction) from antenna.	Antenna ground plane used? (Y / N) ✓ "
		Antenna radome used? (Y / N) ✓ If yes,
		Eccentric occupation (>0.5 mm)? (Y / N) ✓ describe.
		Any obstructions above 10°? (Y / N) ✓ Use
		Radio interference source nearby (Y / N) ✓ Vis. form

Tripod or Antenna Mount: Check one:
✓ Fixed-Leg Tripod, ❒ Collapsible-leg tripod ❒ Fixed Mount
Brand & Model: Seco fixed height
P/N:
S/N: 5115-00-FLY
Last Adjustment date: 2018-03-05

Psychrometer (if used) Brand & Model:
P/N:
S/N:
Last Calibration or check Date:

** ANTENNA HEIGHT **	Before Session Begins: Meters	Feet	After Session Ends: Meters	Feet
A= Datum point to Top of Tripod (Tripod Height)	2.000		2.000	
B=Additional offset to ARP if any (Tribrach/Spacer)	0.000		0.000	
H= Antenna Height = A + B = Datum Point to Antenna Reference Point (ARP)	2.000	6.56	2.000	6.56

Meters = Feet x (0.3048)
Height Entered Into Receiver = 2.000 meters.
Note &/or sketch **ANY** unusual conditions. Be **Very Explicit** as to where and how Measured!

Barometer (if used) Brand & Model:
S/N:

Weather Data	Weather Codes	Time (UTC)	Dry-Bulb Temp Fahrenheit	Dry-Bulb Temp Celsius	WetBulb Temp Fahrenheit	WetBulb Temp Celsius	Rel. % Humidity	Atm. Pressure inches Hg	Atm. Pressure millibar
Before	00010	19:45							
Middle									
After	00010	19:49							

Remarks, Comments on Problems, Sketches, Pencil Rubbing, etc:

Reference point is 0.2 feet SE of the SE side of a 1-1/2 foot steel pile. This is the furthest SE pile at the end of the Fred Devine Diving and Salvage Company dock in the Swan Island Lagoon. This pile is to be used for daily position checks for sediment sampling operations. Pile is for position only and not elevation.
NAD83(2011) Oregon North Zone International Feet Coordinates
North 700967.9 East 7634507.7

Weather codes are required. Weather data are optional but encouraged. *Antenna code comes from ant_info file furnished by project coordinator.

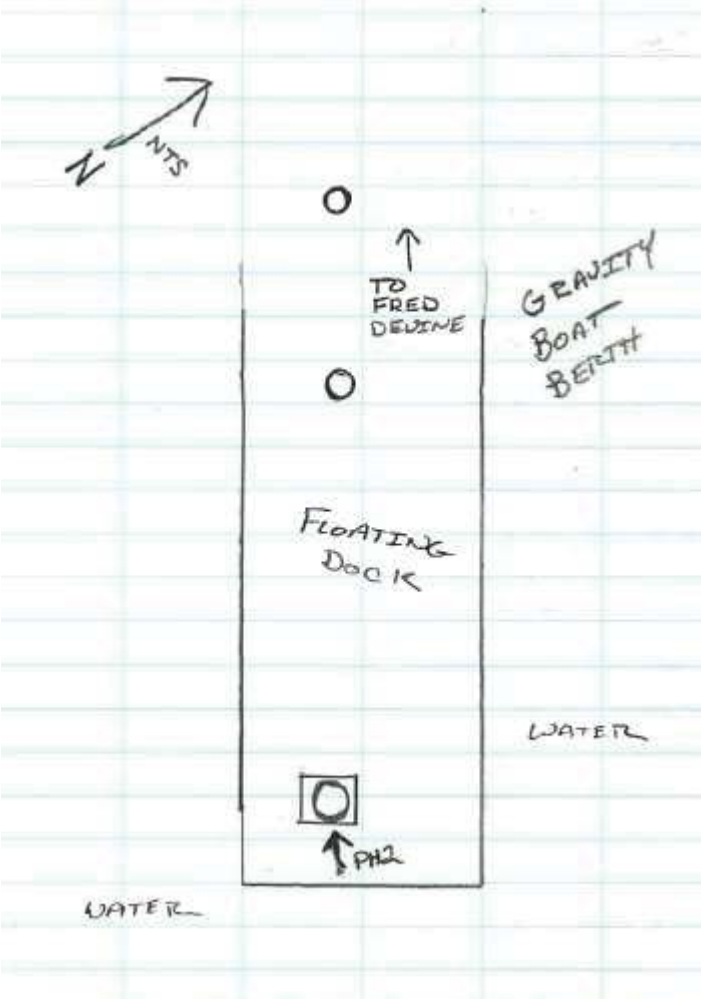
Data File Name(s):
(Standard NGS Format = aaaaddds.xxx)
where aaaa=4-Character ID, ddd=Day of Year, s=Session ID, xxx=file dependant extension

Updated Station Description: ❒ Attached ❒ Submitted earlier
Visibility Obstruction Form: ❒ Attached ❒ Submitted earlier
Photographs of Station: ✓ Attached ❒ Submitted earlier
Pencil Rubbing of Mark: ❒ Attached

LOG CHECKED BY: Jon Dasler

Table of Weather Codes	CODE	PROBLEM	VISIBILITY	TEMPERATURE	CLOUD COVER	WIND
	0	did not occur	Good, over 15 miles	Normal, 32° F- 80° F	Clear, below 20%	Calm, under 5mph (8km/h)
	1	did occur	Fair, 7-15 miles	Hot, over 80°F (27 C)	Cloudy, 20% to 70%	Moderate, 5 to 15 mph
	2	- not used -	Poor, under 7 miles	Cold, below 32° F (0 C)	Overcast, over 70%	Strong, over15 mph (24km/h)
Examples:	00000 = No problem, good visibility, normal temp, clear, calm wind				12121 = Problems, poor visibility, hot, overcast, moderate wind	

Sketch and Fieldnotes



200 CHK PH1

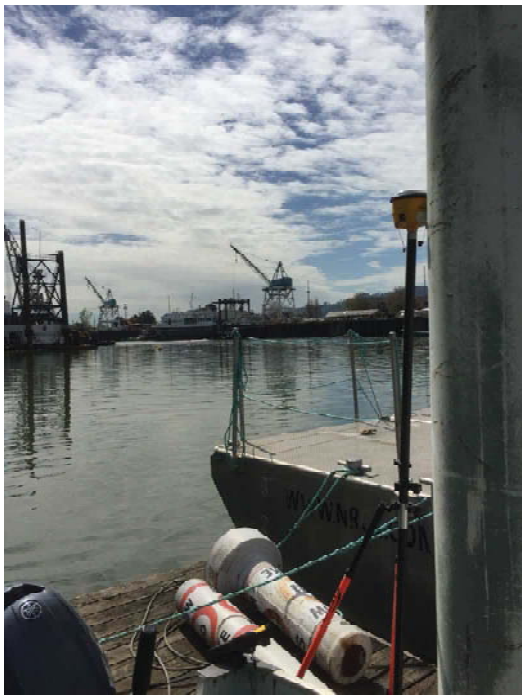
	KNOWN COORDS	OBS	Δ (FT)
	N = 698702.46	N = 698702.45	0.01
	E = 7637426.37	E = 7637426.39	0.02
	Z = 33.38	Z = 33.37	0.01

201 SE FACE OF PILE
3-MIN OBS
N = 700967.87
E = 7634507.64
Z = N/A

202 SW FACE TOPO
203 NW FACE TOPO
204 NE FACE TOPO

Overview of PH2 Pile

GNSS Setup on PH2 Pile



View facing south

View facing northwest

NOTE: This form intended for field use. Unsolicited data submitted to NGS must be converted to bluebook format.

GPS STATION OBSERVATION LOG
April 16, 2003

Station Designation: (check applicable:__ FBN__ CBN__ PAC__ SAC __BM) Raindeer		Station PID, if any:	Date (UTC): 06-Mar-18
General Location: Sauvie Island, Willamette River	Airport ID, if any:	Station 4-Character ID:	Day of Year: 065
Project Name: Portland Harbor - AETR00000034	Project Number: GPS-	Station Serial # (SSN):	Session ID:(A,B,C etc)

NAD83 Latitude ° ' "	NAD83 Longitude ° ' "	NAD83 Ellipsoidal Height meters	Agency Full Name: David Evans and Associates, Inc.
Observation Session Times (UTC): Sched. Start _____ Stop _____ Actual Start 17:38 Stop 23:45	Epoch Interval= 1 Seconds Elevation Mask = 10 Degrees	NAVD88 Orthometric Ht. meters GEOID99 Geoid Height meters	Operator Full Name: David T. Moehl Phone #: ( ) (360) 314-3200 e-mail address: dtm@deainc.com

Receiver Brand & Model: Trimble SPS855	Antenna Code*, Brand & Model: Trimble Zephyr 3 Base	Antenna plumb before session? (✓Y / N) Circle
P/N: 69855-60	P/N: 115000-00	Antenna plumb after session? (✓Y / N) Yes or No
S/N: 5506R0074	S/N: 1551129193	Antenna oriented to true North? (✓Y / N) -If no,
Firmware Version: 5.30	Cable Length, meters: 10	Weather observed at antenna ht. (Y / N✓) explain
❒ CamCorder Battery, ✓❒ 12V DC, ❒ 110V AC, ❒ Other	Vehicle is Parked n/a meters ____(direction) from antenna.	Antenna ground plane used? (Y / N✓) "
		Antenna radome used? (Y / N✓) If yes,
		Eccentric occupation (>0.5 mm)? (Y / N✓) describe.
		Any obstructions above 10°? (Y / N✓) Use
		Radio interference source nearby (Y / N✓) Vis. form

Tripod or Antenna Mount: Check one:
✓❒ Fixed-Leg Tripod, ❒ Collapsible-leg tripod ❒ Fixed Mount
Brand & Model: Seco fixed height
P/N:
S/N: 5115-00-FLY
Last Adjustment date: 2018-03-05

Psychrometer (if used) Brand & Model:
P/N:
S/N:
Last Calibration or check Date:

** ANTENNA HEIGHT **	Before Session Begins: Meters	Feet	After Session Ends: Meters	Feet
A= Datum point to Top of Tripod (Tripod Height)	2.000		2.000	
B=Additional offset to ARP if any (Tribrach/Spacer)	-0.003		-0.003	
H= Antenna Height = A + B = Datum Point to Antenna Reference Point (ARP)	1.997	6.55	1.997	6.55

Meters = Feet x (0.3048)
Height Entered Into Receiver = 2.000 meters.
Note &/or sketch **ANY** unusual conditions. Be **Very Explicit** as to where and how Measured!

Barometer (if used) Brand & Model:
S/N:

Weather Data	Weather Codes	Time (UTC)	Dry-Bulb Temp Fahrenheit	Dry-Bulb Temp Celsius	WetBulb Temp Fahrenheit	WetBulb Temp Celsius	Rel. % Humidity	Atm. Pressure inches Hg	Atm. Pressure millibar
Before	00000	17:38							
Middle									
After	00000	23:45							

Remarks, Comments on Problems, Sketches, Pencil Rubbing, etc:

Weather codes are required. Weather data are optional but encouraged. *Antenna code comes from ant_info file furnished by project coordinator.

Data File Name(s): 00740650.T02
(Standard NGS Format = aaaaddds.xxx)
where aaaa=4-Character ID, ddd=Day of Year, s=Session ID, xxx=file dependant extension

Updated Station Description: ❒ Attached ❒ Submitted earlier
Visibility Obstruction Form: ❒ Attached ❒ Submitted earlier
Photographs of Station: ✓Attached ❒ Submitted earlier
Pencil Rubbing of Mark: ❒ Attached

LOG CHECKED BY: Jon Dasler

Table of Weather Codes	CODE	PROBLEM	VISIBILITY	TEMPERATURE	CLOUD COVER	WIND
	0	did not occur	Good, over 15 miles	Normal, 32° F- 80° F	Clear, below 20%	Calm, under 5mph (8km/h)
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	2	- not used -	Poor, under 7 miles	Cold, below 32° F (0 C)	Overcast, over 70%	Strong, over15 mph (24km/h)
Examples:	00000 = No problem, good visibility, normal temp, clear, calm wind			12121 = Problems, poor visibility, hot, overcast, moderate wind		

Photo of Monument RAINDEER

Photo of Monument RAINDEER

GNSS Setup on RAINDEER

APPENDIX B-4

RI Round 2 FSP Excerpt of PID Field Headspace Screening (Integral 2004) and PID Calibration Procedures

APPENDIX B-4 – Round 2 FSP Excerpt from PID Field Screening (Integral 2004)

Except for sample volumes collected for volatile analytes, sediment from each subsample will be individually mixed in the decontaminated, stainless-steel bowl to a uniform color and texture using a decontaminated, stainless-steel spoon. The sediment will be stirred periodically while individual samples are taken to ensure that the mixture remains homogeneous. Care will be taken to not include sediment that is in direct contact with the aluminum tube. In addition, the cutting of the aluminum tube can introduce metal shavings to the core sediment. Care will also be taken to avoid mixing these shavings into the homogenate. Pre-labeled jars for chemical testing will be filled with the homogenized sediment.

The types and number of field QC samples for subsurface sediment samples will follow the same guidelines prescribed for surface sediment samples. If additional volumes of sediment are required to perform all analyses in addition to QC analyses, an additional core may need to be collected from the same location and subsampled and homogenized accordingly.

Sample handling and storage procedures will follow those described for surface sediment samples in Section 4.6.1 with the following exception. When required, sediment subsamples for volatile organics will be collected from within appropriate intervals following the opening of the core and designation of the lithologic units. This process will minimize the release of volatile organics caused by mixing. Rinsate blanks will be performed at the same frequency (5%) as performed for the surface sediment sampling program.

4.6.4 Subsurface Sediment Sample Field Screening

In addition to visual observation, headspace screening using a photoionization detector (PID) and/or flame ionization detector (FID) may be used on all sample intervals to aid in the selection of samples to be analyzed.

Headspace Screening

Headspace screening involves the semi-quantitative measurement of total volatile compounds in the air above the sample material. Headspace concentrations will be measured using the following procedure.

1. A small representative sample will be collected from each sample interval to be screened using a decontaminated sampling spoon. The material will be placed in a resealable plastic bag or glass jar with a septum lid.

2. The bag or jar will be tightly sealed (the jar with aluminum foil and plastic lid with septum opening), and the material will be allowed to warm at least to the ambient temperature (>32° F). The sample will be allowed to sit for at least 10 to no more than 60 minutes to allow headspace concentrations to develop, and shaken

periodically for at least 30 seconds at the beginning and end of the development period.

3. The PID/FID probe tip will be inserted into the container within the headspace, with care taken to avoid taking sediment or moisture into the probe.

4. The highest reading (excluding possible erratic readings) on the meter will be recorded for the sample.

5. The deepest sample interval showing a response during headspace screening will be submitted in the initial round of analyses.

4.7 WASTE DISPOSAL

Any excess water or sediment remaining after processing will be returned to the river in the vicinity of the collection site. Any water or sediment spilled on the deck of the sampling vessel will be washed into the surface waters at the collection site before proceeding to the next station.

All disposable materials used in sample processing, such as paper towels and disposable coveralls and gloves, will be placed in heavyweight garbage bags or other appropriate containers. Disposable supplies will be removed from the site by sampling personnel and placed in a normal refuse container for disposal at a solid waste landfill. Phosphate-free, detergent-bearing, liquid wastes from decontamination of the sampling equipment will be washed overboard or disposed of into the sanitary sewer system. Waste solvent rinses will be held in sealed plastic buckets and disposed of into the sanitary sewer. Oily or other obviously contaminated investigation-derived waste will be placed in appropriate containers, and a waste determination will be made before it is disposed of at an appropriate facility.

4.8 SAMPLE HANDLING AND TRANSPORT

Since samples collected in support of CERCLA activities may be used in litigation, their possession must be traceable from the time of sample collection through laboratory and data analysis to introduction as evidence. To ensure samples are traceable, the following procedures will be followed.

4.8.1 Chain-Of-Custody Procedures

Samples are in custody if they are in the custodian's view, stored in a secure place with restricted access, or placed in a container secured with custody seals. A chain-of-custody record will be signed by each person who has custody of the samples

STANDARD OPERATING PROCEDURE

PID EQUIPMENT CALIBRATION, OPERATION, AND MAINTENANCE

Introduction

The standard operating procedure (SOP) for photoionization detector (PID) equipment calibration describes a procedure to confirm that monitoring equipment used for screening the quality and safety of sediment samples are operating within the manufacturer's specifications.

Calibration

PIDs will be calibrated on a daily basis each morning prior to making measurements and will be adjusted to operate within the manufacturers' specifications. The PIDs will be calibrated using 100 parts per million (ppm) isobutylene calibration gas provided by the equipment vendor.[1] After calibration, the equipment output will read "Span 1 is done and reading is XXX." Manufacturer states that reading should be close to span gas value. Field crew is using a span gas value of 100 ppm ± 5%. If readings are outside of this value, then equipment will be sent back to the manufacturer for maintenance. All calibration information shall be recorded in the project logbook.

Special attention shall be noted by field crew to instruments that may be affected by the change in the ambient temperature or humidity. Calibration checks should also be performed when sampling conditions change significantly, sample matrix changes, and/or readings are unstable or there is a change of parameter measurements that appear unusual.

As needed through the day, a black marker may be used to confirm a "positive" reading by the PID instrument.

Maintenance

All field monitoring equipment and accessories are to be maintained in accordance with the manufacturer's recommendations and specifications and/or established field practices. All maintenance will be performed by qualified personnel and documented in the field logbook or returned to manufacturer for maintenance.

Equipment requiring battery charging shall be charged as recommended by the manufacturer. Backup batteries for meters requiring them shall be included as part of the meters' accessories. Care must be taken to protect meters from adverse elements. Protective measures may involve placing the meter in a large plastic bag to shield it from the weather.

Documentation

All field equipment calibration, maintenance, and operation information shall be recorded within the field logbook to document that appropriate procedures have been followed and to track the equipment operation.

[1] 100 ppm calibration gas = "Span 1"

Logbook entries shall contain, but are not necessarily limited to, the following:

- Equipment model and serial numbers
- Date and time of calibration or maintenance performed
- Calibration standard used
- Calibration lot number and expiration date if listed on bottle
- Calibration procedure used if there are multiple options
- Calibration and calibration check readings, including units used
- Problems and solutions regarding use, calibration, or maintenance of the equipment
- Other pertinent information

Field records should contain sufficient detail to provide a clear understanding of which equipment was used and how equipment was calibrated. All documentation shall be placed in the project files and retained following completion of the project.

APPENDIX B-5

Core Photography Procedures for Sediment Coring

STANDARD OPERATING PROCEDURE

CORE PHOTOGRAPHY PROCEDURES FOR SEDIMENT CORING

Purpose

The purpose of this standard operating procedure (SOP) is to describe core photography procedures.

Scope and Applicability

This SOP is applicable to taking digital photographs of subsurface sediment cores.

Equipment and Materials

Equipment and materials for taking digital photographs include the following:

- Digital camera
- Spare batteries
- Tripod
- Color calibration card
- Measuring tape
- Light stands
- Digital camera-carrying case and manual
- Photo log form
- Dry-erase board
- Dry-erase marker
- Black waterproof pen

Typical Camera Features

- Save photographs (in standard mode) directly to a memory stick or comparable device
- Auto focus; manual focus available if required
- Zoom
- Brightness control
- Playback of photographs on camera screen
- Display of photograph number, date, and time

- Timed or remote release
- Display showing time remaining on battery and remaining disk capacity
- Ability to protect and delete images that have been taken

Camera Use

A digital camera will be used by the core processing team to photo document the subsurface sediment cores. The field team leader will be responsible for digital photograph documentation or for assigning documentation duties to a team member. Digital photographs will be collected at a high-pixel setting such that enlargements can be made with minimal degradation in picture quality.

Photograph Documentation Procedures

Field Team Responsibilities

The core processing team will keep a daily hard copy log of all photographs. The following digital photograph data will be collected:

- Date and time—as provided by the camera display
- Team members—list each team member
- Camera identifier (type, model, equipment number)
- Sample Location ID and depth interval
- Photograph ID—record the number of the photograph and the photograph file name (as coded below)
- Description—the target of the photograph

Photography Procedures

- Sediment cores should be photographed indoors with flood lights and oriented so that shadows are eliminated.
- The camera should be affixed to a tripod and photos taken using a timed or remote release to minimize shaking.
- The axis of the camera lens should be as close to perpendicular as possible to the core to minimize distortion of core and linear features.
- A measuring scale (e.g., tape measure or ruler) should be placed adjacent to the edge of the core as a size reference.
- A color proof strip should be included in the photo to ensure true color reproduction during photo post processing.
- The core Location ID and depth interval should be written onto a dry erase board and included in the photo frame.

Digital Photograph File Name

At the end of each field day, the member of the field team who is responsible for the camera will transfer the electronic data from the camera to the field operations computer. The folder structure will be as follows (or as specified in the Data Quality Management Plan [DQMP]):

\\DATA\PHOTOS\YYYYMMDD\SAMPLE AREA\file\[1, 2, 3, ...N]

The notation YYYYMMDD represents the year, month, and day. The sample area is the sampling area name (e.g., Willamette River). The individual files for the day (e.g., file 1, file 2, file N) will be placed within this folder using the default file identifier provided by the camera.

Transfer of Information and Archive

After the photograph disks have been uploaded, the original hard copy of the photograph log will be initialed and dated by the team member who downloaded the photographs, then archived by the field team leader.

Sample Processing Coordinator Responsibilities

The field team leader will be responsible for 1) reviewing electronic photographs and the logs as they are made available to ensure consistency and completeness of annotations; 2) collecting and archiving the hard copies of the photograph logs; 3) reviewing electronic photographs and the logs as they are made available to ensure consistency and completeness of annotations; and 4) notifying the sampling team leader of apparent inconsistencies and making recommendations for corrective action.

Key Checks and Items

Important checks for digital camera management include the following:

- Make sure the camera's battery is fully charged on a daily basis.
- Keep extra memory sticks available.
- To save battery life, use flash only when necessary.
- Make sure the camera quality level is set at "best" or equivalent (high pixel).
- Review photograph records periodically to ensure that the electronic photographs, dry erase board information, and the Specimen Tally and Location Form agree.
- Leave enough time at the end of the field day to transfer the data.

APPENDIX B-6

Management of Investigation-Derived Waste

STANDARD OPERATING PROCEDURE
MANAGEMENT OF INVESTIGATION-DERIVED WASTE

Introduction

Investigation derived wastes (IDW) generated during the Pre-Remedial Design Investigations at the Portland Harbor Superfund Site may include:

- Soils/sediments
- Surface water
- Other materials:
    - Personal protective equipment
    - Disposable sampling equipment
    - Spent decontamination liquids
    - Plastic sheeting, containers, etc.

The management of these wastes will be conducted to limit exposure of Site personnel to hazardous materials, and to prevent introduction of contaminated materials to uncontaminated environmental media at the Site (soils, sediment). The following Standard Operating Procedures (SOPs) establish protocols for testing, storage, and disposal of these materials.

Disposal of laboratory test equipment and supplies will be handled in accordance with the laboratory Quality Assurance Project Plan (QAPP).

General

IDW management will follow guidance described in the Office of Solid Waste and Emergency Response (OSWER) document, Guide to Management of Investigation-Derived Wastes (United States Environmental Protection Agency [EPA] 1992). This guidance discusses factors to consider as part of an IDW management program. These factors include protectiveness of human health and the environment, compliance with applicable and relevant or appropriate requirement (ARAR)-based cleanup levels, land disposal restrictions, storage requirements, recordkeeping and manifesting, and handling of non- Resource Conservation and Recovery Act (RCRA) hazardous wastes. The IDW management program described in this section incorporates these factors in the program.

All IDW identified as potentially contaminated with hazardous materials will be stored in a designated and clearly marked IDW management area located at the AECOM Technical Services (AECOM) Field Laboratory. All vessels will also be clearly labeled to indicate the source of the IDW. The IDW storage area will be inspected daily to ensure that storage procedures (as outlined below) are being followed. Any violations of these procedures will be

documented and remedied as quickly as possible. Potentially contaminated IDW will be identified based on its origin, olfactory evidence, and visual evidence. Laboratory testing will be required to determine the proper disposition of these IDW.

Media Specific IDW Management

Sediment/Soils

Waste soils and sediments will be generated as excess sample material. The required testing and handling of this IDW will depend on its origin and characteristics. Olfactory and visual observations will be used to determine if the soils contain potentially elevated levels of hazardous materials. The amount of sediment generated will be minimized to the volume necessary for sampling and analysis, if possible. During field operations, leftover sediment material will be returned to the location it was generated from unless a significant sheen or non-aqueous phase liquid (NAPL) is observed. If significant sheen or NAPL is observed, sediment on the vessel or laboratory processing area will be temporally stored in 5-gallon buckets with lids, then transferred to 55-gallon drums. Each drum will be labeled using a grease pencil or paint pen to indicate the date sealed, location, and contents. Each of the sealed drums will then be staged at a designated solid waste management unit location for later disposal characterization.

Surface Water

Sampling activities may result in the creation of surface water sheens. Sorbent booms will be deployed if significant sheen is encountered on the water surface during coring/grab sampling. A small support boat may be used to manage the boom so the sampling vessel can operate without interruption. AECOM will coordinate with the Office of Spill Prevention Section on additional mitigation measures and agency notifications for releases. Surface water generated during sediment collection will be returned to the lake unless a significant sheen is observed. If a sheen is observed, water will be contained in 55-gallon drums or plastic containers and managed accordingly.

Personal Protective Equipment (PPE)

Investigation-derived PPE consists of gloves, chemically protective clothing, respirator canisters, and other one-time use equipment used during the field investigation. All used PPE will be containerized in plastic garbage bags and disposed of on-site for subsequent transport to the municipal landfill.

Decontamination Fluids

Decontamination fluids will be drummed up in either 55-gallon drums or disposed of in sanitary sewers if no significant sheen is observed. Alconox used on the boat will be discarded overboard if no significant sheen is observed. The decontamination containers will be kept on-site until the water has been analyzed for hazardous materials, at which time the water will be discarded appropriately.

Chemical Liquid Wastes

Chemical liquid wastes will include the spent solvents and acids and other residual chemicals generated during the decontamination process.

Waste acids and solvents will be collected in (dedicated) satellite containers as follows:

- Waste acids (e.g., hydrogen chloride, nitric acid) will be collected in a plastic storage carboy (20-L) SEPARATE FROM WASTE SOLVENTS, labeled with a Class 8 Corrosive Liquid label and containing a tag that indicates acid name, concentration, and volume along with users' initials and date/time.
- Waste solvents (e.g., acetone, methanol, and hexane) will be collected in Type I or II UL-approved galvanized steel disposal can, SEPARATE FROM WASTE ACIDS, labeled with a Class 3 Flammable Liquid label and containing a tag that indicates solvent name, concentration, and volume along with users' initials and date/time.

Solvent Waste (Acetone, Methanol, Hexane)

- Assign a unique identification number to the Type I or II UL-approved steel disposal can (clearly marked on the top and sides).
- Prepare a log for the drum, listing the volume and concentration of each solvent transferred to the drum along with date/time.
- Place a label indicating that the drum contains IDW pending characterization and a Class 3 Flammable Liquid label on the drum.
- Close the drum after each transfer.
- Store the drum in a secure area at the field facility until pickup by an authorized waste handler at the end of the field phase. Drums containing hazardous waste will be removed from the facility within the time mandated for the governing hazardous waste generator status (large quantity generator, small quantity generator, or conditionally except generator).

Other Materials

All plastic sheeting, sampling containers, and other disposable equipment that is free from hazardous materials will be containerized in plastic garbage bags and disposed of on-site for subsequent transport to the municipal landfill. Materials that have visible NAPL will also be drummed and shipped off-site for disposal at an approved facility. Non-disposable or bulky materials may be decontaminated and re-used or disposed as solid waste (see SOP for decontamination). Other disposable materials used on-site (tarps covering non-contaminated soils, caution tape, potable water containers) that have not contacted contaminated media will be disposed as solid waste.

Testing and Disposal

All drummed materials will be tested to determine the proper disposal method. Composite samples will be collected from each drum for analysis. Composite samples will be collected such that reasonable likelihood exists that the entire volume of material in a drum is represented in the sample.

Composite samples will be tested for the parameters identified in the QAPP. Modifications of this analyte list may be made based on specific knowledge of the origin and likely contaminants in the materials.

Soils contaminated above hazardous waste criteria will be shipped to a licensed disposal facility following any further required waste characterization or stabilization.

References

United States Environmental Protection Agency (EPA). 1992. Guide to Management of Investigation-Derived Wastes. Office of Solid Waste and Emergency Response. 9345-03FS.

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111 SW Columbia Avenue
Suite 1500
Portland
OR, 97217
USA
aecom.com

Geosyntec
520 Pike Street
Suite 1375
Seattle
WA, 98101
USA
geosyntec.com

UPDATED FINAL

Fish Tissue Field Sampling Plan

Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling

Portland Harbor Superfund Site

AECOM Project Number: 60554349
Geosyntec Project Number: PNG0767A

August 20, 2018 (Rev. 3)

Prepared for:

United States Environmental Protection Agency, Region 10
1200 Sixth Avenue, Suite 900
Seattle, Washington 98101

On behalf of:

Portland Harbor Pre-RD AOC Group
Portland, Oregon

Prepared by:

AECOM

111 SW Columbia, Suite 1500
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Geosyntec consultants

engineers | scientists | innovators

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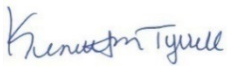
CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.



August 20, 2018

Kenneth M. Tyrrell
PDI Project Coordinator
AECOM Technical Services

Date

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ACRONYMS AND ABBREVIATIONS

AECOM	AECOM Technical Services
ASAOC	Administrative Settlement Agreement and Order on Consent
BEHP	bis-2-ethylhexylphthalate
BHHRA	baseline human health risk assessment
COC	contaminant of concern
CSM	Conceptual Site Model
D/U Reach	the Downtown Reach and the Upriver Reach
EDD	electronic data deliverable
EPA	United States Environmental Protection Agency
ESA	Endangered Species Act
FC	Field Coordinator
FS	feasibility study
FSP	Field Sampling Plan
Geosyntec	Geosyntec Consultants, Inc.
GPS	global positioning system
Gravity	Gravity Marine Services
GSI	GSI Water Solutions, Inc.
ID	identification
LWG	Lower Willamette Group
mm	millimeter
NAD	North American Datum of 1983
NMFS	National Marine Fisheries Service
ODFW	Oregon Department of Fish and Wildlife
PBDE	polybrominated diphenyl ether
PCB	polychlorinated biphenyl
PDI	pre-remedial design investigation
PHSS	Portland Harbor Superfund Site
Pre-RD AOC Group	Pre-Remedial Design Agreement and Order on Consent Investigation Group
QA	quality assurance
QAPP	quality assurance project plan
QC	quality control
RI	remedial investigation
RM	river mile

ROD	Record of Decision
RV	research vessel
Site	Portland Harbor Superfund Site
SMA	sediment management area
SMB	smallmouth bass
SOP	Standard Operating Procedure
SOW	Statement of Work

1. INTRODUCTION

The Record of Decision (ROD) described a post-ROD sampling effort for the Portland Harbor Superfund Site (Site or PHSS; Figure 1) located in Portland, Oregon, to delineate and better refine the sediment management area (SMA) footprints, refine the Conceptual Site Model (CSM), determine baseline conditions, and support remedial design (U.S. Environmental Protection Agency [EPA] 2017a). Geosyntec Consultants, Inc. (Geosyntec) and AECOM Technical Services (AECOM) submitted a detailed Work Plan for Pre-Remedial Design Investigation and Baseline Sampling (PDI) on behalf of a group of industrial parties called the Pre-Remedial Design Agreement and Order on Consent Investigation Group (Pre-RD AOC Group). On December 19, 2017, EPA entered into an Administrative Settlement Agreement and Order on Consent (ASAOC) with the Pre-RD AOC Group to conduct the PDI studies at the Site (EPA 2017b). The ASAOC includes the Statement of Work (SOW) and the PDI Work Plan (an attachment to the SOW), which generally describe the field investigation activities, data analyses, schedule, and deliverables for the PDI.

These PDI studies are a foundational step in what will be a multi-phase effort to update current conditions from the collection of data during the remedial investigation (RI)/feasibility study (FS). The RI/FS was initiated by a group of potentially responsible parties known as the Lower Willamette Group (LWG) and completed by EPA in 2016 (EPA 2016a, 2016b). The RI consisted of three rounds of data collection, including surface and subsurface sediment, bank soils, surface water, sediment traps, porewater, and fish tissue, and other media from 2001 through 2007.

This Field Sampling Plan (FSP) was prepared to support the fish tissue sampling efforts outlined in the PDI Work Plan (Geosyntec 2017) and the project Quality Assurance Project Plan (QAPP) (AECOM and Geosyntec 2018). To the extent practicable, previously approved FSPs from the RI are referenced.

1.1 Project Setting

The PHSS is located in Portland, Oregon, on the lower Willamette River immediately downstream of the urban downtown. The Site extends from river mile (RM) 1.9 upstream to RM 11.8 and covers 2,190 acres (Figure 1). There are two reaches located immediately upstream of the Site. The Downtown Reach, which includes the urbanized area of downtown Portland, is defined by EPA as extending from RM 11.8 to RM 16.6. EPA defines the Upriver Reach as extending from RM 16.6 to RM 28.4. Collectively, the river from RM 11.8 to 28.4 is referred to as the D/U Reach.

1.2 Project Overview

The target species of the PDI 2018 Fish Tissue Study is smallmouth bass (SMB; *Micropterus dolomieu*) because of their abundance, more limited home range, extensive historical chemistry database, and importance in the baseline human health risk assessment (BHHRA). This study

builds on prior SMB sampling in the PHSS, including the 2002 and 2007 RI, the 2011 program (GSI Water Solutions, Inc. [GSI] 2011), and the 2012 program (Windward Environmental 2012)[1]. The focus of this sampling effort is the collection of whole body SMB throughout the Site and upstream of the Site to characterize current concentrations of ROD Table 17 contaminants of concern (COCs).

1.3 Fish Tissue Sampling Goals and Objectives

The PDI sampling provides a synoptic baseline chemistry dataset for sediment, fish tissue, and surface water for use in future long-term monitoring of the PHSS. As outlined in the QAPP, the goals of the PDI for fish tissue sampling include the following:

- Characterize current levels of fish tissue COCs in resident SMB tissue on a site-wide basis and smaller spatial scale.
- Characterize upriver concentrations in fish tissue.
- Update statistically based evaluations of polychlorinated biphenyl (PCB) differences and changes in fish tissue concentrations.
- Update and evaluate study area conditions to refine the CSM for all pathways consistent with the ROD.

2. SAMPLING DESIGN AND APPROACH

This section describes the sample design, sampling schedule, sample locations, sample size, and other sampling considerations. The overall design and methods are consistent with the *Sampling and Analysis Plan: Portland Harbor 2011 Baseline Smallmouth Bass Tissue Study* (GSI 2011) and *Portland Harbor RI/FS: 2012 Modifications to the Field Sampling Plan for Bass Tissue* (Windward Environmental 2012).

2.1 Fish Sampling Design

SMB have been collected from the Site several times, including 2002, 2007, 2011, and 2012, and analyzed for COCs in fillet and whole body tissue using individual and composite samples. The overall PDI sample design for SMB is consistent with the most recent and approved 2012 SMB program, which included sampling and analysis of whole body specimens throughout the Site and a portion of the D/U Reach. The design includes collection of one specimen from each of 95 sampling locations within the Site, as well as 20 specimens from the Downtown Reach and 20 from the Upriver Reach. The target number of specimens within the Site is the same as the 2012

[1] SMB tissue chemistry data collected as part of the 2011 and 2012 sampling programs were not included in the RI dataset.

program. While a total of 135 SMB are targeted, the number collected will be to the extent sufficient numbers of fish are present in the summer/fall of 2018.

2.2 Fish Sampling Schedule

Fish collection is expected to include two 10- to 12-day sessions: one session in August before Labor Day and one in September after Labor Day. This schedule includes a safety rest break over the Labor Day holiday weekend. The field schedule may be affected by adverse weather and fishing success. At the end of the first 10- to 12-day sampling session, the SMB catch rate will be evaluated in consultation with EPA to determine if adjustments to the FSP are needed to achieve the target sample number.

An optional boat electrofishing session (described below in Section 4.3.2) is proposed if numbers of specimens caught by hook-and-line angling at the proposed sampling locations are not sufficient.

2.3 Sampling Locations

A total of 135 sampling locations are proposed for the 2018 Study (Figures 2a and 2b). Within the PHSS, the 95 sampling locations include areas that were successful in the 2011 and 2012 SMB studies and provide coverage of both sides (east and west) of the river and the SMAs. The sample design targets 20 to 30 samples in each of the four segments of the PHSS: RM 1.9 to 5 (Segment 4); RM 5 to 7.5 (Segment 3); RM 7.5 to 9 (Segment 2); and RM 9 to 11.8 (Segment 1) with samples collected from the east and west sides of the river. Within the D/U Reach, 40 sampling locations are proposed to characterize upriver concentrations in resident fish tissue. Half of the sampling locations (n=20) are in the Downtown Reach and include locations previously sampled in the 2011 and 2012 programs. The remaining 20 sampling locations are located throughout the Upriver Reach up to Willamette Falls. Table 1 presents the proposed 2018 sample locations (final positioning will change based on the specific locations where fish are caught).

2.4 Specimen Lengths

Consistent with the 2011 and 2012 sampling, SMB that are 225 to 355 millimeters (mm) in total length (approximately 9 to 14 inches) will be targeted. Specimens that do not meet the target size range will be released. SMB larger than 355 mm may be retained for archival at the selected laboratory for possible future analysis. If there are insufficient numbers of SMB collected in the target size range, larger SMB of up to 460 millimeters will be accepted if necessary based on consultation with EPA. Specimens will be measured in millimeters as shown in Appendix B, Field Forms: Specimen Tally and Location Form.

2.5 Other Sampling Considerations

The specimens will be frozen and shipped to the laboratory for processing as whole fish samples. No compositing or filleting of SMB specimens will occur in the field. If any tagged fish from the Fish Tracking Study are caught, the tagged fish will not be retained. The capture location and tag identification number will be documented and the tagged fish returned to the water as carefully and quickly as possible.

2.6 Key Changes from Previously Approved FSPs

Fish sampling will be performed in accordance with EPA-approved project plans (GSI 2011, Windward Environmental 2012), except where noted. Key PDI changes include the following:

- Samples will be analyzed for the COCs listed in ROD Table 17 for fish tissue (presented in Table 6 of the PDI Work Plan).
- In addition to sample preparation and analysis by Axys, an additional laboratory (ALS) will be used for analysis of specific ROD Table 17 COCs, as specified in Section 5 of this FSP and the project QAPP.
- Tissue sample identification codes will be modified to describe the 2018 PDI sampling, as described in Section 4.2.1 of the QAPP.

3. PROJECT ORGANIZATION AND FIELD TEAM

3.1 Team Organization and Responsibilities

EPA is the lead agency overseeing the work. The EPA Project Manager is Davis Zhen. EPA will be assisted in the review of technical documents by an oversight contractor.

Team organization is presented in detail in the PDI Work Plan and in Section 2 of the QAPP (AECOM and Geosyntec 2018a). As it relates to this FSP, AECOM is coordinating activities, including management of all subcontractors, field sampling, analysis, and reporting scoping tasks.

The PDI Project Coordinator, Mr. Ken Tyrrell, and PDI Project Manager, Dr. Jennifer Pretare, Ph.D. (AECOM), will be responsible for overall project coordination and providing oversight on planning and coordination, work plans, all project deliverables, and performance of the administrative tasks needed to ensure timely and successful completion of the project. Ms. Betsy Ruffle (AECOM) will serve as the senior technical lead for this study. Dr. Pretare is also the Project Field Coordinator (FC). In this role, she will oversee all phases of work, including planning, permitting, health and safety, logistics, field sample collection, sample packaging, and shipment to the laboratory. Dr. Pretare will be responsible for overall field study implementation

and field data quality. Deviations from this FSP will not be made without prior approval from the FC. Dr. Pretare will oversee the preparation of the field report.

Mr. Andy Clodfelter and Mr. Glen Mejia (AECOM) are the Fish Tissue Study fisheries biologists. Ms. Josie Smith (AECOM) will be a qualified Fish Supervisor. Mr. Clodfelter, Mr. Mejia, or Ms. Smith may act as field supervisor at times when Dr. Pretare is not present at the study area. All are qualified to implement fish tissue collection, maintain field documentation, and address any stipulations that may arise from scientific collection permits or Endangered Species Act (ESA) compliance for the study. The team will include fisheries biologists who are trained and qualified to identify and document any incidental catch of ESA-listed species.

The research vessels (RV) for this study will be provided by Gravity Marine Services (Gravity). Mr. Shawn Hinz is the point of contact for Gravity. One primary RV will be at least 30 feet in length and have capacity for up to 8 people, including observers, fishing gear, and coolers for sample storage. A second RV will be a smaller "jon boat" of less than 15 feet in length for navigating into nearshore areas. Gravity will provide RV captains and crew who are qualified to fish for SMB and to assist in tissue collection procedures. All team members will have valid State of Oregon fishing licenses.

The Oregon Bass & Panfish Club will assist as fishing guides and anglers. Volunteers from this organization have assisted the LWG and EPA in previous studies and have experience supporting scientific studies within Portland Harbor.

3.2 Communication/Information Flow

The communication strategy is outlined in Section 2 of the QAPP. The FC will be the point of contact for field staff during the implementation of this FSP. Deviations from this FSP or the project-specific QAPP will be reported to the PDI Project Manager for consultation. Significant deviations from the FSP/QAPP will be further reported to representatives of the Pre-RD AOC Group and EPA.

3.2.1 Coordination with EPA

The PDI Project Coordinator will notify the EPA Project Manager a minimum of 1 week prior to beginning any field activities so that EPA can schedule any oversight activities required. The PDI Project Coordinator will also notify the EPA Project Manager once field activities have been completed.

4. SAMPLE COLLECTION PROCEDURES

This section describes the procedures and methods that will be used for sample collection; recordkeeping; sample handling, storage, and shipping protocols; and field quality assurance (QA)/quality control (QC) procedures. Sample collection will follow procedures outlined in the

2012 Modifications to the Field Sampling Plan for Bass Tissue (Windward Environmental 2012) and the *Sampling and Analysis Plan: Portland Harbor 2011 Baseline Smallmouth Bass Tissue Study* (GSI 2011). The intended sample locations are described in Section 2.3 and displayed in Figures 2a and 2b and Figures 3a through 3i. Sampling will be conducted using a two-boat team. The smaller boat will have a boat operator and an angler. The remaining team members and any observers will be located on the larger RV. The precise team configuration may vary on a given day, but at a minimum one scientist and one angler not otherwise engaged in vessel operations will be present. The boat operator and deck hand will also serve as an angler when not operating the vessels. All field work will be conducted in accordance with the project-specific Health and Safety Plan (AECOM and Geoysntec 2018b). Standard Operating Procedures (SOPs) associated with the fish tissue collection program are provided in Appendix A.

4.1 Sampling Vessel and Equipment

Sampling vessels will be provided and operated by Gravity. The proposed sampling vessels are R/V *Tieton* or other vessels at least 22 feet in length with space for gear, staff, and an observer. The R/V *Tieton* is a 32-foot landing craft type vessel with a 16-foot working deck that provides a stable platform for fish sampling and angling.

4.2 Station Positioning and Navigation

Station position and navigation will be performed using methods outlined in the SOP for Horizontal and Vertical Survey Control (Appendix A) . For the Fish Tissue Study, the hand held Trimble R1 GPS units described on page 5 of the SOP will be used to collect latitude and longitude coordinates. The standard projection method to be used during field activities is Horizontal Datum: North American Datum of 1983 (NAD83), State Plane Coordinate System, Oregon North Zone. Survey control points PH-1 and/or PH-2 will be used as a daily accuracy check, depending on where field crews are operating on a given day.

The positioning objective is to accurately determine and record the position of the sampling vessel at each planned sampling location to within 1 to 2 meters. Once positioned at a planned sampling location, SMB angling specialists and fisheries biologists will determine fishing spots based on specific habitat preferences for SMB and angler expertise. The intent is to focus on fishing in spots with a high probability to capture SMB while still maintaining distribution of sampling locations spread throughout the PHSS and D/U Reach. The fish sample collection location will be recorded. Water depth of the fish sample location will be recorded using the research vessel’s depth transducer, when available. In shallow water, a visual estimate or lead line measurement of depth may be used.

4.3 Fish Collection

4.3.1 Angling

The fish collection SOP is provided in Appendix A. Angling will be conducted using a standard rod and reel with monofilament line (6-12 pound test). SMB can be caught with a variety of lures, depending on the desired sampling depth. For example, lead-weighted hooks with attached green-rubber tube jigs can be used to fish the bottom, while plastic crank baits resembling small fish or crayfish can be used to fish the shallower surface waters (zero to 4 meters). An electric trolling motor will be used on the Gravity-operated jon boat to more accurately access specific angling locations and enable the complete coverage of selected areas. Angling for SMB will be conducted primarily from 7:00 a.m. to 7:00 p.m. Once caught, fish will be handled using nitrile gloves, unhooked, and its length measured in millimeters on a decontaminated measuring board. If a collected SMB is within the target size, it will be euthanized, weighed, and placed into individual labeled resealable plastic bags and placed in a cooler with ice as described in Section 4.3.4. AECOM scientists will be on board each boat to handle and document the fish and to record the GPS coordinates of the capture location of each fish electronically and in the sampling records.

If ESA-listed species are caught during angling, all fishing efforts will stop in that sampling area and the field crew will move to a different sampling area, as directed by the fisheries biologist onboard. The species and specimen health will be recorded on the tally form as described in Section 4.3.4, Field Sample Handling, and the fish will be returned to the water as quickly as possible. The National Marine Fisheries Service (NMFS), EPA, and Oregon Department of Fish and Wildlife (ODFW) will be notified by email at the end of the sampling day. The procedures for reporting incidental catch of ESA-listed species will be confirmed during pre-sampling coordination with NMFS.

4.3.2 Boat Electrofishing

If an insufficient number of SMB are caught by angling, boat electrofishing is proposed as an alternate collection method. Selection of boat electrofishing gear will be based on biological and environmental factors that influence gear efficiency. If boat electrofishing is required, an addendum to this FSP will be developed. The decision to implement electrofishing will be made in concert with EPA, and electrofishing would likely occur in mid to late September after initial angling efforts have been completed.

4.3.3 Contingency Plan for Collecting Samples

During fish sampling efforts, the field crew may encounter field conditions that preclude collection of a SMB specimen at the planned sampling location. For example, the combination of unsuitable river levels, currents, bathymetry, physical obstructions, and absence of catchable fish may preclude collecting a sample at the target sampling location. If no target-sized SMB are captured within 30 minutes at a single planned sampling location, the field crew will move to

another planned sampling location. Effort will be taken to revisit target fish collection locations that were previously unproductive during the early morning or evening when SMB are more active feeders. Unproductive target locations will be visited at least twice if a sample is not collected from that location during the initial visit. If fishing effort is unproductive at a planned sampling location during the second visit, the field crew will select an alternate sampling location in an under-represented area to maintain targeted spatial distribution of collected samples and ensure sampling is sufficiently spread throughout the four segments of the PHSS and D/U Reach and each side of the river is properly represented. Samples will be assigned the sample identification (ID) of the closest planned sample station. Handheld GPS units will be pre-programmed with sampling target locations as shown in Table 1 of the FSP. Anglers will use their current location as displayed on the handheld GPS to determine the closest planned sample location. The planned number of samples relative to sample stations, segment, and east or west sides of the river will be tallied in the logbook daily. Each day, the spatial data will be downloaded and post-processed as described in the Data Quality Management Plan. The tally of sampling locations will be updated if needed and communicated to the field team daily.

4.3.4 Field Sample Handling

All field equipment used to collect and process fish will be decontaminated. All buckets, measuring boards, handheld scales, and coolers used to retrieve and store fish will be washed with Alconox™ soap and rinsed in river water before sampling is initiated at each location.

The number and species of all fish caught during the sampling will be recorded on the Fishing Effort and Tally Form provided in Appendix B, Field Forms. The Fishing Effort and Tally Form will be used to record fish that were caught but not collected for various reasons (incorrect species or size) and to document fishing start-stop times.

Fish will be measured for total length by placing them on a measuring platform. The total length of a fish will be measured from the anterior-most part of the fish to the tip of the longest caudal fin ray (when the lobes of the caudal fin are compressed dorsoventrally). If the fish does not meet the target length range, the specimen will be returned to the river. Fish will be photographed as specified in the field documentation SOP.

Retained fish will be euthanized and weighed using a handheld scale suited for the weight of the fish. Weights of the fish will be measured in grams. Fish will be euthanized using a lethal dose of the anesthetic MS-222 (or other method recommended by the NMFS and/or ODFW, or as stated in the Scientific Take Permit). Once weighed, the fish sample will be wrapped in piece of clean aluminum foil and placed inside a resealable plastic bag as described in SOP-04 (Appendix A). All SMB processing will be performed on the larger primary research vessel. If SMB are caught on the smaller jon boat, they will be transferred to the larger researcher vessel for processing.

A weatherproof label will be filled out and adhered to the inside of a smaller resealable plastic bag. The plastic bags containing the fish and the label then will be placed inside a third resealable plastic bag. All labels will be marked with the date, time, project name (or case

number), sample ID, and initials of the sampler, and the fish sample will be placed in a cooler with ice, as outlined in Section 4.3.4 of the QAPP and attached SOPs (Appendix A). Each retained fish and sample location will be photographed. GPS coordinates will be recorded in the field logbook.

At the end of each day, the coolers will be transported to the secure AECOM Sampling Processing Facility (1115 S.E. Caruthers Street), which will serve as a temporary processing and storage facility. The RVs may transfer fish coolers to field team members at the Swan Island Boat Ramp throughout the day depending on the success of the fish collection efforts. The fish will be transferred to a chest freezer for frozen storage at the AECOM facility. Once frozen, the fish will be placed into coolers with dry ice before shipment to the contract laboratory.

4.4 Management of Investigation-Derived Waste

Fish collected but not retained for analysis will be immediately returned to the lower Willamette River from where they were collected. Water containing diluted amounts of phosphate-free detergent (i.e., Alconox) used for decontaminating the sample processing equipment will also be released to the lower Willamette River at the same sample location. Other consumables such as disposable sampling equipment, fish surgical tools, and gloves will be bagged for disposal and managed as a solid waste and discarded as general municipal waste.

5. LABORATORY ANALYSIS

The chemical analysis of tissue samples will be performed by the following laboratories, or as specified in the QAPP (AECOM and Geosyntec 2018a):

- SGS Axys Analytical Services in British Columbia, Canada, will homogenize each whole body specimen as a discrete sample and analyze the samples for: chlorinated pesticides and hexachlorobenzene, PCB congeners, dioxins/furans congeners, polybrominated diphenyl ethers (PBDEs), and lipids.

- ALS Environmental in Kelso, Washington, will analyze homogenized tissue samples for arsenic, mercury, bis-2-ethylhexylphthalate (BEHP), and pentachlorophenol.

Laboratory QC and data validation protocols will be followed to ensure that data quality and representation are in accordance with method requirements. Additional information is provided in the QAPP. Laboratory QA/QC will be maintained through the use of standard EPA methods and other accepted methods and standard analytical procedures for the target analytes.

6. DATA MANAGEMENT AND REPORTING

All data management will be performed according to the QAPP and Data Quality Monitoring Plan.

6.1 Field Documentation and Reporting

A bound field logbook will be assigned to and maintained by AECOM field team members to provide daily records of significant events, observations, and measurements during the field effort. Each page will be numbered, signed, and dated. Logbooks will be retained as permanent records and will be kept on each sampling vessel. Complete field record-keeping details can be found in the project QAPP.

A brief activity log will be filed with the FC at the completion of each working day. This log will summarize the work activities undertaken/completed each day, progress, personnel on-site, hours worked, health and safety concerns, and any technical issues encountered. Field logbooks and field data sheets completed during fish collection activities will be scanned and emailed to the FC at the conclusion of each working day (or as soon as practically possible).

6.2 Plan Deviations

Deviations to this FSP potentially include the sampling of alternate stations or scope reductions/enhancements related to site conditions or real-time information. Safety will be given the highest priority in all aspects, and the Project FC/PDI Project Manager will be responsible for documenting all plan deviations.

6.3 Data Management and Retention

All related documentation is to be maintained in the project file either in electronic or hardcopy form. All hardcopy records will be maintained in the project file; all electronic records will be maintained in project-specific directories within AECOM's network and a final electronic data deliverable (EDD) will be provided to EPA at the conclusion of the PDI study.

7. REFERENCES

AECOM (AECOM Technical Services) and Geosyntec (Geosyntec Consultants, Inc.). 2018a. Quality Assurance Project Plan. Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling, Portland Harbor Superfund Site, Portland, Oregon. March.

AECOM and Geosyntec. 2018b. Programmatic HAZWOPER Health and Safety Plan. Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling. Portland Harbor Superfund Site. March 2018.

EPA (United States Environmental Protection Agency). 2016a. Portland Harbor RI/FS, Final Remedial Investigation Report, Portland, Oregon. United States Environmental Protection Agency Region 10, Seattle, Washington. 8 February.

EPA (United States Environmental Protection Agency). 2016b. Portland Harbor RI/FS, Final Feasibility Study. Portland, Oregon. United States Environmental Protection Agency Region 10, Seattle, Washington. June.

EPA. 2017a. Record of Decision Portland Harbor Superfund Site, Portland, Oregon. United States Environmental Protection Agency Region 10, Seattle, WA. January.

EPA. 2017b. Administrative Settlement Agreement and Order on Consent and Statement of Work for Pre-Remedial Design Investigation and Baseline Sampling. Agreement between EPA Region 10, Seattle Washington and the Pre-Remedial Design Group. CERCLA Docket No. 10-2018-0236. December 19.

Geosyntec (Geosyntec Consultants, Inc.). 2017. Final Work Plan. Portland Harbor Pre-Remedial Design Investigation Studies, Portland Harbor Superfund Site, Portland, Oregon. Prepared for the Pre-RD AOC Group for submittal to EPA Region 10 (attached to the final Statement of Work). December 19.

GSI (GSI Water Solutions, Inc.). 2011. Portland Harbor 2011 Baseline Smallmouth Bass Tissue Study, Sampling and Analysis Plan, Willamette River, Portland, Oregon. Prepared for U.S. Environmental Protection Agency, U.S. Army Corps of Engineers, and City of Portland.

Integral Consulting. 2007. Portland Harbor RI/FS Round 3B Field Sampling Plan for Fish and Invertebrate Tissue and Co-located Surface Sediment, Appendix C: Standard Operating Procedures for Fish Tissue Processing and Shipping. Integral Consulting Inc. Mercer Island, WA.

Windward Environmental. 2012. Portland Harbor RI/FS: 2012 Modifications to the Field Sampling Plan for Bass Tissue. Prepared for the Lower Willamette Group, Portland, OR. Windward Environmental LLC, Seattle, WA.

TABLES

Table 1. Sample Identification Number and Coordinates

Sample Identification Number	X Coordinate	Y Coordinate
1	7617437.7142	724272.0737
2	7617263.7133	723910.0749
3	7617134.7124	723598.0760
4	7617024.7111	723191.0772
5	7616907.7092	722636.0788
6	7616830.7075	722149.0802
7	7616816.7057	721700.0814
8	7615061.7092	721237.0857
9	7616822.7032	721094.0829
10	7615093.7067	720644.0872
11	7615153.7044	720121.0885
12	7615191.7022	719604.0898
13	7615224.6998	719042.0913
14	7618403.6826	717182.0898
15	7618976.6808	717174.0887
16	7617968.6828	716893.0914
17	7618159.6799	716318.0925
18	7616685.6813	715566.0974
19	7616879.6789	715130.0981
20	7618423.6767	715734.0934
21	7617145.6766	714745.0986
22	7617334.6745	714359.0991
23	7617495.6725	713994.0997
24	7619391.2799	714508.5321
25	7619824.7946	713282.6833
26	7618265.6635	712344.1021
27	7618709.6592	711594.1030
28	7619090.6557	711000.1035
29	7619452.6523	710436.1041
30	7619834.6489	709867.1045
31	7621605.6410	709180.1019
32	7621091.6390	708320.1051
33	7622526.6347	708289.1016
34	7621964.6324	707290.1053
35	7623394.6288	707436.1014
36	7622760.6270	706526.1050
37	7623615.6220	705897.1042
38	7624258.6239	706845.1005
39	7624442.6179	705458.1030
40	7625192.6185	706169.0995
41	7625134.6142	705025.1021
42	7626030.6094	704480.1008
43	7626773.6108	705582.0947
44	7627152.6096	705654.0925
45	7626699.6032	703567.0991

Sample Identification Number	X Coordinate	Y Coordinate
46	7627580.6026	704319.0928
47	7627609.5963	702777.0957
48	7628673.5951	703557.0885
49	7629560.5900	703150.0845
50	7628446.5899	702011.0928
51	7629919.5861	702534.0839
52	7628532.5858	701058.0942
53	7630455.5822	702097.0819
54	7628808.5824	700472.0939
55	7631196.5775	701677.0788
56	7631959.5738	701523.0750
57	7630201.5742	699831.0878
58	7632539.5722	701705.0715
59	7630870.5685	699074.0858
60	7633192.5680	701318.0688
61	7632882.5670	700741.0717
62	7631605.5609	697908.0843
63	7634185.5620	700811.0646
64	7632424.5548	697204.0814
65	7632957.5517	696951.0791
66	7633409.5492	696796.0771
67	7634401.5508	698198.0689
68	7635462.5526	699730.0600
69	7633863.5467	696619.0750
70	7634827.5476	697830.0674
71	7634364.5433	696280.0731
72	7635448.5434	697402.0650
73	7636408.5451	698803.0570
74	7636177.5386	696933.0622
75	7636817.5347	696589.0595
76	7637472.5302	696135.0571
77	7637191.5232	694077.0630
78	7637653.5226	694390.0599
79	7638614.5233	695559.0523
80	7638374.5181	693994.0569
81	7639902.5138	694478.0479
82	7639060.5129	693389.0547
83	7640408.5076	693415.0476
84	7639756.5075	692725.0525
85	7641240.5001	692370.0455
86	7640899.4948	690703.0510
87	7641982.4878	690029.0469
88	7643359.4818	689911.0400
89	7643030.4791	688912.0439
90	7644012.4769	689339.0379
91	7644650.4721	688795.0359

Sample Identification Number	X Coordinate	Y Coordinate
92	7644119.4706	687877.0407
93	7645078.4677	688101.0352
94	7645566.4626	687313.0345
95	7645132.4623	686811.0379
96	7645445.3815	686564.7458
97	7645822.0459	686849.6407
98	7646853.5698	685599.2552
99	7646331.3209	684049.3944
100	7646579.3624	682830.8042
101	7646291.7428	681175.8296
102	7645250.4226	679628.3747
103	7646565.1471	676323.0265
104	7647960.6522	675471.2880
105	7646167.0084	673739.5106
106	7648189.1830	673056.6121
107	7646255.1585	672363.1848
108	7649903.0087	670977.8868
109	7645328.9706	671121.7443
110	7646369.4045	669386.5068
111	7647151.3829	668746.0813
112	7648972.6263	668328.1753
113	7647120.3784	667557.0862
114	7646048.2965	666503.0160
115	7645738.3739	665044.1027
116	7646059.3635	662694.1106
117	7647690.2094	661083.1267
118	7648242.2985	659449.6374
119	7648368.3358	657765.1203
120	7649424.3242	655746.1240
121	7651899.5541	655207.5844
122	7650961.5815	653033.4509
123	7650258.8245	650650.3818
124	7649306.6071	649544.8133
125	7648122.9732	645258.2968
126	7648711.1566	642577.7052
127	7650472.2796	641304.3745
128	7651101.5355	640038.5982
129	7654016.7734	637440.0272

Sample Identification Number	X Coordinate	Y Coordinate
130	7655627.8143	635179.3946
131	7657722.9447	631679.4096
132	7658373.9784	629403.4713
133	7660736.7413	628686.4587
134	7661588.8947	625612.0704
135	7658407.3683	622302.4298

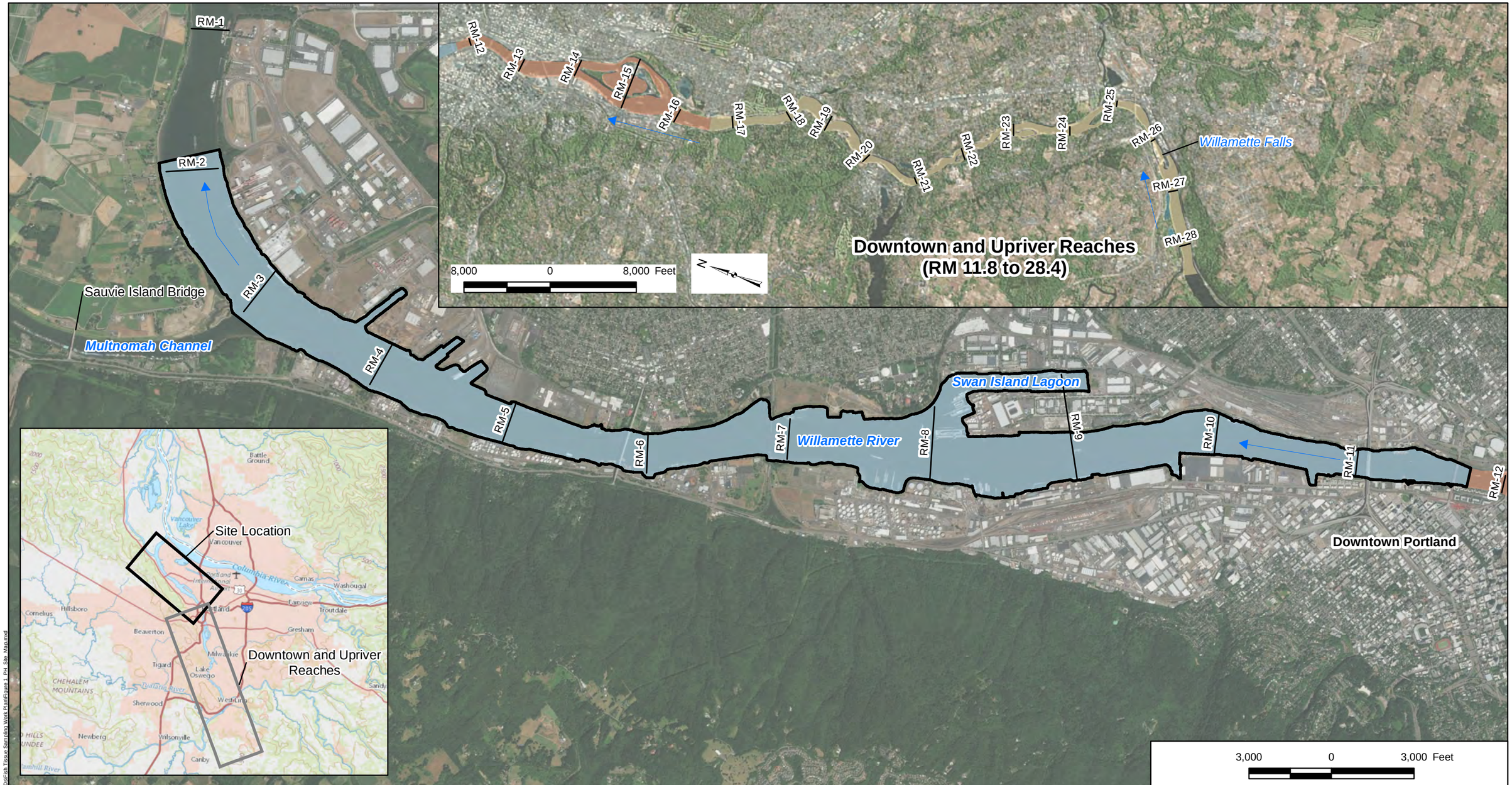
Notes:

1. Samples numbered sequentially based on location downstream to upstream from RM 1 to 135 (matches methodology used for other sampling locations).

2. Horizontal Projection: NAD 1983 Oregon State Plane North (Intl Feet)

Acronyms:
RM = river mile
NAD = North American Datum

FIGURES



Legend

- Flow Direction
- River Mile Marker
- Superfund Site Boundary (RM 1.9 to 11.8)

Study Area

- Site Area (RM 1.9 to 11.8)
- Downtown Reach (RM 11.8 to 16.6)
- Upriver Reach (RM 16.6 to 28.4)

Note:
1. Aerial Imagery provided by ESRI Basemaps 2016

Portland Harbor Site Map

Portland Harbor Superfund Site
PDI Fish Tissue FSP

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Figure 1

Path: P:\Projects\Portland Pre-Design\PN\0767A\900\GIS and CAD\MXD\Fish Tissue Sampling Work Plan\Figure 1_PH_Site_Map.mxd

Legend

- ★ Proposed Fish Tissue Sample Location (n = 135)
- Superfund Site Boundary (RM 1.9 to 11.8)
- Alternative F Mod SMA Footprint

Note:
1. Aerial Imagery provided by ESRI Basemaps 2017
2. n - sample count, RM - River Mile, SMA - Sediment Management Area
3. Site defined as RM 1.9 to 11.8
4. The Downtown Reach is defined by EPA as extending from RM 11.8 to RM 16.6 and Upriver Reach is defined by EPA as extending from RM 16.6 to RM 28.4
5. Fish tissue sample collection locations shown in this figure are proposed and do not reflect final positioning based on field conditions

Summary of Proposed Fish Tissue Sampling Locations (RM 1.9 to 20)

Portland Harbor Superfund Site
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Figure **2a**

Path: P:\Projects\Portland Pre-Design PN\60707A\900 GIS and CAD\MXDs\Fish Tissue Sampling Work Plan\Figure 2a_PH_FishTissueAll.mxd

2,000 0 2,000 Feet

Legend

★ Proposed Fish Tissue Sample Location (n = 135)

Alternative F Mod SMA Footprint

Note:
1. Aerial Imagery provided by ESRI Basemaps 2017
2. n - sample count, RM - River Mile, SMA - Sediment Management Area
3. Site defined as RM 1.9 to 11.8
4. The Downtown Reach is defined by EPA as extending from RM 11.8 to RM 16.6 and Upriver Reach is defined by EPA as extending from RM 16.6 to RM 28.4
5. Fish tissue sample collection locations shown in this figure are proposed and do not reflect final positioning based on field conditions

Summary of Proposed Fish Tissue Sampling Locations (RM 20 to 28.4)

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PDI Fish Tissue FSP

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Figure **2b**

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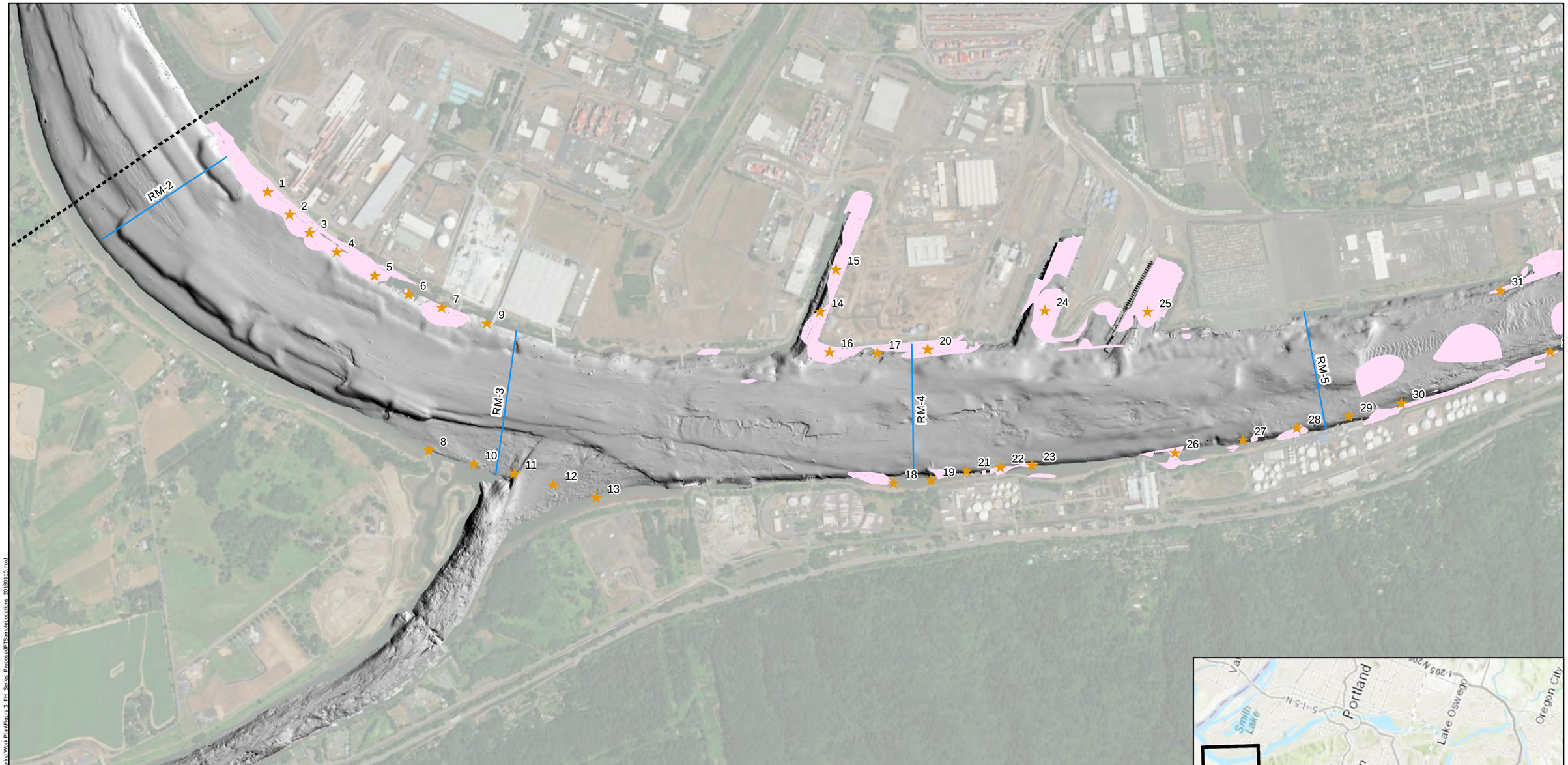
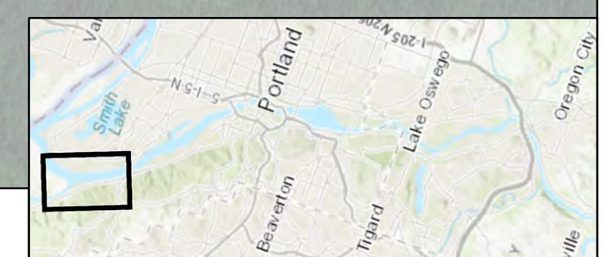
Path: P:\Projects\Portland Pre-Design PN\0076\A900\GIS and CAD\MXD\Fish Tissue Sampling Work Plan\Figure 2b_PH_FishTissueAll.mxd





Legend

- Proposed Fish Tissue Sample Location (n = 135)
- Superfund Site Boundary (RM 1.9 to 11.8)
- River Mile Marker
- Capped Area (Existing)
- Alternative F Mod SMA Footprint

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2 Hillshade derived from 2009 NOAA bathymetric survey.
3. n - sample count, RM - river mile, SMA - Sediment Management Area.

N

1,000 500 0 1,000 2,000 Feet

Proposed Fish Tissue Sampling Locations RM 1.9 to 5

Portland Harbor Superfund Site
PDI Fish Tissue FSP

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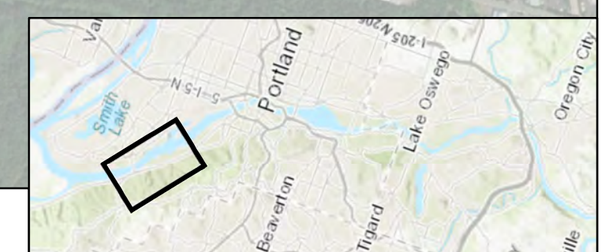
Figure **3a**

MI/SEA | March 23 2018

Path: P:\Projects\Portland Pre-Design\PN\G076\EA\900\GIS and CAD\MXD\sFish Tissue Sampling Work Plan\Figure 3_PH_Series_ProposedFTSampleLocations_20180110.mxd



Legend

- Proposed Fish Tissue Sample Location (n = 135)
- Superfund Site Boundary (RM 1.9 to 11.8)
- River Mile Marker
- Capped Area (Existing)
- Alternative F Mod SMA Footprint

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2 Hillshade derived from 2009 NOAA bathymetric survey.
3. n - sample count, RM - river mile, SMA - Sediment Management Area.

N

1,000 500 0 1,000 2,000 Feet

Proposed Fish Tissue Sampling Locations RM 5 to 8

Portland Harbor Superfund Site
PDI Fish Tissue FSP

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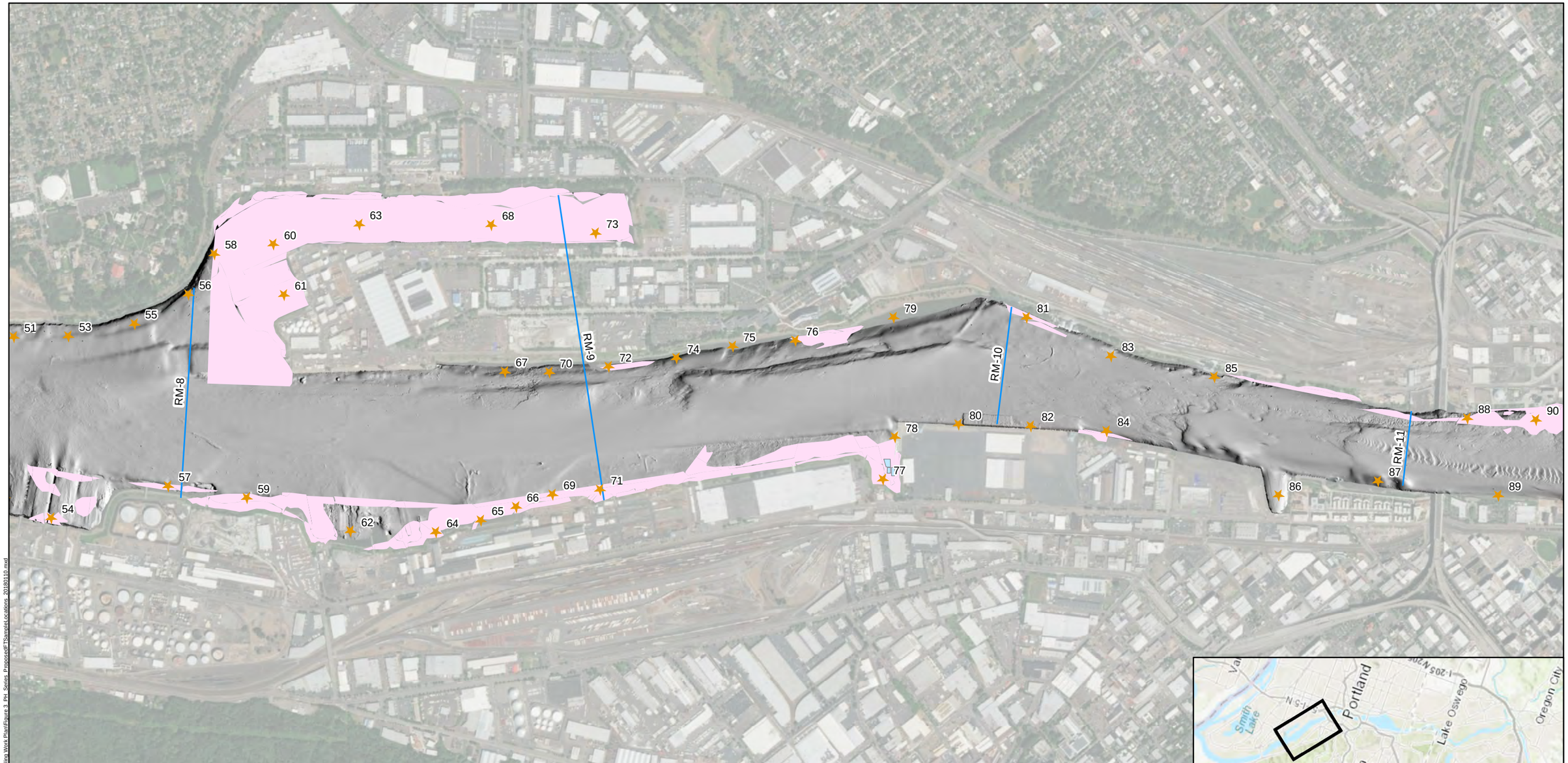
Figure 3b

MI/SEA | March 23, 2018

Path: P:\Projects\Portland Pre-Design PN\60767A\900 GIS and CAD\MXD\Fish Tissue Sampling Work Plan\Figure 3_PH_Series_ProposedFTSampleLocations_20180110.mxd



Legend

- Proposed Fish Tissue Sample Location (n = 135)
- Superfund Site Boundary (RM 1.9 to 11.8)
- River Mile Marker
- Capped Area (Existing)
- Alternative F Mod SMA Footprint

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2 Hillshade derived from 2009 NOAA bathymetric survey.
3. n - sample count, RM - river mile, SMA - Sediment Management Area.

N

1,000 500 0 1,000 2,000 Feet

Proposed Fish Tissue Sampling Locations RM 8 to 11

Portland Harbor Superfund Site
PDI Fish Tissue FSP

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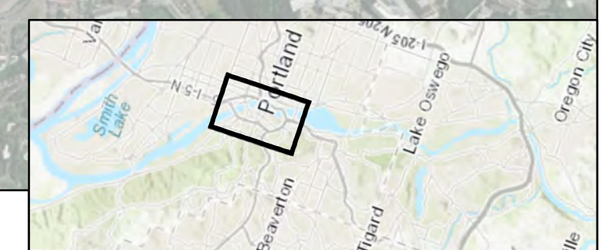
Figure 3c

MI/SEA | March 23 2018

Path: P:\Projects\Portland Pre-Design\PN\G0767A\9\90\GIS and CAD\MXDs\Fish Tissue Sampling Work Plan\Figure 3_PH_Series_ProposedFTSampleLocations_20180110.mxd



Legend

- Proposed Fish Tissue Sample Location (n = 135)
- Superfund Site Boundary (RM 1.9 to 11.8)
- River Mile Marker
- Capped Area (Existing)
- Alternative F Mod SMA Footprint

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2 Hillshade derived from 2009 NOAA bathymetric survey.
3. n - sample count, RM - river mile, SMA - Sediment Management Area.

N

1,000 500 0 1,000 2,000 Feet

Proposed Fish Tissue Sampling Locations RM 11 to 14

Portland Harbor Superfund Site
PDI Fish Tissue FSP

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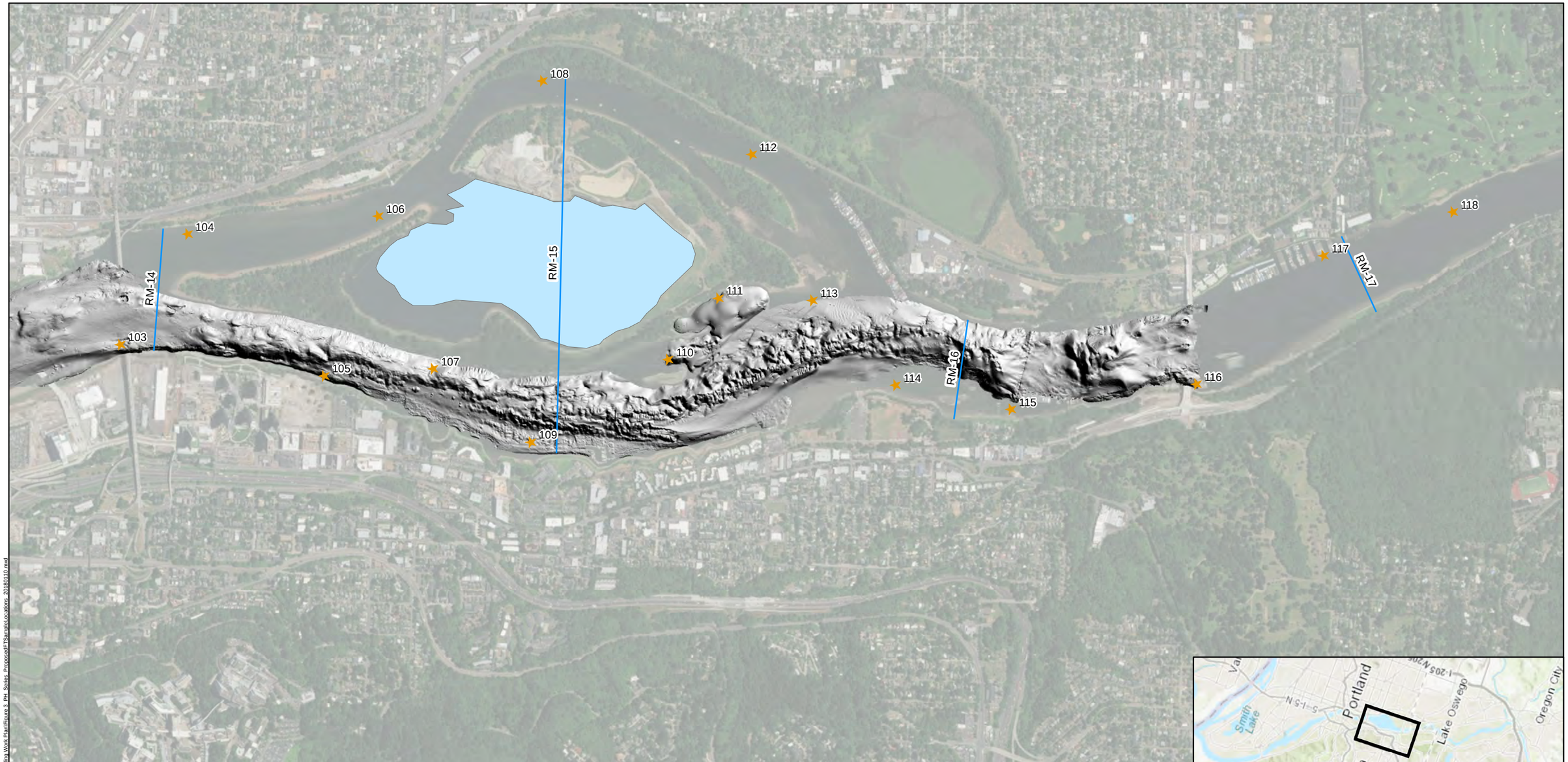
Figure 3d

MI/SEA | March 23, 2018

Path: P:\Projects\Portland Pre-Design\PN\G0767A\900\GIS and CAD\MXDs\Fish Tissue Sampling Work Plan\Figure 3 Pht. Series. ProposedFTSampleLocations_20180110.mxd



Legend

- ★ Proposed Fish Tissue Sample Location (n = 135)
- Superfund Site Boundary (RM 1.9 to 11.8)
- River Mile Marker
- Capped Area (Existing)
- Alternative F Mod SMA Footprint

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2 Hillshade derived from 2009 NOAA bathymetric survey.
3. n - sample count, RM - river mile, SMA - Sediment Management Area.

N

1,000 500 0 1,000 2,000 Feet

Proposed Fish Tissue Sampling Locations RM 14 to 17

Portland Harbor Superfund Site
PDI Fish Tissue FSP

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Figure 3e

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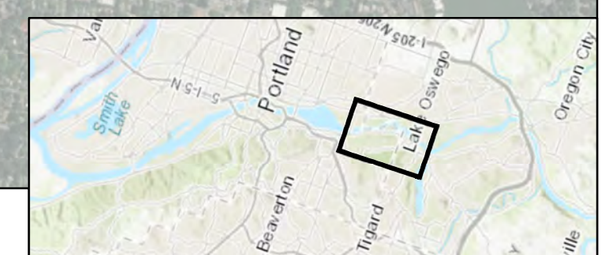
Path: P:\Projects\Portland Pre-Design PNG0767A\900 GIS and CAD\MXDs\Fish Tissue Sampling Work Plan\Figure 3_PH_Series_ProposedFTSampleLocations_20180110.mxd



Legend

- Proposed Fish Tissue Sample Location (n = 135)
- Superfund Site Boundary (RM 1.9 to 11.8)
- River Mile Marker
- Capped Area (Existing)
- Alternative F Mod SMA Footprint

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2 Hillshade derived from 2009 NOAA bathymetric survey.
3. n - sample count, RM - river mile, SMA - Sediment Management Area.

N

1,000 500 0 1,000 2,000 Feet

Proposed Fish Tissue Sampling Locations RM 17 to 20

Portland Harbor Superfund Site
PDI Fish Tissue FSP

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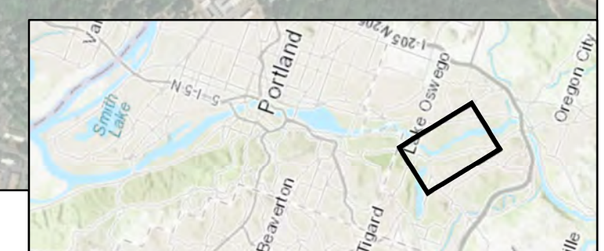
Figure 3f

MI/SEA | March 23, 2018

Path: P:\Projects\Portland Pre-Design\PN\0767A\900\GIS and CAD\MXD\Fish Tissue Sampling Work Plan\Figure 3_PH_Series_ProposedFTSampleLocations_20180110.mxd



Legend

- ★ Proposed Fish Tissue Sample Location (n = 135)
- Superfund Site Boundary (RM 1.9 to 11.8)
- River Mile Marker
- Capped Area (Existing)
- Alternative F Mod SMA Footprint

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2 Hillshade derived from 2009 NOAA bathymetric survey.
3. n - sample count, RM - river mile, SMA - Sediment Management Area.

N

1,000 500 0 1,000 2,000 Feet

Proposed Fish Tissue Sampling Locations RM 20 to 23

Portland Harbor Superfund Site
PDI Fish Tissue FSP

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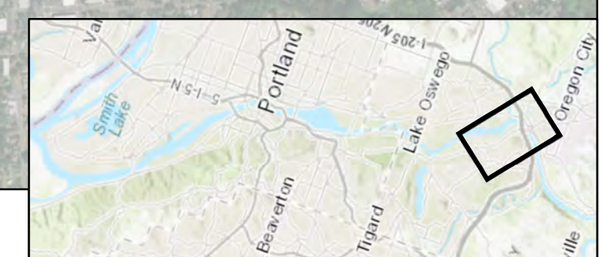
Figure **3g**

MI/SEA | March 23, 2018

Path: P:\Projects\Portland Pre-Design PN\0767A\900 GIS and CAD\MXDs\Fish Tissue Sampling Work Plan\Figure 3_PH_Series_ProposedFTSampleLocations_20180110.mxd



Legend

- ★ Proposed Fish Tissue Sample Location (n = 135)
- Superfund Site Boundary (RM 1.9 to 11.8)
- River Mile Marker
- Capped Area (Existing)
- Alternative F Mod SMA Footprint

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2 Hillshade derived from 2009 NOAA bathymetric survey.
3. n - sample count, RM - river mile, SMA - Sediment Management Area.

N

1,000 500 0 1,000 2,000 Feet

Proposed Fish Tissue Sampling Locations RM 23 to 26

Portland Harbor Superfund Site
PDI Fish Tissue FSP

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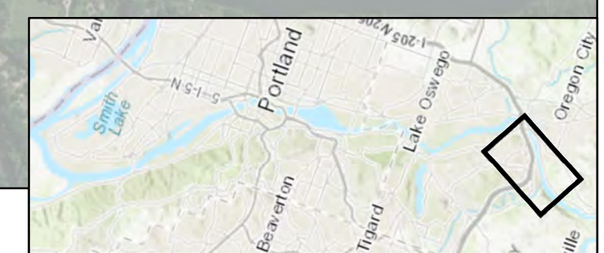
Figure 3h

MI/SEA | March 23, 2018

Path: P:\Projects\Portland Pre-Design\PN\0076\A\900\GIS and CAD\MXD\sFish Tissue Sampling Work Plan\Figure 3_PH_Series_ProposedFTSampleLocations_20180110.mxd



Legend

- ★ Proposed Fish Tissue Sample Location (n = 135)
- Superfund Site Boundary (RM 1.9 to 11.8)
- River Mile Marker
- Capped Area (Existing)
- Alternative F Mod SMA Footprint

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2 Hillshade derived from 2009 NOAA bathymetric survey.
3. n - sample count, RM - river mile, SMA - Sediment Management Area.

N

1,000 500 0 1,000 2,000 Feet

Proposed Fish Tissue Sampling Locations RM 26 to 28.4

Portland Harbor Superfund Site
PDI Fish Tissue FSP

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Figure 3i

MI/SEA | March 23, 2018

Path: P:\Projects\Portland Pre-Design PN G0767A\900 GIS and CAD\MXDs\Fish Tissue Sampling Work Plan\Figure 3_PH_Series_ProposedFTSampleLocations_20180110.mxd

APPENDIX A

Standard Operating Procedures

- Decontamination
- Digital Camera Use
- Field Documentation
- Fish Tissue Sampling
- Recording Sample Location
- Sample Labeling
- Sample Packaging and Shipping
- Horizontal and Vertical Survey Control (rev. August 2018)

STANDARD OPERATING PROCEDURE SOP-01

DECONTAMINATION

Scope and Applicability

This standard operating procedure (SOP) describes procedures for decontaminating sampling and processing equipment contaminated by inorganic and organic materials. To prevent potential cross-contamination of samples, all reusable sampling and processing equipment will be decontaminated before each use. Decontaminated equipment will be stored away from areas that may cause recontamination. When handling decontamination chemicals, field personnel will follow all relevant procedures and will wear protective clothing as stipulated in the project health and safety plan (HASP).

Equipment and Materials

Equipment and materials for this task include the following:

- Plastic bucket(s) (e.g., 5-gallon bucket)
- Properly labeled squirt bottles (or large spray bottles if needed)
- Long-handled, hard-bristle brushes
- Plastic sheeting, garbage bags, and aluminum foil
- Tap water or river water
- Personal protective equipment, as specified in the HASP

Decontamination Procedures

When necessary, reusable sampling equipment should be decontaminated before and after the sampling effort, between sampling stations, and at any other times specified by the field sampling plan (FSP). The specific procedures for decontaminating reusable sampling equipment are as follows:

1. Rinse the equipment thoroughly with tap or river water to remove any visible sediment or debris.
2. Pour a small amount of concentrated laboratory detergent (e.g., Alconox) into a bucket (e.g., about 1/2 tablespoon per 5-gallon bucket) and fill it halfway with tap or river water. If the detergent is in crystal form, all crystals should be completely dissolved prior to use.
3. Scrub the equipment in the detergent solution using a long-handled brush with rigid bristles, using a back-and-forth motion. Be sure to clean the outside of samplers,

bowls, and other tools that may be covered with sediment or tissue. Remove all particulate matter and surface films.

4. Rinse with tap or river water. Equipment does not need to be dried before use.
5. If the decontaminated sampling equipment is not to be used immediately, wrap small items in aluminum foil (dull side facing the cleaned area).
6. If the sample collection or processing equipment is cleaned at the field laboratory and transported to the sampling site, then the decontaminated equipment will be wrapped in aluminum foil (dull side facing the cleaned area) and stored and transported in a clean plastic bag (e.g., a trash bag) until ready for use, unless the FSP lists special handling procedures.

STANDARD OPERATING PROCEDURE SOP-02

DIGITAL CAMERA USE AND DOCUMENTATION PROCEDURES

Purpose

The purpose of this standard operating procedure (SOP) is to describe the use of digital cameras and procedures for digital camera data management.

Scope and Applicability

This SOP is applicable to taking digital photographs and placing the digital data in a database. Digital photographs may be taken to document field activities, site conditions and features, and sampling locations.

Equipment and Materials

Equipment and materials for taking digital photographs include the following:

- Digital camera
- Spare batteries
- Digital camera-carrying case and manual
- Photo log form
- Dry-erase board
- Dry-erase marker
- Personal computer
- Black waterproof pen

Typical Camera Features

- Save photographs (in standard mode) directly to a memory stick or comparable device
- Auto focus; manual focus available if required
- Zoom
- Brightness control
- Playback of photographs on camera screen
- Display of photograph number, date, and time
- Flash
- Timer

- Display showing time remaining on battery and remaining disk capacity
- Ability to protect and delete images that have been taken

Camera Use

Digital cameras will be used by the field team to document field activities. Each field team will be directly responsible for the camera to ensure that it is not exposed to excessive heat, cold, or moisture. The field team leader will be responsible for digital photograph documentation or for assigning documentation duties to a team member.

Digital photographs will be taken to document field activities and locations. Examples of field activities for which photo documentation will be useful include 1) individual samples; 2) sampling location; and 3) field sampling techniques used, such as equipment use and operation.

Each individual sample and each sample location will be photographed. A minimum of three photographs of each field sampling technique will also be photographed.

Digital photographs will be collected at a high-pixel setting such that enlargements can be made with minimal degradation in picture quality.

Photograph Documentation

Field Team Responsibilities

Each field team will keep a daily hard copy log of all photographs. The following digital photograph data will be collected:

- Date and time—as provided by the camera display.
- Team members—list each team member.
- Camera identifier (type, model, equipment number).
- Sample Location ID, if applicable. This information is obtained from the field team leader and/or Data Quality Management Plan (DQMP). This ID should be written onto a dry erase board and included in the photo frame.
- Sample ID, if applicable. This ID should be written onto a dry erase board and included in the photo frame.
- Photograph ID—record the number of the photograph and the photograph file name (as coded below).
- Description—the target of the photograph.

Digital Photograph File Name

At the end of each field day, the member of the field team who is responsible for the camera will transfer the electronic data from the camera to the field operations computer. The folder structure will be as follows (or as specified in the DQMP):

\\DATA\PHOTOS\YYYYMMDD\SAMPLE AREA\file\[1, 2, 3, ...N]

The notation YYYYMMDD represents the year, month, and day. The sample area is the sampling area name (e.g., Willamette River). The individual files for the day (e.g., file 1, file 2, file N) will be placed within this folder using the default file identifier provided by the camera.

Transfer of Information and Archive

After the photograph disks have been uploaded, the original hard copy of the photograph log will be initialed and dated by the team member who downloaded the photographs, then archived by the field team leader.

Sample Processing Coordinator Responsibilities

The field team leader will be responsible for 1) reviewing electronic photographs and the logs as they are made available to ensure consistency and completeness of annotations; 2) collecting and archiving the hard copies of the photograph logs; 3) reviewing electronic photographs and the logs as they are made available to ensure consistency and completeness of annotations; and 4) notifying the sampling team leader of apparent inconsistencies and making recommendations for corrective action.

Key Checks and Items

Important checks for digital camera management include the following:

- Make sure the camera's battery is fully charged on a daily basis.
- Keep extra memory sticks available.
- To save battery life, use flash only when necessary.
- Make sure the camera quality level is set at "best" or equivalent (high pixel).
- Review photograph records periodically to ensure that the electronic photographs, dry erase board information, and the Specimen Tally and Location Form agree.
- Leave enough time at the end of the field day to transfer the data.

STANDARD OPERATING PROCEDURE SOP-03

FIELD DOCUMENTATION

Scope and Applicability

This standard operating procedure (SOP) presents the general information that will be documented for all sampling activities conducted by field personnel. Proper record keeping will be implemented in the field to allow samples to be traced from collection to final disposition. All information pertaining to field operations during sample collection must be properly documented to ensure transparency and reproducibility of methods and procedures. Several types of field documents will be used for this purpose by field personnel.

Equipment and Materials

Equipment and materials used for this SOP include the following:

- Field logbook, preferably Rite-in-the-Rain 8.5 x 11 inch spiral-side notebook
- Field forms
- Black-ink waterproof pen
- Digital camera

Field Logbooks

During field sampling events, field logbooks and field forms are used to record all daily field activities. The purpose of the field logbook is to thoroughly document the sampling event to ensure transparency and reproducibility. The field logbook will contain sampling-related information supplemental to the field forms. Any deviations from the project-specific field sampling plan (FSP) that occur during sampling (e.g., personnel, responsibilities, sample station locations) and the reasons for these changes will be documented in the field logbook. Other types of information, as applicable, that should be documented in the field logbook include the following:

- Project sampling name and type
- Name of person making entries and other field staff
- On-site visitors, if any
- Observations made during sample collection, including collection complications and other details not entered onto the field form
- A record of health and safety meetings, updates, and related monitoring
- Presence of vessel traffic, construction and maintenance activities, or man-made features that may influence sampling

- Specific measured characteristics of collected samples

The field supervisor will maintain the field logbook and is responsible for ensuring that the field logbook and all field data forms are correct. Requirements for logbook entries will include the following:

- Entries will be made legibly with black (or dark) waterproof ink.
- Unbiased, accurate language will be used.
- Entries will be made while activities are in progress or as soon afterward as possible (the date and time that the notation is made should be documented, as well as the time of the observation itself).
- Each consecutive day's first entry will be made on a new, blank page.
- The field supervisor must sign and date the last page of each daily entry in the field logbook.
- Logbooks will be photographed daily and copied or scanned weekly, and backups of data will be generated as specified in the Data Quality Management Plan.
- When field activity is complete, the logbook will be scanned into the project file, and originals will be retained by the Project Manager.

All logbook entries must be completed at the time any observations are made. Logbook corrections will be made by drawing a single line through the original entry, allowing the original entry to be read. The corrected entry will be written alongside the original. Corrections will be initialed and dated and may require a footnote for explanation.

Upon completion of the field sampling event, the field supervisor will be responsible for submitting all field logbooks to be copied. A discussion of copy distribution is provided below.

Field Forms

Field data forms will be used to record the relevant sample information collected during a sampling event. These forms will be filled out completely by the sampling team during sampling.

The Fishing Effort and Tally Form will be used to record data on all fish caught and shall include the following:

- Sampling date (YYYY-MM-DD)
- Sampling location
- Angler initials
- Fishing start and stop times (24-hour Pacific Standard Time)
- Total duration of fishing effort; this will used to calculate catch per unit effort

- Catch time (24-hour Pacific Standard Time)
- Catch species, Abbreviations: BB= brown bullhead, BC= black crappie, BG= bluegill, CC= common carp, LS= largescale sucker, LMB= largemouth bass, NP= northern pikeminnow, PS= pumpkinseed, SC= sculpin, SMB= smallmouth bass, WC= white crappie, YP= yellow perch; for ESA species: CHK=Chinook salmon, CM= chum salmon, CO= coho salmon, STH= steelhead
- Health examination will include general condition, injuries, survivability after release.
    - Good: Rapid swimming away on release, usually with a vigorous splash.
    - Fair: Slow but strong swimming away on release.
    - Poor: Short recovery time (up to 30 seconds) required; once recovered, slow but sometimes atypical swimming away on release.
    - Very poor: Long recovery time (more than 30 seconds); once recovery, limited or no swimming observed on release but respiration functional.
    - Dead: Dead on removal from gear or does not recover following removal from gear.

For any SMB that are caught, the Smallmouth Bass Specimen Tally and Location Form will be used and data to be recorded shall include:

- Collection date and time (YYYY-MM-DD and 24-hour Pacific Standard Time)
- Sample ID
- Sample Location ID
- Fork and total length in millimeters
- Weight in grams
- Health examination, including gill condition, fin condition, visible parasites, and presence/absence of lesions
- Retained for analysis or tagging?
- Sample location depth to mudline in feet
- Sample location coordinates

Upon completion of the field sampling event, the field supervisor will be responsible for submitting all field data forms to be copied. A discussion of copy distribution is provided below.

Photographs

Reference SOP-02 of the FSP for procedures regarding digital photographs.

Distribution of Copies

Electronic scans of the field logbooks and field data forms will be made after completion of the field sampling event and stored electronically in the project files for use by project staff. The original field logbooks and forms will be placed in a locked file cabinet at the Project Manager's location.

Set-up of Locking File Cabinet

Each field event will have its own dedicated section in a locking file cabinet. The section label will include the project name and work order number. The following documents may be included in this cabinet for each field event:

- Original field logbook(s)
- Original field data forms
- Original signed chain-of-custody forms

STANDARD OPERATING PROCEDURE SOP-04

FISH TISSUE SAMPLING

Scope and Applicability

This standard operating procedure (SOP) describes the procedures for fish tissue sampling. Collection, handling, and processing procedures for fish tissue sampling of a variety of fish species at the Portland Harbor Superfund Site were previously described in the U.S. Environmental Protection Agency-approved Portland Harbor Fish Tissue Sampling SOP (SEA et al. 2002), incorporated here by reference. This SOP focuses on smallmouth bass (*Micropterus dolomieu*) tissue collection using angling (hook and line).

Equipment and Materials

Equipment and materials for this task include the following:

- Personal protective equipment as specified in the project Health and Safety Plan (HASP)
- HASP and scientific collection permits (as needed)
- Field location maps
- Bait-casting or spinning rod, with medium action and rated for an 8- to 12-pound line and 1/4- to 3/4-ounce lure or similar.
- Monofilament line (6-12 pound line)
- Lures: plastic worms, crankbaits (diving plugs), spinnerbaits, jigs, top-water lures, swimbaits
- Dip net
- Decontamination supplies
- Resealable plastic bags, black permanent markers, waterproof labels, and aluminum foil
- Appropriately sized fish measuring board (in millimeters)
- Hanging fish scale (in grams)
- Plastic bucket(s) (e.g., 5-gallon bucket)
- Sample containers/coolers and ice
- Rite-in-the-rain field notebooks
- White board and dry erase markers

- Boat-mounted GPS or handheld differential GPS device
- Fish anesthetic (MS-222 or other method recommended by the National Marine Fisheries Service and/or Oregon Department of Fish and Wildlife, or as stated in the Scientific Take Permit)

Target Species, Species Length, and Number of Specimens

The target species for this SOP is smallmouth bass. The target size is 225 to 355 millimeters (9-14 inches) in total length. Specimens that do not meet the target range will be released. Smallmouth bass larger than 355 millimeter up to 460 millimeters (14 to 18 inches) may be retained for archival at the laboratory for possible future analysis. The targeted number of specimens for chemical analysis is 135 smallmouth bass as follows: 95 from the Site, plus 20 from the Downtown Reach and 20 from the Upriver Reach. Specimens will be measured in millimeters.

Fish Sampling Techniques

Fish collection will be exclusively by angling. However, if an insufficient number of smallmouth bass are caught by angling, boat electrofishing is proposed, and a separate boat electrofishing SOP will be developed. Bass fishing techniques tend to be based on the type of lure. As described in previous sampling plans, smallmouth bass can be caught with a variety of lures, depending on the desired sampling depth. Lead-weighted hooks with attached green-rubber tube jigs can be used to fish the bottom, while plastic crank baits resembling small fish or crayfish can be used to fish the shallower surface waters (zero to 20 feet). Electric trolling motors may be used to more accurately access specific smallmouth angling locations and enable the complete coverage of selected areas. Angling for smallmouth bass will be conducted primarily from 7:00 a.m. to 7:00 p.m.

Fish Processing and Identification

Qualified biologists will be a part of each team to oversee fish processing. All buckets, measuring boards, handheld scales, and coolers used to retrieve and store fish will be washed with Alconox™ soap and rinsed in river water before the sampling effort is initiated at each sampling location.

Once caught, fish will be handled using nitrile gloves, unhooked, and identified. Non-target species will be released. Retained smallmouth bass specimens will be measured for total length by placing them on a measuring platform. The total length of a fish will be measured from the anterior-most part of the fish to the tip of the longest caudal fin ray (when the lobes of the caudal fin are compressed dorsoventrally). If the length requirement is not met, the specimen will be returned to the river. Smallmouth bass that have met the target size will be rinsed with river water to remove any foreign material from the external surface, and a general fish health examination will be conducted. A general fish health examination will include gill condition, fin condition, visible parasites, and presence/absence of lesions.

Retained fish will be weighed using a handheld scale, euthanized, wrapped in aluminum foil, and placed inside a resealable plastic bag. Fish will be euthanized using a lethal dose of the anesthetic MS-222 (or other method recommended by the National Marine Fisheries Service and/or Oregon Department of Fish and Wildlife, or as stated in the Scientific Take Permit). A weatherproof label will be filled out and adhered to the inside of a smaller resealable plastic bag. The plastic bags containing the fish and the label then will be placed inside a third resealable plastic bag.

When wrapping the fish sample, foil should be folded with space away from the spiny dorsal fin to minimize punctures. The aluminum foil in addition to the plastic bags is intended to protect the sample from cross-contamination and storage on ice.

All labels will be marked with the date, time, project name (or case number), specimen identification (ID), and initials of the sampler, and the fish sample will be placed in a cooler with ice. Each retained fish will be photographed along with the habitat conditions at each sampling location. Photographs of fish and sampling location will contain the sample number written on a white board included in the frame. GPS coordinates, sample number, date, time and other pertinent information will be recorded in the field logbook.

At the end of each day, the coolers will be transported to the secure AECOM laboratory (1115 S.E. Caruthers Street), which will serve as a temporary processing and storage facility. The research vessels may transfer fish coolers to field team members at the Swan Island Boat Ramp throughout the day depending on the success of the fish collection efforts. The fish will be transferred to a chest freezer for frozen storage at the AECOM facility. Once frozen, the fish will be placed into coolers with dry ice before shipment to the contract laboratory.

References

SEA, Windward, and Kennedy/Jenks. 2002. Fish Tissue Sampling SOP Round 1A Portland Harbor RI/FS. Prepared for Lower Willamette Group, Portland, OR. Striplin Environmental Associates, Inc., Olympia, WA.

STANDARD OPERATING PROCEDURE SOP-05

RECORDING SAMPLE COLLECTION LOCATIONS

Scope and Applicability

This standard operating procedure (SOP) describes procedures recording sampling stations across the Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling (PDI) Site (hereafter the Site). Accurate station positioning is required to ensure quality and consistency in collecting samples and in data interpretation and analysis. Station positioning must be both absolutely accurate in that it correctly defines a position by latitude and longitude, and relatively accurate in that the position must be repeatable.

Latitude and longitude coordinates will be obtained using a global positioning system (GPS) on the vessels operated by Gravity and supplemented by a hand-held differential GPS unit.

The methods described in this SOP should be usable for any hand-held differential GPS unit; however, the owner's manual for any GPS unit used should be consulted and used to support this SOP.

Equipment and Materials

The following is a list of equipment and materials needed by the field sampling team:

- Hand-held differential GPS unit (e.g., Trimble GeoXH or R1)
- Spare batteries
- Charging unit

A GPS hardware system, such as a Trimble GeoXH, R1, or equivalent device, should be used for recording the location of each sample. The standard projection method to be used during field activities is specified in the Data Quality Management Plan.

Positioning System Verification

GPS requires no calibration because all signal propagation is controlled by the United States government (the Department of Defense for satellite signals and the U.S. Coast Guard and U.S. Forest Service for differential corrections). Verification of the accuracy of the GPS requires that coordinates be known for one (or more) horizontal control points within the study area. The GPS position reading at any given station can then be compared to the known control point. GPS accuracy verification shall be conducted at least daily and performed in accordance with equipment manufacturer recommendations.

Station Location Procedures

Sampling area boundaries and other applicable geographic information systems (GIS) data layers (e.g., aerial photographs, topography) will be uploaded into the hand-held GPS unit(s)

prior to the sampling effort. A position will be recorded electronically at each sample location where fish are collected. Ancillary information will be recorded in the field logbook and should include the name of the personnel operating the GPS system and the time samples were collected. Water depth of the sample collection location will be recorded using the research vessel's depth transducer, when available. In shallow water, a visual estimate or lead line measurement of depth may be used.

A brief summary of procedures to locate a specific sampling location using a hand-held GPS unit are as follows:

- Turn on the unit.
- Wait for it to acquire the location of satellites.
- Save the location into the GPS memory (site coordinates may also be noted on field forms or in the field logbook).
- Charge unit and batteries when not in use.

Upon completion of the sampling effort, all data points will be downloaded from the GPS unit and displayed on a GIS map. Any sampling locations outside of the originally defined sampling areas will be mapped and described with supporting documentation in the field sampling report.

STANDARD OPERATING PROCEDURE SOP-06

SAMPLE LABELING

Scope and Applicability

This standard operating procedure (SOP) describes the general procedures for completing sample labels that will be used for all sampling. The project-specific field sampling plan (FSP) should be consulted regarding the rationale behind the sample labeling protocol.

Equipment and Materials

Equipment and materials for this task include the following:

- Sample labels
- Indelible marker
- Copy of the FSP and DQMP

Sample Identifiers

Sample identifiers will be established before field sampling begins and assigned to each sample as it is collected. Sample identifiers consist of codes designed to fulfill three purposes: 1) to identify related samples to ensure proper data analysis and interpretation, 2) to clearly connect sample results to sampling locations, and 3) to track individual samples to ensure that the laboratory receives all of the material associated with a single sample. The Data Quality Management Plan (DQMP) contains details of the location and sample nomenclature to be used in this study.

Sample Labels

Sample ID information will be entered onto the sample label with an indelible marker. Other information that will be entered onto the sample label includes the following:

- Samplers' initials
- Date
- Time

The format for the date and time will be specified as YYYY-MM-DD and 24-hour, Pacific Time. If necessary, corrections will be made on the sample labels by drawing a single line through the error and entering the correct information with an indelible marker. All corrections will be initialed and dated by the person performing the correction (i.e., the individual who made the error).

For fish samples, a weatherproof label will be filled out and adhered to the inside of a smaller resealable plastic bag. The plastic bags containing the fish and the label then will be placed inside a third resealable plastic bag. Sample packaging is discussed in SOP-07.

STANDARD OPERATING PROCEDURE SOP-07

SAMPLE PACKAGING AND SHIPPING

Scope and Applicability

Specific requirements for sample packaging and shipping must be followed to ensure the proper transfer and documentation of environmental samples collected during field operations. Procedures for the careful and consistent transfer of samples from the field to the laboratory are outlined herein. This standard operating procedure (SOP) presents the method to be used when packaging samples that will either be hand-delivered or shipped by commercial carrier to the laboratory.

Equipment and Materials

Specific equipment or supplies necessary to properly pack and ship environmental samples include the following:

- Field sampling plan (FSP)
- Project-specific field logbook
- Resealable airtight bags (assorted sizes)
- Shipping coolers
- Drum liners or sturdy trash bags for securing samples within coolers
- Fiber-reinforced packing tape and duct tape
- Clear plastic packing tape
- Scissors or knife
- Chain‑of‑custody (COC) forms; these forms may be produced in an electronic format using a database program, in which case a computer and printer would be needed as well
- COC seals
- Large plastic garbage bags (preferably 3 mil [0.003 inch] thick) for cooler lining
- Paper towels
- “Fragile,” “This End Up,” or “Handle With Care” labels and “Perishable Goods” labels
- Address labels for processing laboratory
- Airbills for overnight shipment

Procedure – Fish Tissue

After completing each day of sampling, all fish tissue samples will be transferred from the coolers with wet ice into a freezer or cooler with dry ice and held there until preparation for shipment to the laboratory. Although there is no specified duration of time after collection that samples must be frozen, sample transfer will be done as soon as the field crew returns to the location where samples are being held. The temperature of the cooler/freezer will be recorded in the logbook twice daily (both in the morning and evening).

Depending on the logistics of the operation, field personnel may transport samples to the laboratory themselves or use a commercial courier or shipping service. If a courier service is used, then field personnel should be aware of potentially limiting factors to timely shipping (e.g., availability of overnight service and weekend deliveries to specific areas of the country and shipping regulations regarding "restricted articles") prior to shipping the samples.

Sample Storage Prior to Shipment

Samples will be placed in secure storage (i.e., locked warehouse) or remain in the possession of sampling personnel before shipment. Sample storage areas will be locked and secured to maintain sample integrity and COC requirements. The appropriate storage temperature will be maintained for samples in a secure area while they are awaiting shipping.

Sample Preparation for Fish Tissue Samples

Staff responsible for shipping samples on dry ice will be trained in Dangerous Goods regulations. Staff will also contact FedEx International Customer Service at 1-800-463-3339 prior to packaging samples to determine to most up-to-date regulations for shipping samples to British Columbia, Canada. A "FedEx Shipping Dry Ice" job aid is added to this SOP for reference. The following steps should be followed to ensure the proper transfer of samples from the field to the laboratory.

At the Sample Collection Site and Following the Completion of the Sampling Day

1. Document all samples appropriately using the proper logbooks or field forms and required sample container identification (i.e., sample labels with unique identification numbers [IDs]) by following the sample labeling procedures described in SOP-06.
2. Clean the outside of all dirty sample containers to remove any residual material that may lead to cross contamination.
3. Place labeled and bagged fish tissue samples in a second resealable plastic bag such that the sample label can be read, and place double-bagged sample into a cooler.
4. Because the samples have a required storage temperature, place a sufficient amount of wet ice in the sample cooler to maintain the temperature inside the cooler (e.g., 4°C) throughout the sampling day.

5. At the end of each sampling day, transfer fish tissue samples from the coolers with wet ice into a freezer or cooler with dry ice, and hold there until preparation for shipment to the laboratory.

To Prepare Fish Tissue Samples and Coolers for Shipping

1. Choose the appropriate shipping cooler(s) for dry ice; make sure that the outside and inside of the cooler is clean of gross contamination.
2. Line the cooler with bubble wrap.
3. Concurrently with placing samples in the shipping cooler(s), the field supervisor will fill out COC forms with sample IDs and laboratory analyses to be performed.
4. Make sure any applicable laboratory quality control sample designations have been made on the COC forms.
5. Check sample IDs for all samples against the COC form to ensure all samples intended for shipment are included.
6. Place samples inside a large plastic bag (e.g., sturdy garbage bag or drum liner); the bag will be tied closed and sealed at the tied area with a custody seal to ensure that custody is maintained if the cooler is opened for inspection during shipment.
7. Because the samples have a required storage temperature, add enough dry ice to keep the samples frozen during overnight shipping (i.e., <0°C). The amount of dry ice that may be required should always be overestimated. Ice should be enclosed in a resealable plastic bag and then placed in a second resealable plastic bag to prevent leakage. Avoid separating the samples from the ice with excess bubble wrap because it will insulate the containers from the ice.
8. Sufficient fish tissue samples will be placed in each cooler to occupy approximately 60 to 70 percent of the cooler volume, and the remaining space in the cooler will be filled with dry ice.
9. After all samples and ice have been added to the cooler, use bubble wrap (or other available clean packing material) to fill any empty space to keep the samples from shifting during transport.
10. The field supervisor will sign and date the completed COC form and retain a copy for the project files. Place the signed COC form in a resealable bag and tape the bag containing the form to the inside of the cooler lid. Each cooler should contain an individual (or multiple) COC form(s) for the samples contained in that particular cooler.
11. After the cooler is sufficiently packed to prevent shifting of the containers, close the lid and seal it shut with fiber-reinforced packing tape. The cooler should be taped

shut using nylon strapping tape around the opening between the lid and the bottom of the cooler and around the circumference of the cooler at both hinges.

12. As security against unauthorized handling of the samples, apply two COC seals across the opening of the cooler lid—one on the front of the cooler and one on the side. Be sure the seals are properly affixed to the cooler so they are not removed during shipment. Additional clear packing tape across the seal may be necessary if the outside of the cooler is wet.
13. Appropriate shipping labels indicating the use of dry ice should be affixed to the containers.
14. Attach the address label for the processing laboratory, overnight shipping bill, a perishable goods label, and at least one of the following labels: “This End Up,” “Fragile,” or “Handle With Care.”
15. Notify the laboratory project manager and quality assurance manager that samples will be shipped and the estimated arrival time. Upon completion of field activities, the field supervisor will provide copies of all COC forms to the task manager and task analytical chemistry quality assurance and quality control (QA/QC) coordinator.

Sample Shipping

Hand Delivery to the Testing Laboratory

1. The field supervisor will notify the laboratory contact and the team project QA/QC coordinator that samples will be delivered to the laboratory and the estimated arrival time.
2. All samples that are hand-delivered to the testing laboratory will be received by the laboratory on the same day that they were packed in the coolers.
3. Copies of all COC forms will be provided to the task manager.

Shipped by Commercial Carrier to the Laboratory

1. Use an address label and label the cooler with destination and return addresses, and add other appropriate stickers, such as “This End Up,” “Fragile,” and/or “Handle With Care” as well as “Perishable Goods” labels. If the shipment contains multiple coolers, indicate on the address label the number of coolers that the testing laboratory should expect to receive (e.g., 1 of 2; 2 of 2). Place clear tape over the mailing label to firmly affix it to the outside of the cooler and to protect it from the weather. This is a secondary label in case the airbill is lost during shipment.
2. Fill out the airbill as required and fasten it to handle tags provided by the shipper (or the top of the cooler if handle tags are not available).

3. Frozen fish tissue samples may be shipped on Monday through Thursday, with overnight service.

SHIPPING DRY ICE

Introduction

Many perishable items, such as food, medical shipments or non-hazardous chemicals, are shipped with dry ice as a refrigerant. As long as the dry ice is not chilling a dangerous good (as defined by the U.S. Department of Transportation or the International Air Transport Association), the procedures for shipping are straightforward and easy. When a *company* ships dry ice the shipment must be prepared by an employee **trained** in the Dangerous Goods regulations. For information or to register for FedEx Express Dangerous Goods Seminars, go to **fedex.registration.meetingevolution.net.**

Before You Prepare Your Shipment

When shipping internationally, call FedEx International Customer Service at 1.800.GoFedEx 1.800.463.3339 and say "international services" to check commodity acceptability by service and origin in combination with the destination city/postal code/country. Some service limitations also exist for Alaska and Hawaii. Call 1.800.GoFedEx 1.800.463.3339 for more information.

How To Prepare a Dry Ice Shipment

1. Package

- Dry ice releases carbon dioxide gas which can build up enough pressure to rupture the packaging. You must ensure the packaging you use allows the release of this pressure to prevent rupturing the package. For example, do not use steel drums or jerricans as outer packaging, and do not place dry ice within sealed plastic bags.
- Use good quality fiberboard (corrogated cardboard), plastic or wooden boxes. FedEx® packaging may not be used.
- A layer of Styrofoam within a box works well as insulation. Ensure the styrofoam IS NOT sealed to be airtight.
- Styrofoam must not be used as an outer packaging unless it has been preapproved by FedEx Packaging Services (1.800.633.7019).
- The maximum amount of dry ice per package is 200 kg.
  Exception: Overpacks containing dry ice and shipments which meet Special Provision A151.

2. Mark

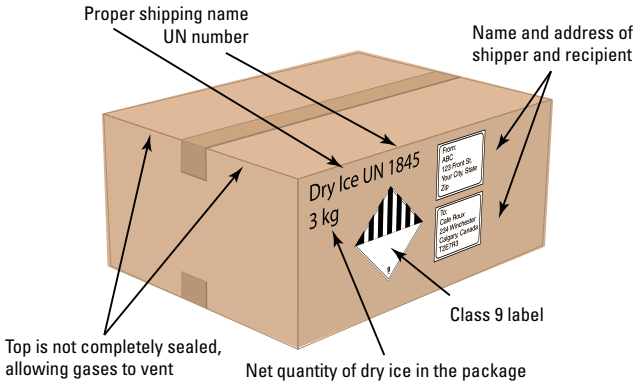
- The following package markings are required:

a. Dry Ice (or Carbon Dioxide Solid)
Note: The Proper Shipping Name, namely Dry Ice (or Carbon Dioxide Solid) must be on the same surface of the package as the hazard label or Class 9 label, when package dimensions are adequate.

b. UN 1845

c. The net quantity of dry ice in the package or overpack, in kilograms (1 kg = 2 lb).

- The name and address of both the shipper and recipient must be durably marked. This information can be marked on the package



All self-adhesive labels must be affixed directly to the package. Do not place labels in, or on, a plastic pouch.

This document is an uncontrolled, reference-only copy.

itself, or you can mark the shipper and recipient information in the address blocks of the FedEx Express Dry Ice label with a magic marker or pen.

- The shipper and recipient markings are satisfied when the self-adhesive FedEx Express electronic shipping label has this information preprinted on it.

New Minimum Marking Sizes

- Package capacity > (greater than) 30 KG
  - requires 12 mm type or larger for UN 1845
- Package capacity > 5 KG up to 30 KG
  - requires 6 mm type or larger for UN 1845
- Package capacity < (less than) 5 KG
  - requires the package marking UN 1845 to be of adequate size
- Other package markings and overpack used markings should be 12 mm or larger if package capacity is greater than 30 kg, 6 mm or larger for package capacity at 30 kg or less.

UN 1845 (12 mm)

UN 1845 (6mm)

NOTE: If using a Dry Ice label with preprinted UN number, please handwrite the UN number to ensure appropriate marking size for package capacity.

Acceptable as Shipper and Recipient Markings:

- Addresses completed on the FedEx Express Dry Ice label.
- FedEx Ship Manager® self-adhesive electronic shipping label (with both addresses) placed directly on the package.
- Peel-and-stick FedEx Express Package US Airbill attached directly to the package.
- Package durably marked with both addresses with a magic marker or pen.
- Separate self-adhesive label(s) with addresses handwritten or typed/computer generated.
- A piece of paper with both addresses taped to the package with clear package tape. Entire surface of the paper must be taped.

Unacceptable as Shipper and Recipient Markings:

- A paper airbill or sheet of paper from a FedEx electronic shipping device attached to the package in a pouch.
- A FedEx Ship Manager electronic shipping label attached to the package in a pouch, or placed on top of a pouch.

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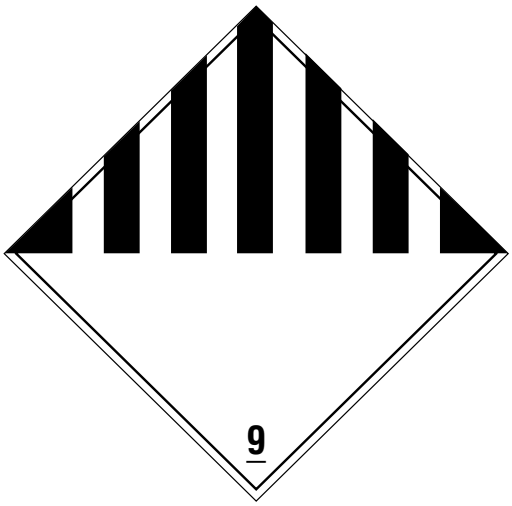
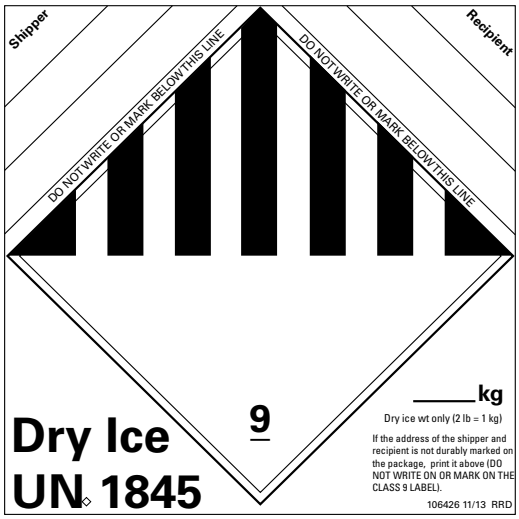
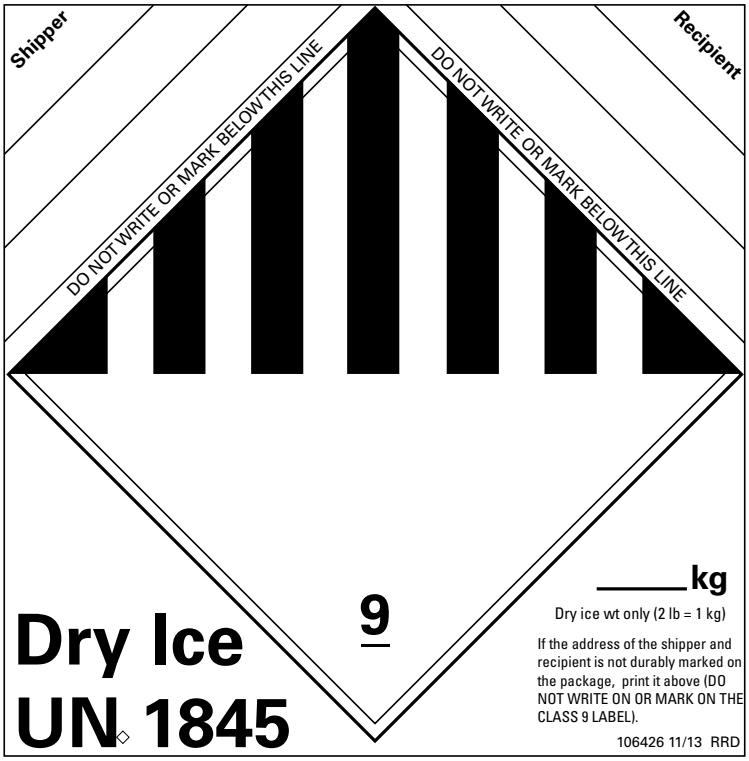
3. Label

- A Class 9 label is required. Do NOT write inside the diamond border of the label.
- The label may be attached to the package by means of a strong tag.
- Special FedEx Express Dry Ice labels are available free of charge by calling 1.800.GoFedEx 1.800.463.3339. These labels greatly simplify the marking and labeling process.
- Part# 167095 (Package of 50 labels)
- Part# 106426 (Roll of 250 labels)





Note: the labels have SEVEN vertical stripes.



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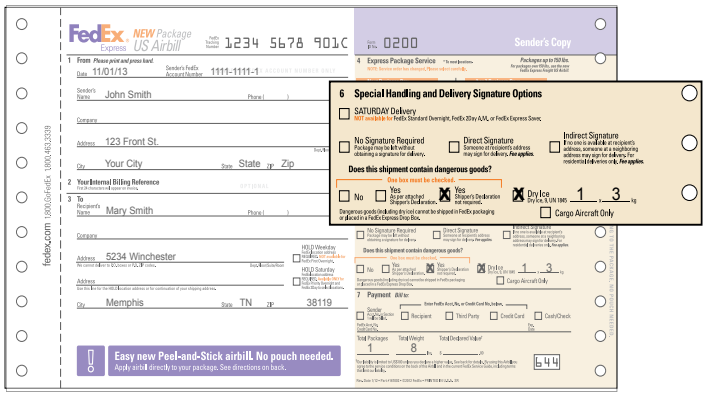
4. Prepare Paperwork and Complete Final Steps



- The following are required airbill entries for shipments of dry ice when refrigerating non-dangerous goods:
  - ~ If a paper airbill is used, check "Yes, Shipper's Declaration NOT Required."
  - ~ UN 1845, Dry Ice, ___ x ___kg (where the first blank is the number of packages and the 2nd blank is net quantity in kilograms)
  - ~ When FedEx Ship Manager electronic shipping software is used, this information is entered on-screen and prints on the thermal label.
- Ensure all the required DG markings and labels are not obscured by opaque tape or tape with company logos, pouches, or labels (including service labels).
- To schedule pickups, find drop-off locations for dry ice, or to get rates, call 1.800.GoFedEx 1.800.463.3339.

Helpful Resources

- To purchase the current calendar year International Air Transport Association (IATA) DG regulations go to www.iata.org
- The following URL is for the Perishable chapter of the FedEx "How to Pack" brochure: **images.fedex.com/us/services/pdf/packaging/Perishables_fxcom.pdf**
- If you have questions about the requirements for your dry ice shipment, call the FedEx Dangerous Goods/ Hazardous Materials hotline at 1.800.GoFedEx 1.800.463.3339, and press "81" or say "dangerous goods," then press "4" to reach the next available DG Agent.

DISCLAIMER
Proper training is required under federal, state and/or international regulations to handle, ship, package or transport dangerous goods and/or hazardous materials. All persons and entities must comply with all federal, state, or international governmental regulations and requirements including, if applicable, the specific training requirements of 49 C.F.R. (172.700 – 172.704). FedEx Express provides materials and advice as a courtesy, to be used as guidelines to assist properly trained shippers. The information provided by FedEx Express in no way alters, satisfies or influences any federal, state or international governmental requirements. The information provided does not meet the training requirements as required by regulations, including DOT 49 C.F.R. The study and/or use of this information does not qualify an individual to prepare, package, transport or otherwise handle dangerous goods or hazardous materials. The information contained in this document is subject to change or update due to changing government regulations. The user of this information assumes responsibility for complying with all applicable laws and regulations regarding the shipment of dangerous goods. FedEx Express shall not be held responsible for any loss, injury and/or damage caused by errors, omissions, misprints or misrepresentations of the contents of this document or for any unauthorized or inappropriate use.

STANDARD OPERATING PROCEDURE
HORIZONTAL AND VERTICAL SURVEY CONTROL

Introduction

This Standard Operating Procedure (SOP) has been developed for the Pre-Remedial Design Sampling and Baseline Investigations (PDI) at the Portland Harbor Superfund Site located in Portland, Oregon to confirm accurate positioning of vessels and samples during sample collection activities. The survey control requirements described in this SOP are specifically for environmental sample collection and will generally comply with map-grade precision and accuracy in contrast to the geodetic-grade precision and accuracy performed for the Bathymetric Survey conducted by David Evans and Associates (DEA). However, the same survey control points and geodetic parameters will be used in both surveys for consistency, and a portion of the quality assurance/quality control (QA/QC) process will involve consultation with DEA Oregon Professional Land Surveyor (PLS) staff to review the map-grade data collected for the environmental sample collection.

The organization of this SOP is as follows:

- Methodology Overview
- Project Geodetic Parameters
- Survey Accuracy, Precision, and Control
- Primary Equipment
- Hand-Held GPS Operation
- Vessel Navigation and Equipment Operation
- Data Processing and QA/QC Procedures

Tables, figures, and attachments are presented at the end of the SOP.

Methodology Overview

Horizontal (Map) Data Collection

A combination of vessel-mounted and hand-held GPS receivers will be used to navigate to sampling locations and to collect map location coordinates (Northings, Eastings) for those sampling locations. The vessel-mounted GPS receivers will be the primary tool used for navigation to the pre-planned sampling locations in a GIS file, which will be pre-loaded into the vessel navigational system. The hand-held GPS devices will be used as a backup and confirmation of vessel position only if there are problems with the vessel GPS navigation system or if there is no specific vessel navigation system (i.e., smaller boats). Since the inception of field work, the vessel GPS coordinates have been consistently verified and deemed to be sufficient to meet position and accuracy requirements for the project. The hand-held GPS devices will primarily be used for studies involving small vessels. These devices will also have the pre-loaded basemap content depicting planned sampling locations.

The vessel GPS will operate in two modes, collecting both a separate continuous data stream of positional information (line file) and recording GPS soundings (target file) when a sample is specifically collected. The sample location target file will be recorded when the sampling device is in position for the grab (e.g., when sampler is on the river bottom). The specific Location ID associated with the sample will also be recorded in the GPS device log. Field personnel will be required to write that same Location ID on their field data collection forms at the same time. Both the continuous and episodic dataset will be timestamped to allow comparison of the two types of data. This data will be recorded and maintained on the vessel, and will also be exported from the vessel navigation system and archived to project servers on a daily basis.

The hand-held GPS devices will be operated independently of the vessel's systems and will be used to record a location sounding wherever a sample is collected only for studies unable to use the vessel GPS navigation system. The sample location sounding will be recorded approximately at the same time as when the vessel GPS measurement is collected (e.g., when sampler is in position). The specific Location ID associated with the sample will also be recorded on the GPS device. Field personnel will write this Location ID on the field forms only if the vessel measurement described earlier cannot be collected for some reason (e.g., equipment failure). These measurements will also be timestamped. The data from the hand-held GPS devices will be wirelessly synchronized to a "cloud" web service in near real-time; the data from the "cloud" will also downloaded and saved to project servers daily.

Vertical Data Collection

Vertical (elevation) data is also required for water levels, sample collection depth below surface water, and bottom (mudline) depth location for some types of sample locations. For increased precision and accuracy, it is proposed that bottom (mudline) depth locations (e.g., for sediment cores) be calculated from the 2018 bathymetric surface to be developed by the hydrographic survey performed by DEA (since the data will be collected within a few months of each other). The NAVD88 elevation will be calculated from the intersection of the surface map location coordinates collected as described earlier, projected vertically down to the bathymetric surface (United States Army Corps of Engineers [USACE], 2004). The elevation from the intersection of the bathymetric surface will be used as the final or "best" elevation for the sample.

In contrast, for depth measurements that require less precision (e.g., water levels, depth to samples below water surface), the onboard vessel sonar will be used to record depth and then subsequently calculate elevation. All depths will be recorded relative to the water surface and time tagged to correct with time tagged gauge data for obtaining riverbed elevations. The elevation will be calculated to NAVD88 datum (in feet). To correct elevations, gauge data from the Northwest River Forecast Center will be downloaded for gauge PRT03, which is representative of the former Morrison gauge which has been moved. This gauge does not report NAVD88 elevations but rather reports a value that is 0.3 feet above Columbia River Datum (CRD). Corrections from CRD to NAVD88 differ moving down the river from the gauge due to the fact that NAVD88 is a reference normal to gravity (water does not flow if the elevation is unchanging), and CRD is a gradient datum that follows the lower water surface. In Portland Harbor, the difference between CRD and NAVD88 (Geoid12b) ranges from 0.00 feet CRD = -5.16 feet NAVD88 (Geoid12b) at Willamette River river mile (RM) 2.0, to 0.00 feet CRD = -5.41

feet NAVD88 (Geoid12b) at Willamette River RM 12.8 (approximate location of PRT03 Gauge). Accordingly, a correction to the Willamette Gauge in Portland would be -5.41+0.3 or -5.11 feet at RM 12.8. An approximation would be to subtract 5 feet from the gauge reading for the full length of the study area, but precision will vary depending on tides and river gradient.

For sample locations requiring vertical information, depth will be recorded by field staff on their data collection forms relative to the water surface, and these values will be loaded to the project database as described in the Data Quality Management Plan (DQMP). Final calculated NAVD88 elevation data (feet) will also be entered into a separate data field in the project database after completion of spatial analysis, calculations, and QA/QC. DEA will provide support during the QA/QC process to verify proper calculation of NAVD88 elevation data.

Location Position Recording in Project Database

Discrete Samples

When discrete samples are collected, the Location ID and the location coordinates (Northing/Easting) will be recorded on the GPS device(s) and the field data collection form(s). The location coordinates will be based on the vessel GPS instantaneous target measurement. This target measurement will be the location coordinate pair loaded initially to the project database. After the field event is completed, the target measurement will be compared to the line file (vessel continuous GPS measurement) to confirm that the coordinate pair loaded to the project database is appropriate. If analysis reveals precision or accuracy issues, the loaded location coordinate pair in the project database may be updated and edited with a better value derived from the line file. In general, the hand-held GPS devices will be used as a backup and confirmation of vessel position only if there are problems with the vessel GPS navigation system or an independent navigation system is not available on the vessel. These coordinates will be loaded to the project database only if there is a significant problem with the vessel GPS (e.g., equipment failure) or if there is no vessel GPS.

Composite Samples

When composite samples are collected, location coordinates will also be recorded as both target measurements and continuous measurements using the vessel GPS. The continuous GPS measurements will be recorded during the entire compositing event, and instantaneous target measurements will be collected when the sampler is in position for each individual composite grab. At each compositing location, a target measurement will be recorded in the vessel GPS along with the Location ID with an “a,” “b,” or “c” suffix. These measurements will be recorded on the field forms in the same manner (e.g., there will be three sets of location coordinates, lithologic descriptions, etc.).

When the location data is loaded to the project database, a single set of location coordinates will be recorded in the project database with a Location ID that excludes the “a,” “b,” or “c” suffix. As a presumed middle time point, the “b” set of coordinates will be loaded with the primary Location ID to the project database. After the field event is completed, the target measurement associated with the “b” location composite will be compared to the line file (vessel continuous GPS measurement) to assess vessel position and the timeframe of the entire sampling event to confirm if the coordinate pair loaded to the project database is appropriate. The goal will be to finalize the location coordinate information in the project database based on the most representative position based on this analysis. Similar to

discrete sample collection, a hand-held GPS device and related data will only be loaded to the project database if there is a significant problem with operation of the vessel GPS or if the vessel does not have a GPS.

Finally, after field data are collected and surveys are completed, as defined in the DQMP, the location coordinate data will be joined with the tabular data collected by the field teams and loaded to the project database.

Project Geodetic Parameters

The geodetic parameters to be used for the PDI field studies will be as follows:

Horizontal Datum: North American Datum of 1983 (2011)
Projection: State Plane Coordinate System (SPCS) Oregon North Zone
Vertical Datum: North American Vertical Datum of 1988 (NAVD88) Geoid12b
Horizontal Units: International Feet
Vertical Units: Feet

Survey Accuracy, Precision, and Control

The anticipated horizontal accuracy of environmental sampling associated with vessel and hand-held GPS devices is a range of 1 to 5 meters (target 1 to 2 meters for the DGPS unit itself). This should be consistent with RI target accuracy (Integral 2002) and best practices (Puget Sound Estuary Protocols [PSEP] 1998 and US Environmental Protection Agency [EPA] 2008).

The anticipated vertical accuracy of final elevation calculations derived from vessel sonar systems is anticipated to be 1.0 meter.

Table 1 summarizes the survey control locations used in the DEA Bathymetric Survey, which will be used for the environment sample collection work described in this SOP. Figure 1 shows the PH2 piling at the Fred Devine boat dock, and Figure 2 shows the approximate locations of the survey control references for PH1 and PH2. Figure 3 shows approximate location of PH3 for survey control above the Willamette Falls. Attachment 1 contains detailed survey sheets of the following control points: Raindeer, PH1 and PH2, and PH3. Additional information regarding the DEMSI and 2100 control points is available upon request.

Primary Equipment

- Trimble® SPS 461 GPS with dual antennas (vessel GPS)
- A-frame assembly, sampling winch (vessel boom)
- Trimble® R1 (hand held GPS), tethered to Bluetooth® capable smartphone or tablet, ESRI Collector software with Trimble® GNSS Status middleware
- GPS owner's manual
- Writing tools (pencils, Sharpie®)

- Field logbook
- Spare batteries and/or battery charger
- Compass
- Tape measure

Hand-Held GPS Operations

For ease of use, the project team will utilize smartphones tethered to the Trimble® R1 GNSS Receiver via a Bluetooth® connection. The smartphone will be configured with Trimble's middleware software called GNSS Status to convert and stream NMEA satellite data to the smartphone for real-time correction and display to a simple electronic data collection form developed on the ESRI Collector platform. The form will contain a limited number of data fields, including location, study name and operator, date, and notes or comments. This form is not intended to duplicate the content and scope of the field data collection forms, but rather clearly link the GPS data to those forms via the unique Location ID. There are metadata fields available as well from these GPS records, such as estimated horizontal accuracy.

Collected data recorded onto the phone will be transmitted wirelessly via a synchronization process invoked when data is "saved" to the device. The data will be pushed to AECOM Online's Portal and ArcGIS Server for storage of "corrected" location coordinates, Location ID, and other information captured when the GPS sounding is recorded. The sampling event will be trackable in near-real-time as samples are collected on the ArcGIS Portal Interface. Either dedicated, experienced GPS-operators will be collecting the measurements on the smartphones, or, due to the very simple nature of the interface, field personnel will be trained to use the devices. Initial training sessions were already successfully conducted March 19-20, 2018 on use of the smartphone GPS interface. These handheld devices were successfully used for the first 2 weeks of field work. For some studies, such as the smallmouth bass tracking study, these handhelds may be used as the primary GPS due to smaller vessel configuration.

Vessel Navigation and Equipment Operation

Vessel positioning will be conducted through the marine navigation and hydrographic software package HYPACK. This software package allows the visualization of the vessel over navigable charts, the processing of satellite corrections, stored hardware, and vessel parameters, as well as the storing of physical target locations during sampling activities. HYPACK version 2017 will be used for this project.

Vessel position is measured using a Trimble SPS 461 GPS dual antenna receiver. The dual antennas provide precise vessel positioning via both satellite and differential radio corrections along with heading correction to 0.09 degree. GPS data is output through a serial connection into computer running the HYPACK software, for vessel positioning and target collection.

At each sampling location, depth to mudline will be measured using an onboard fathometer (with lead line as confirmation as needed) immediately prior to or during the sampling. Water depths are measured at each station using an Airmar ss510 survey sonar at the sampling point and confirmed daily with a lead line with reference to water surface. Vertical measurements will be recorded to the

nearest 0.1 foot. Water depths will be converted to elevations in NAVD88 based on the river stage at the time of sampling as recorded at the closest available tide gage.

Data Processing and QA/QC Procedures

All GPS devices will be subject to a position check to confirm the accuracy of the on-vessel GPS and hand-held GPS devices and to validate the positions derived from each GPS receiver. Correctors will be applied as needed, resulting in a position that is within specified positioning accuracy of the DEA published position for control monuments PH1, PH2, and PH3 (or future control point approved by EPA). At the start and end of each field day, the benchmark location will be visited to perform a position check.

At the piling serving as the PH2 control monument (accessible by boat), the on-vessel GPS calibrated to the top of A-frame assembly will be maneuvered as close to the benchmark piling as possible to record a point. The GPS-derived position of the sampling vessel is compared with the known horizontal location; results will be recorded in HYPACK to confirm that accuracy is within +/- 2 meters.

For handheld GPS, field staff will occupy the PH1 at the Swan Island boat launch parking lot or PH3 at the Willamette Park boat launch. Using the R1 and phone/tablet combination GPS setup, the field staff will hold the R1 above PH1 or PH3 and wait for a satellite "fix," and when ready, the staff will record the GPS location in Collector. This GPS location will be compared to the known coordinates to confirm the accuracy is within +/- 2 meters. The survey control monuments act as a known location to allow for corrected station location coordinates during post-processing of data as needed. If a need arises to locate another benchmark, there are several USGS control points near the project area and near the AECOM project warehouse. Experienced GPS operators on the project team will be involved in all aspects of field data collection events to troubleshoot devices and assist in daily review of extracted geospatial datasets. Additional details on QA/QC procedures can be found on the DQMP.

References

AECOM (AECOM Technical Services) and Geosyntec (Geosyntec Consultants, Inc.). 2018. Data Quality Management Plan Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling. Portland Harbor Superfund Site. 22 February.

Integral (Integral Consulting). 2002. Round 1 Field Sampling Plan. Prepared for the Lower Willamette Group (LWG) for submittal and approval by EPA Region 10. June 14.

EPA (United States Environmental Protection Agency). 2008. National Geospatial Data Policy. August 24.

PSEP. 1998. Recommended Guidelines for Station Positioning in Puget Sound. Prepared for United States EPA Region 10 and the Puget Sound Water Quality Action Team. September.

USACE (United States Army Corps of Engineers). 2004. Engineering and Design Hydrographic Surveying Manual, EM 1110-2-1003, U.S. Army Corps of Engineers, April 2004

Tables and Figures

Table 1. Benchmark Monument Coordinates and Description

Figure 1. Photograph of Piling PH2, at the end of the Fred Devine Boat Dock

Figure 2. Locations of control monuments PH1 and PH2 at Swan Island Boat Launch and Fred Devine Boat Dock, respectively

Figure 3. PK nail in the middle of Willamette Park Boat Launch parking is survey monument PH3

Attachments

Detailed survey sheets of PH Control Points of Portland Harbor (PH1, PH2, and PH3), and Raindeer survey monuments

Table 1. Benchmark Monument Coordinates and Description

Designation	Approx. Location	Description	NAD83 (2011), Oregon SPCS North (ft)		NAVD88 Elevation (ft)
			Northing	Easting	
DEMSI-BASE	Columbia River	Fixed antenna with height at antenna reference point	718172.70	7654431.05	73.58
DEMSI- CHECK	Columbia River	Fixed antenna with height at antenna reference point	718170.73	7654419.84	71.67
RAINDEER	RM 2	USACE Brass Cap	722443.24	7614886.64	35.44
Portland Harbor 1 (PH1)	Swan Island Boat Ramp	1/2" Iron Rod with red plastic cap stamped "DEA Control" Point is 0.3 feet south of the back of curb at the Swan Island Boat Ramp, 10.5 feet north of a cyclone fence, and 60 feet east of a light post	698702.46	7637426.37	33.38
Portland Harbor 2 (PH2)	Fred Devine Boat Dock	Reference point is 0.2 feet SE of the SE side of a 1-1/2-foot diameter steel pile. This is the furthest SE pile at the end of the Fred Devine Diving and Salvage Company dock in the Swan Island Lagoon.	700967.87	7634507.67	NA
Portland Harbor 3 (PH3)	Willamette Park Boat Launch (above the falls)	PK nail in trailer parking lot of boat launch ramp, near center of loop and approximately even with seventh parking space.	617123.76	7649701.80	72.42
2100	RM 13	5/8" bolt on SW corner of screen wall at DEA office 2100 SW River Parkway, Portland, OR	678400.01	7645190.81	159.51

General Notes:

1. The two DEMSI and the 2100 stations (indicated with green shading) are transceiver beacon stations in upland areas. These stations will not be used for daily location control checks by sampling team. More information regarding these stations is available upon request.
2. PH1 is located at the Swan Island boat ramp parking lot and accessible by foot.
3. PH2 is located at a piling at the boat dock where project-related vessels will be docked and is accessible by boat. This pile is to be used for daily position checks for sediment sampling operations. Pile is for position only and not elevation.
4. PH3 is located in the parking lot of the boat launch above the Willamette Falls and is accessible by foot.
5. Raindeer station is located adjacent to the river and accessible by foot (for the hand-held GPS).

Acronyms:
DEA = David Evans and Associates; ft = feet; NAD83 = North American Datum of 1983; NAVD88 = North American Vertical Datum of 1988; PH = Portland Harbor; RM = river mile; PK nail = survey marker; USACE = US Army Corps of Engineers; SPCS = State Plane Coordinate System

Figure 1. Photograph of Piling PH2, at the end of the Fred Devine Boat Dock. Piling was surveyed during and captured in DEA bathymetric survey. Photo is facing northwest.

PH2 is located on the SE corner of the Fred Devine Boat Dock, where Gravity's boats berth every night.

PH1 is located on the SW side of the Swan Island Boat Launch parking lot, where field crews park to meet the boats at the launch dock.

Figure 2. Locations of control monuments PH1 and PH2 at Swan Island Boat Launch and Fred Devine Boat Dock, respectively.

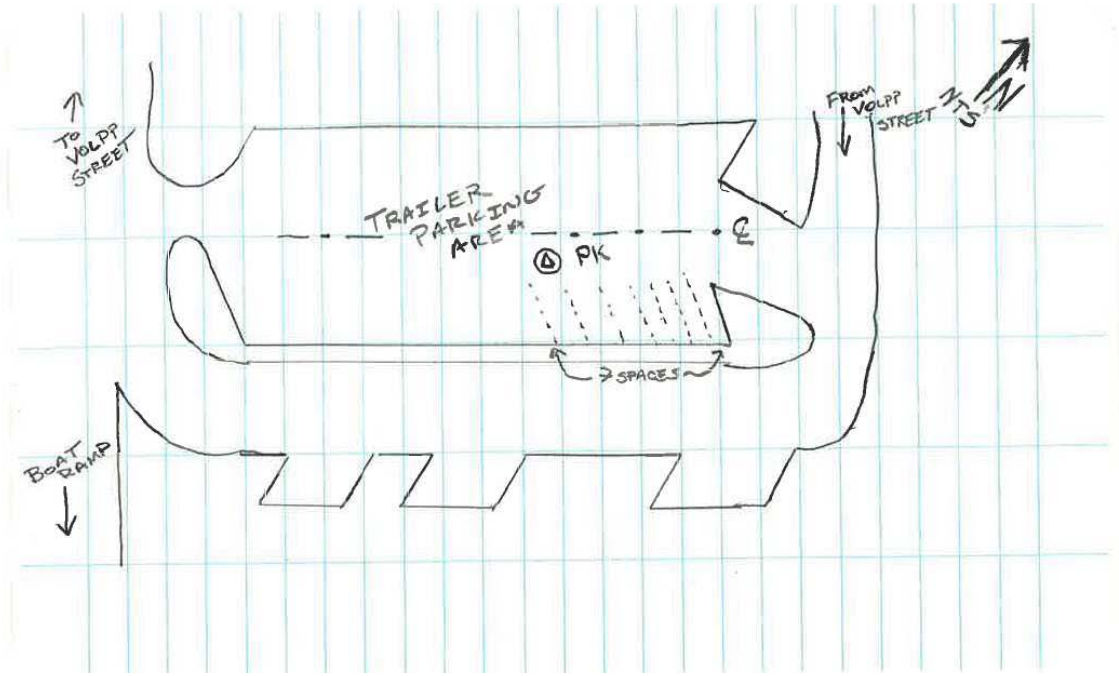


Figure 3. PK nail in the middle of Willamette Park Boat Launch parking marks survey monument PH3. It was land-surveyed by DEA and marked with pink survey tape. Photo shows survey equipment set-up over PH3.

NOTE: This form intended for field use. Unsolicited data submitted to NGS must be converted to bluebook format.

GPS STATION OBSERVATION LOG
April 16, 2003

Station Designation: (check applicable:__ FBN__ CBN__ PAC__ SAC __BM) Portland Harbor 1 (PH1)		Station PID, if any:	Date (UTC): 06-Mar-18
General Location: Swan Island Boat Launch	Airport ID, if any:	Station 4-Character ID:	Day of Year: 065
Project Name: Portland Harbor - AETR00000034	Project Number: GPS-	Station Serial # (SSN):	Session ID:(A,B,C etc)

NAD83 Latitude: o ' "
NAD83 Longitude: o ' "
NAD83 Ellipsoidal Height: meters
NAVD88 Orthometric Ht.: meters
GEOID99 Geoid Height: meters

Agency Full Name: David Evans and Associate, Inc.
Operator Full Name: David T. Moehl
Phone #: ( ) (360) 314-3200
e-mail address: dtm@deainc.com

Observation Session Times (UTC):
Sched. Start _____ Stop _____
Actual Start 19:30 Stop 21:32

Epoch Interval= 1 Seconds
Elevation Mask = 10 Degrees

Receiver Brand & Model: Trimble SPS985
P/N: 82500-60
S/N: 5616F59510
Firmware Version: 5.30
❒ CamCorder Battery, ❒ 12V DC, ❒ 110V AC, ✓ Other

Antenna Code*, Brand & Model: Trimble SPS985 Internal
P/N:
S/N:
Cable Length, meters: n/a
Vehicle is Parked 10 meters N (direction) from antenna.

Antenna plumb before session?	(✓ / N)	Circle
Antenna plumb after session?	(✓ / N)	Yes or No
Antenna oriented to true North?	(Y / N✓)	-If no,
Weather observed at antenna ht.	(Y / N✓)	explain
Antenna ground plane used?	(Y / N✓)	"
Antenna radome used?	(Y / N✓)	If yes,
Eccentric occupation (>0.5 mm)?	(Y / N✓)	describe.
Any obstructions above 10°?	(Y / N✓)	Use
Radio interference source nearby	(Y / N✓)	Vis. form

Tripod or Antenna Mount: Check one:
✓ Fixed-Leg Tripod, ❒ Collapsible-leg tripod ❒ Fixed Mount
Brand & Model: Seco fixed height
P/N:
S/N: 5115-00-FLY
Last Adjustment date: 2018-03-05

Psychrometer (if used) Brand & Model:
P/N:
S/N:
Last Calibration or check Date:

** ANTENNA HEIGHT **	Before Session Begins: Meters	Feet	After Session Ends: Meters	Feet
A= Datum point to Top of Tripod (Tripod Height)	2.000		2.000	
B= Additional offset to ARP if any (Tribrach/Spacer)	0.000		0.000	
H= Antenna Height = A + B = Datum Point to Antenna Reference Point (ARP)	2.000	6.56	2.000	6.56

Meters = Feet x (0.3048)
Height Entered Into Receiver = 2.000 meters.
Note &/or sketch **ANY** unusual conditions. Be **Very Explicit** as to where and how Measured!

Barometer (if used) Brand & Model:
S/N:

Weather Data	Weather Codes	Time (UTC)	Dry-Bulb Temp Fahrenheit	Dry-Bulb Temp Celsius	WetBulb Temp Fahrenheit	WetBulb Temp Celsius	Rel. % Humidity	Atm. Pressure inches Hg	Atm. Pressure millibar
Before	00000	19:30							
Middle									
After	00000	21:32							

Remarks, Comments on Problems, Sketches, Pencil Rubbing, etc:

Control point is a 1/2" iron rod with red plastic cap stamped "DEA CONTROL" set 0.1' below natural grade. Control point is 0.3' south of the back of curb, 10.5' north of a cyclone fence and 60' easterly of the 2nd light post east of the boat ramp. See detached sketch and photos.

Weather codes are required. Weather data are optional but encouraged. *Antenna code comes from ant_info file furnished by project coordinator.

Data File Name(s): 95100650.T02
(Standard NGS Format = aaaaddds.xxx)
where aaaa=4-Character ID, ddd=Day of Year, s=Session ID, xxx=file dependant extension

Updated Station Description: ❒ Attached ❒ Submitted earlier
Visibility Obstruction Form: ❒ Attached ❒ Submitted earlier
Photographs of Station: ✓ Attached ❒ Submitted earlier
Pencil Rubbing of Mark: ❒ Attached

LOG CHECKED BY: Jon Dasler

Table of Weather Codes

CODE	PROBLEM	VISIBILITY	TEMPERATURE	CLOUD COVER	WIND
0	did not occur	Good, over 15 miles	Normal, 32° F- 80° F	Clear, below 20%	Calm, under 5mph (8km/h)
1	did occur	Fair, 7-15 miles	Hot, over 80°F (27 C)	Cloudy, 20% to 70%	Moderate, 5 to 15 mph
2	- not used -	Poor, under 7 miles	Cold, below 32° F (0 C)	Overcast, over 70%	Strong, over15 mph (24km/h)

Examples: 00000 = No problem, good visibility, normal temp, clear, calm wind 12121 = Problems, poor visibility, hot, overcast, moderate wind

Sketch of Monument PH1

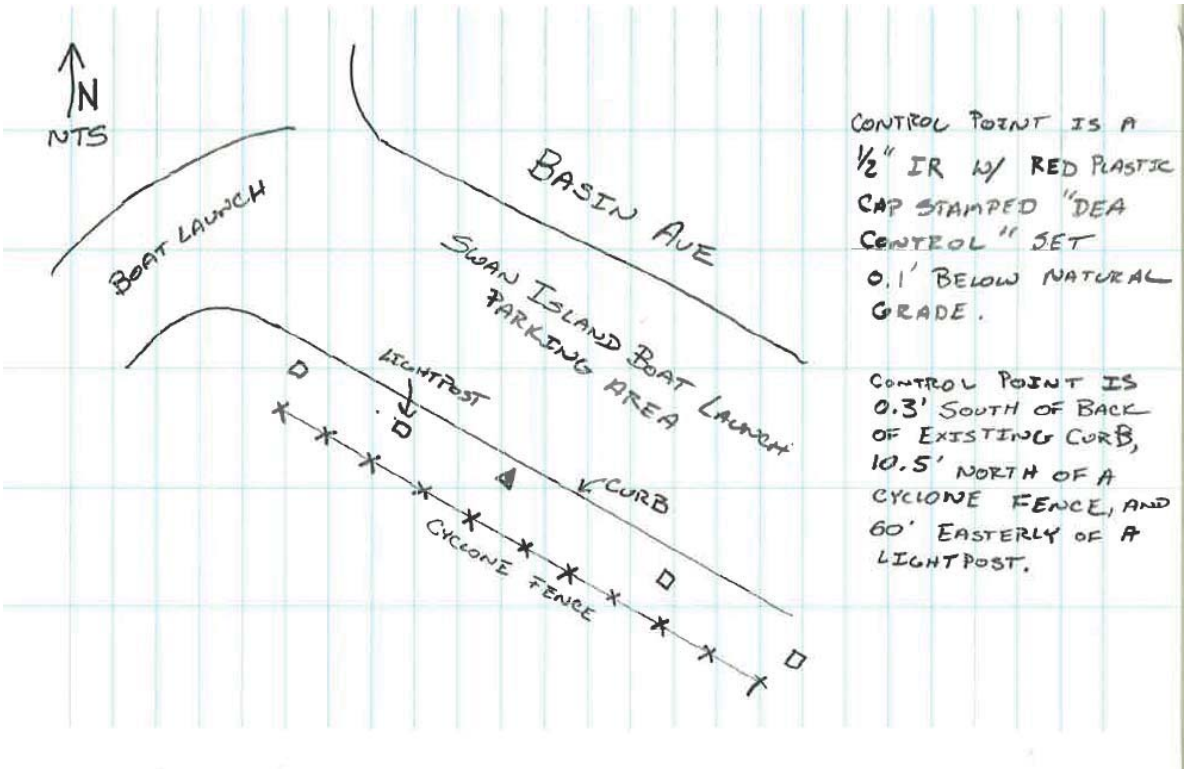


Photo of Monument PH1

GNSS Setup on PH1

NOTE: This form intended for field use. Unsolicited data submitted to NGS must be converted to bluebook format.

GPS STATION OBSERVATION LOG
April 16, 2003

Station Designation: (check applicable:__ FBN__ CBN__ PAC__ SAC __BM) Portland Harbor 2 (PH2)		Station PID, if any:	Date (UTC): 20-Apr-18
General Location: Fred Devine Boat Dock	Airport ID, if any:	Station 4-Character ID:	Day of Year: 111
Project Name: Portland Harbor - AETR00000034	Project Number: GPS-	Station Serial # (SSN):	Session ID:(A,B,C etc)

NAD83 Latitude o ' "	NAD83 Longitude o ' "	NAD83 Ellipsoidal Height meters	Agency Full Name: David Evans and Associate, Inc.
Observation Session Times (UTC): Sched. Start _____ Stop _____ Actual Start 19:45 Stop 19:49	Epoch Interval= 1 Seconds Elevation Mask = 10 Degrees	NAVD88 Orthometric Ht. meters GEOID99 Geoid Height meters	Operator Full Name: David T. Moehl Phone #: ( ) (360) 314-3200 e-mail address: dtm@deainc.com

Receiver Brand & Model: Trimble SPS985	Antenna Code*, Brand & Model: Trimble SPS985 Internal	Antenna plumb before session? (Y / N) ✓ Circle
P/N: 82500-60	P/N:	Antenna plumb after session? (Y / N) ✓ Yes or No
S/N: 5616F59510	S/N:	Antenna oriented to true North? (Y / N) ✓ -If no,
Firmware Version: 5.30	Cable Length, meters: n/a	Weather observed at antenna ht. (Y / N) ✓ explain
❒ CamCorder Battery, ❒ 12V DC, ❒ 110V AC, ✓ Other	Vehicle is Parked n/a meters ____(direction) from antenna.	Antenna ground plane used? (Y / N) ✓ "
		Antenna radome used? (Y / N) ✓ If yes,
		Eccentric occupation (>0.5 mm)? (Y / N) ✓ describe.
		Any obstructions above 10°? (Y / N) ✓ Use
		Radio interference source nearby (Y / N) ✓ Vis. form

Tripod or Antenna Mount: Check one:
✓ Fixed-Leg Tripod, ❒ Collapsible-leg tripod ❒ Fixed Mount
Brand & Model: Seco fixed height
P/N:
S/N: 5115-00-FLY
Last Adjustment date: 2018-03-05

Psychrometer (if used) Brand & Model:
P/N:
S/N:
Last Calibration or check Date:

** ANTENNA HEIGHT **	Before Session Begins: Meters	Feet	After Session Ends: Meters	Feet
A= Datum point to Top of Tripod (Tripod Height)	2.000		2.000	
B=Additional offset to ARP if any (Tribrach/Spacer)	0.000		0.000	
H= Antenna Height = A + B = Datum Point to Antenna Reference Point (ARP)	2.000	6.56	2.000	6.56

Meters = Feet x (0.3048)
Height Entered Into Receiver = 2.000 meters.
Note &/or sketch **ANY** unusual conditions. Be **Very Explicit** as to where and how Measured!

Barometer (if used) Brand & Model:
S/N:

Weather Data	Weather Codes	Time (UTC)	Dry-Bulb Temp Fahrenheit	Dry-Bulb Temp Celsius	WetBulb Temp Fahrenheit	WetBulb Temp Celsius	Rel. % Humidity	Atm. Pressure inches Hg	Atm. Pressure millibar
Before	00010	19:45							
Middle									
After	00010	19:49							

Remarks, Comments on Problems, Sketches, Pencil Rubbing, etc:

Reference point is 0.2 feet SE of the SE side of a 1-1/2 foot steel pile. This is the furthest SE pile at the end of the Fred Devine Diving and Salvage Company dock in the Swan Island Lagoon. This pile is to be used for daily position checks for sediment sampling operations. Pile is for position only and not elevation.
NAD83(2011) Oregon North Zone International Feet Coordinates
North 700967.9 East 7634507.7

Weather codes are required. Weather data are optional but encouraged. *Antenna code comes from ant_info file furnished by project coordinator.

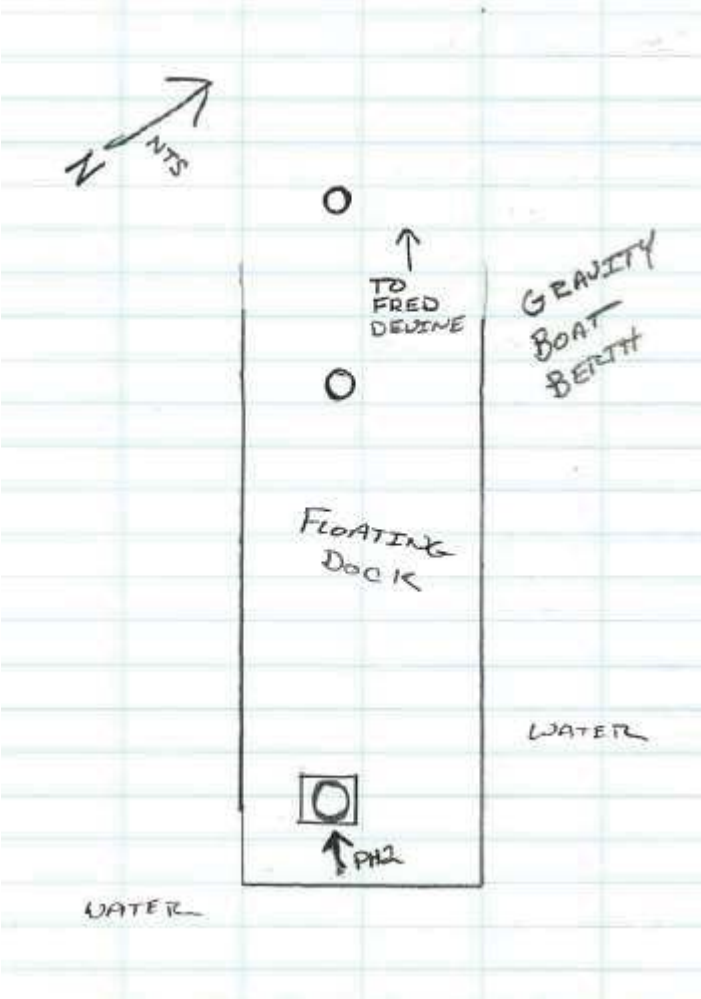
Data File Name(s):
(Standard NGS Format = aaaaddds.xxx)
where aaaa=4-Character ID, ddd=Day of Year, s=Session ID, xxx=file dependant extension

Updated Station Description: ❒ Attached ❒ Submitted earlier
Visibility Obstruction Form: ❒ Attached ❒ Submitted earlier
Photographs of Station: ✓ Attached ❒ Submitted earlier
Pencil Rubbing of Mark: ❒ Attached

LOG CHECKED BY: Jon Dasler

Table of Weather Codes	CODE	PROBLEM	VISIBILITY	TEMPERATURE	CLOUD COVER	WIND
	0	did not occur	Good, over 15 miles	Normal, 32° F- 80° F	Clear, below 20%	Calm, under 5mph (8km/h)
	1	did occur	Fair, 7-15 miles	Hot, over 80°F (27 C)	Cloudy, 20% to 70%	Moderate, 5 to 15 mph
	2	- not used -	Poor, under 7 miles	Cold, below 32° F (0 C)	Overcast, over 70%	Strong, over15 mph (24km/h)
Examples:	00000 = No problem, good visibility, normal temp, clear, calm wind				12121 = Problems, poor visibility, hot, overcast, moderate wind	

Sketch and Fieldnotes



200 CHK PH1

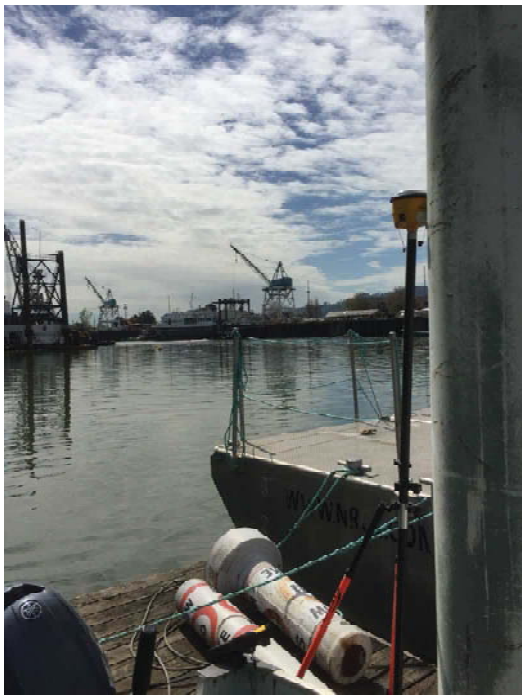
	KNOWN COORDS	OBS	Δ (FT)
	N = 698702.46	N = 698702.45	0.01
	E = 7637426.37	E = 7637426.39	0.02
	Z = 33.38	Z = 33.37	0.01

201 SE FACE OF PILE
3-MIN OBS
N = 700967.87
E = 7634507.64
Z = N/A

202 SW FACE TOPO
203 NW FACE TOPO
204 NE FACE TOPO

Overview of PH2 Pile

GNSS Setup on PH2 Pile



View facing south

View facing northwest

NOTE: This form intended for field use. Unsolicited data submitted to NGS must be converted to bluebook format.

GPS STATION OBSERVATION LOG
April 16, 2003

Station Designation: (check applicable:__ FBN__ CBN__ PAC__ SAC __BM)		Station PID, if any:	Date (UTC):
General Location:	Airport ID, if any:	Station 4-Character ID:	Day of Year:
Project Name:	Project Number: **GPS-**	Station Serial # (SSN):	Session ID:(A,B,C etc)

NAD83 Latitude o ' "	NAD83 Longitude o ' "	NAD83 Ellipsoidal Height meters NAVD88 Orthometric Ht. meters GEOID99 Geoid Height meters	Agency Full Name: Operator Full Name: Phone #: ( ) e-mail address:
Observation Session Times (UTC): Sched. Start _____ Stop _____ Actual Start _____ Stop _____	Epoch Interval=____ Seconds Elevation Mask = _____ Degrees		

Receiver Brand & Model:

P/N:
S/N:
Firmware Version:

❒ CamCorder Battery, ❒ 12V DC, ❒ 110V AC, ❒ Other

Antenna Code*, Brand & Model:

P/N:
S/N:
Cable Length, meters:

Vehicle is Parked _____ meters ____(direction) from antenna.

Antenna plumb before session?	(Y / N)	Circle Yes or No -If no, explain "
Antenna plumb after session?	(Y / N)	
Antenna oriented to true North?	(Y / N)	
Weather observed at antenna ht.	(Y / N)	
Antenna ground plane used?	(Y / N)	
Antenna radome used?	(Y / N)	If yes, describe. Use Vis. form
Eccentric occupation (>0.5 mm)?	(Y / N)	
Any obstructions above 10°?	(Y / N)	
Radio interference source nearby	(Y / N)	

Tripod or Antenna Mount: Check one:
❒ Fixed-Leg Tripod, ❒ Collapsible-leg tripod ❒ Fixed Mount
Brand & Model:
P/N:
S/N:
Last Adjustment date:

Psychrometer (if used) Brand & Model:

P/N:
S/N:
Last Calibration or check Date:

** ANTENNA HEIGHT **	Before Session Begins: Meters	Before Session Begins: Feet	After Session Ends: Meters	After Session Ends: Feet
A= Datum point to Top of Tripod (Tripod Height)				
B=Additional offset to ARP if any (Tribrach/Spacer)				
H= Antenna Height = A + B = Datum Point to Antenna Reference Point (ARP)	2.003	6.57	2.003	6.57

Meters = Feet x (0.3048)
Height Entered Into Receiver = _____ meters.
Note &/or sketch **ANY** unusual conditions. Be **Very Explicit** as to where and how Measured!

Barometer (if used) Brand & Model:

S/N:

Weather Data	Weather Codes	Time (UTC)	Dry-Bulb Temp Fahrenheit	Dry-Bulb Temp Celsius	WetBulb Temp Fahrenheit	WetBulb Temp Celsius	Rel. % Humidity	Atm. Pressure inches Hg	Atm. Pressure millibar
Before									
Middle									
After									

Remarks, Comments on Problems, Sketches, Pencil Rubbing, etc:

Weather codes are required. Weather data are optional but encouraged. *Antenna code comes from ant_info file furnished by project coordinator.

Data File Name(s):

(Standard NGS Format = aaaaddds.xxx)
where aaaa=4-Character ID, ddd=Day of Year, s=Session ID, xxx=file dependant extension

Updated Station Description: ❒ Attached ❒ Submitted earlier
Visibility Obstruction Form: ❒ Attached ❒ Submitted earlier
Photographs of Station: ❒ Attached ❒ Submitted earlier
Pencil Rubbing of Mark: ❒ Attached

LOG CHECKED BY:

Table of Weather Codes

CODE	PROBLEM	VISIBILITY	TEMPERATURE	CLOUD COVER	WIND
0	did not occur	Good, over 15 miles	Normal, 32° F- 80° F	Clear, below 20%	Calm, under 5mph (8km/h)
1	did occur	Fair, 7-15 miles	Hot, over 80°F (27 C)	Cloudy, 20% to 70%	Moderate, 5 to 15 mph
2	- not used -	Poor, under 7 miles	Cold, below 32° F (0 C)	Overcast, over 70%	Strong, over15 mph (24km/h)

Examples: 00000 = No problem, good visibility, normal temp, clear, calm wind 12121 = Problems, poor visibility, hot, overcast, moderate wind

Sketch of Monument PH3

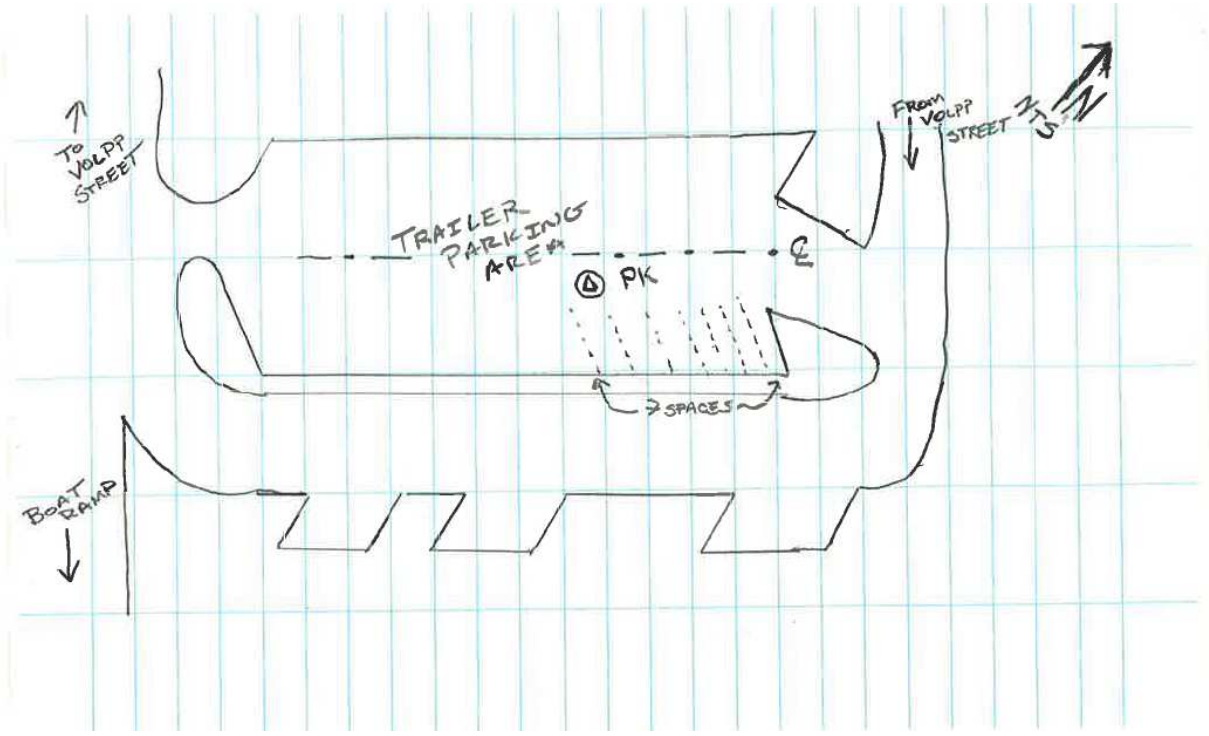


Photo of Monument PH3

GNSS Setup on PH3

NOTE: This form intended for field use. Unsolicited data submitted to NGS must be converted to bluebook format.

GPS STATION OBSERVATION LOG
April 16, 2003

Station Designation: (check applicable:__ FBN__ CBN__ PAC__ SAC __BM) Raindeer		Station PID, if any:	Date (UTC): 06-Mar-18
General Location: Sauvie Island, Willamette River	Airport ID, if any:	Station 4-Character ID:	Day of Year: 065
Project Name: Portland Harbor - AETR00000034	Project Number: GPS-	Station Serial # (SSN):	Session ID:(A,B,C etc)

NAD83 Latitude ° ' "	NAD83 Longitude ° ' "	NAD83 Ellipsoidal Height meters	Agency Full Name: David Evans and Associates, Inc.
Observation Session Times (UTC): Sched. Start _____ Stop _____ Actual Start 17:38 Stop 23:45	Epoch Interval= 1 Seconds Elevation Mask = 10 Degrees	NAVD88 Orthometric Ht. meters GEOID99 Geoid Height meters	Operator Full Name: David T. Moehl Phone #: ( ) (360) 314-3200 e-mail address: dtm@deainc.com

Receiver Brand & Model: Trimble SPS855	Antenna Code*, Brand & Model: Trimble Zephyr 3 Base	Antenna plumb before session? (✓Y / N) Circle
P/N: 69855-60	P/N: 115000-00	Antenna plumb after session? (✓Y / N) Yes or No
S/N: 5506R0074	S/N: 1551129193	Antenna oriented to true North? (✓Y / N) -If no,
Firmware Version: 5.30	Cable Length, meters: 10	Weather observed at antenna ht. (Y / N✓) explain
❒ CamCorder Battery, ✓❒ 12V DC, ❒ 110V AC, ❒ Other	Vehicle is Parked n/a meters ____(direction) from antenna.	Antenna ground plane used? (Y / N✓) "
		Antenna radome used? (Y / N✓) If yes,
		Eccentric occupation (>0.5 mm)? (Y / N✓) describe.
		Any obstructions above 10°? (Y / N✓) Use
		Radio interference source nearby (Y / N✓) Vis. form

Tripod or Antenna Mount: Check one:
✓❒ Fixed-Leg Tripod, ❒ Collapsible-leg tripod ❒ Fixed Mount
Brand & Model: Seco fixed height
P/N:
S/N: 5115-00-FLY
Last Adjustment date: 2018-03-05

Psychrometer (if used) Brand & Model:
P/N:
S/N:
Last Calibration or check Date:

** ANTENNA HEIGHT **	Before Session Begins: Meters	Feet	After Session Ends: Meters	Feet
A= Datum point to Top of Tripod (Tripod Height)	2.000		2.000	
B=Additional offset to ARP if any (Tribrach/Spacer)	-0.003		-0.003	
H= Antenna Height = A + B = Datum Point to Antenna Reference Point (ARP)	1.997	6.55	1.997	6.55

Meters = Feet x (0.3048)
Height Entered Into Receiver = 2.000 meters.
Note &/or sketch **ANY** unusual conditions. Be **Very Explicit** as to where and how Measured!

Barometer (if used) Brand & Model:
S/N:

Weather Data	Weather Codes	Time (UTC)	Dry-Bulb Temp Fahrenheit	Dry-Bulb Temp Celsius	WetBulb Temp Fahrenheit	WetBulb Temp Celsius	Rel. % Humidity	Atm. Pressure inches Hg	Atm. Pressure millibar
Before	00000	17:38							
Middle									
After	00000	23:45							

Remarks, Comments on Problems, Sketches, Pencil Rubbing, etc:

Weather codes are required. Weather data are optional but encouraged. *Antenna code comes from ant_info file furnished by project coordinator.

Data File Name(s): 00740650.T02
(Standard NGS Format = aaaaddds.xxx)
where aaaa=4-Character ID, ddd=Day of Year, s=Session ID, xxx=file dependant extension

Updated Station Description: ❒ Attached ❒ Submitted earlier
Visibility Obstruction Form: ❒ Attached ❒ Submitted earlier
Photographs of Station: ✓Attached ❒ Submitted earlier
Pencil Rubbing of Mark: ❒ Attached

LOG CHECKED BY: Jon Dasler

Table of Weather Codes	CODE	PROBLEM	VISIBILITY	TEMPERATURE	CLOUD COVER	WIND
	0	did not occur	Good, over 15 miles	Normal, 32° F- 80° F	Clear, below 20%	Calm, under 5mph (8km/h)
	1	did occur	Fair, 7-15 miles	Hot, over 80°F (27 C)	Cloudy, 20% to 70%	Moderate, 5 to 15 mph
	2	- not used -	Poor, under 7 miles	Cold, below 32° F (0 C)	Overcast, over 70%	Strong, over15 mph (24km/h)
Examples:	00000 = No problem, good visibility, normal temp, clear, calm wind			12121 = Problems, poor visibility, hot, overcast, moderate wind		

Photo of Monument RAINDEER

Photo of Monument RAINDEER

GNSS Setup on RAINDEER

APPENDIX B

Field Forms

EQUIPMENT CALIBRATION LOG

Project Name: Portland Harbor PDI Studies 2018, Study Name:

Field Crew Initials:

Comments:

Circle or Write in Type/Equipment Model	Serial No.	Calibrated By	Date	Time	Parameter Calibrated and Calibration Standard		Calibration/ check Pass Y/N?
scale					zeroing	check	
					0 grams of weight	1 gram of weight:	
					initial reading:	50 grams of weight:	
					adjustment:	100 grams of weight:	
					Final reading:		
freezer					condition of samples (frozen/thawed)?		
					freezer setting?		
					freezer temperature?		
					Adjustment made to temperature sertting?		
refrigerator					condition of samples (frozen/thawed)?		
					refrigerator setting?		
					refrigerator temperature?		
					Adjustment made to temperature sertting?		
other equipment					zeroing	check	
					units		
					initial reading:		
					adjustment:		
					Final reading:		

FISHING EFFORT AND TALLY FORM

Portland Harbor PDI Studies – 2018 Fish Tissue Study or 2018 Fish Tracking Study (circle one)

Field Crew Initials:

Fishing Technique:

Sampling Date	Sampling Location ID (e.g. SMB001)	Angler Initials	Fishing Start Time	Fishing Stop Time	Total Duration (minutes)	Catch Time	Catch Species*	Health	Comments

* Catch Species Abbreviations: BB= brown bullhead, BC= black crappie, BG= bluegill, CC= common carp, LS= largescale sucker, LB= largemouth bass, NP= northern pikeminnow, PS= pumpkinseed, SC= sculpin, SMB= smallmouth bass, WC= white crappie, YP= yellow perch; for ESA species: CHK=Chinook salmon, CM= chum salmon, CO= coho salmon, SWT= steelhead

SMALLMOUTH BASS SPECIMEN TALLY AND LOCATION FORM

Portland Harbor PDI Studies – 2018 Fish Tissue Study or 2018 Fish Tracking Study (circle one)

Field Crew Initials:

Fishing Technique:

Collection Date	Collection Time	Sample ID*	Sample Location ID (e.g. SMB001)	Fork Length (mm)	Total Length (mm)	Weight	Health	Retained for Analysis or Tagging?	Sample Location Depth to Mudline (ft)	X Coordinate Easting (ft)	Y Coordinate Northing (ft)	Comments

*Sample ID nomenclature is as follows: SMB Tissue Study = PDI-TF-SMB001; Acoustic Tracking Study = PDI-AT-SMBT01.

PHOTO LOG

Portland Harbor PDI 2018 Study Name:

Boat Name:

Team Members:

Date and Time	Camera Identifier (type, model, equipment number)	Location ID	Sample ID	Photo ID	Photo Direction	Description	Habitat Condition	Photo Notes and Comments

AECOM
111 SW Columbia Avenue
Suite 1500
Portland
OR, 97217
USA
aecom.com

Geosyntec
520 Pike Street
Suite 1375
Seattle
WA, 98101
USA
geosyntec.com

UPDATED FINAL

Surface Water and Sediment Trap Field Sampling Plan

Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling

Portland Harbor Superfund Site

AECOM Project Number: 60554349
Geosyntec Project Number: PNG0767A

September 27, 2018 (Rev. 3)

Prepared for:

United States Environmental Protection Agency, Region 10
1200 Sixth Avenue, Suite 900
Seattle, Washington 98101

On behalf of:

Portland Harbor Pre-RD AOC Group
Portland, Oregon

Prepared by:

AECOM

111 SW Columbia, Suite 1500
Portland, OR 97201
USA

Geosyntec consultants

520 Pike Street, Suite 1375
Seattle, WA 98101
USA

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CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

September 27, 2018

Kenneth M. Tyrrell
PDI Project Coordinator
AECOM Technical Services

Date

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A-3: PR2900 Sampling Log

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Appendix B. Standard Operating Procedures

B-1: Water Quality Parameters SOP (LISST and YSI)

B-2: ADCP SOP

B-3: Surface Water Sampling with Peristaltic Pump SOP (Integral 2004b)

B-4: High-Volume Surface Water Sampling with PR2900 SOP

B-5: Horizontal and Vertical Location Control SOP

B-6: Excerpts from Sediment Trap FSP (Integral 2006c)

B-7: Investigation-Derived Waste SOP

ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
µm	micrometer
2,3,7,8-TCDD	2,3,7,8-tetrachlorodibenzodioxin
ADCP	acoustic Doppler current profiler
AECOM	AECOM Technical Services
ALS	ALS Environmental
ARARs	applicable or relevant and appropriate requirements
ASAOC	Administrative Settlement Agreement and Order on Consent
BEHP	bis-(2-ethylhexyl) phthalate
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cfs	cubic feet per second
COCs	contaminants of concern
CRD	Columbia River Datum
CSM	Conceptual Site Model
D/F	dioxins/furans
DDx	dichlorodiphenyltrichloroethane (DDT) and its derivatives
DGPS	differential global positioning system
DI	deionized water
DOC	dissolved organic carbon
DQMP	Data Quality Management Plan
DQOs	data quality objectives
EDD	electronic data deliverable
EPA	United States Environmental Protection Agency
FC	Field Coordinator
FS	feasibility study
FSP	Field Sampling Plan
Geosyntec	Geosyntec Consultants, Inc.
GFF	glass fiber flat
Global	Global Diving & Salvage, Inc.
Gravity	Gravity Marine Services
ID	identification number

Integral	Integral Consulting
L	liters
LISST	Laser *In Situ* Scattering and Transmissometery
LWG	Lower Willamette Group
MCPP	methylchlorophenoxypropionic acid
MDL	method detection limit
min	minute
NAD	North American Datum
NAVD88	North American Vertical Datum of 1988
NTU	Nephalometric Turbidity Unit
NWIS	National Weather Information System
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PDI	Pre-Remedial Design Investigation
pg	Particulate Phase
PHSS	Portland Harbor Superfund Site
PP	peristaltic pump
PQL	practical quantitation limits
Pre-RD AOC Group	Pre-Remedial Design Agreement and Order on Consent Group
PSEP	Puget Sound Estuary Program
QA	quality assurance
QAPP	quality assurance project plan
QC	quality control
RI	remedial investigation
RM	river mile
ROD	Record of Decision
Site	Portland Harbor Superfund Site
SOP	standard operating procedure
SOW	Statement of Work
ST	sediment trap
SVOC	semi-volatile organic compound
SW	surface water
TDS	total dissolved solids

TestAmerica	TestAmerica Laboratories
TOC	total organic carbon
TSS	total suspended solids
USGS	United States Geological Survey
VOC	volatile organic compound

1. INTRODUCTION

The Record of Decision (ROD) described a post-ROD sampling effort for the Portland Harbor Superfund Site (Site or PHSS; Figure 1) located in Portland, Oregon, to delineate and better refine the sediment management area footprints, refine the Conceptual Site Model (CSM), determine baseline conditions, and support remedial design (United States Environmental Protection Agency [EPA] 2017a). Geosyntec Consultants, Inc. (Geosyntec), and AECOM Technical Services (AECOM) have submitted a detailed Work Plan for Pre-Remedial Design Investigations (PDI) on behalf of a group of industrial parties called the Pre-Remedial Design Agreement and Order on Consent Group (Pre-RD AOC Group). On December 19, 2017, EPA entered into an Administrative Settlement Agreement and Order on Consent (ASAOC) with the Pre-RD AOC Group to conduct the PDI studies at the Site (EPA 2017b). The ASAOC includes the Statement of Work (SOW) and the PDI Work Plan (an attachment to the SOW), which generally describe the field investigation activities, data analyses, schedule, and deliverables for the PDI.

These PDI studies are a foundational step in what will be a multi-phase effort to update current conditions from the collection of data during the remedial investigation (RI)/feasibility study (FS). The RI/FS was initiated by a group of potentially responsible parties known as the Lower Willamette Group (LWG) and completed by EPA in 2016 (EPA 2016a, 2016b). The RI consisted of three rounds of data collection, including surface and subsurface sediment, bank soils, surface water, sediment traps, porewater, fish tissue, and other media from 2001 through 2007.

This Field Sampling Plan (FSP) was prepared to support the surface water and sediment trap sampling efforts outlined in the PDI Work Plan (Geosyntec 2017) and the project Quality Assurance Project Plan (QAPP) (AECOM and Geosyntec 2018a). To the extent practicable, previously approved FSPs and standard operating procedures (SOPs) from the RI will be referenced.

1.1 Project Setting

The PHSS is located in Portland, Oregon, on the lower Willamette River immediately downstream of the urban downtown. The Site extends from river mile (RM) 1.9 upstream to RM 11.8 and covers 2,190 acres (Figure 1). There are two reaches located immediately upstream of the Site. The Downtown Reach, which includes the urbanized area of downtown Portland, is defined by EPA as extending from RM 11.8 to RM 16.6. EPA defines the Upriver Reach as extending from RM 16.6 to RM 28.4.

1.2 Project Overview

In the RI (EPA 2016a), surface water samples were collected using two primary methods: 1) a peristaltic pump (PP) method; and 2) a high-volume method using either an Infiltrex 300,

Infiltrex-L, or Gravity PR2900 system with XAD-2 resin columns (Amberlite® XAD®-2 polymeric adsorbent is a hydrophobic crosslinked polystyrene copolymer resin) to collect hydrophobic organic compounds for analysis by ultra-low detection analytical methods (XAD method). The PP method was used to collect samples for total concentrations of constituents (particulate and dissolved combined; whole water samples) and dissolved metals (i.e., as the filtrate of water passed through a 0.45-micrometer [µm] in-line cartridge filter in the field). The XAD method was used to collect samples consisting of a particulate phase (solids captured on a series of filters) and a dissolved phase (consisting of the fraction of dissolved organic constituents binding to the XAD-2 resin), which were summed to a total concentration (calculated).

To support the PDI studies, surface water data will be collected consistent with the RI approach. Surface water samples for analysis of hydrophobic organic compounds by ultra-low detection limit analytical methods will be collected using a high-volume pumping system (Gravity PR2900) connected to an in-line vortex separator, followed by a 0.5 µm glass fiber flat (GFF) filter and a XAD-2 resin column. Surface water samples will also be collected using a PP for the analysis of specific semi-volatile organic compounds (SVOCs), other organics, and metals (including total and dissolved metals via field filtering of samples as described above), and non-chemical parameters (e.g., total suspended solids [TSS]).

Sediment traps were also used in the RI to characterize waterborne sediment contamination that enters the study area from upstream sources (Integral 2006). For the PDI studies, sediment traps will again be deployed to collect sediment settling from the surface water column. The data will provide a line of evidence for incoming sediment load to the Site. The sediment traps will target fine-grained, more mobile suspended sediment, and material higher in total organic carbon (TOC) that is more likely to move downstream and be deposited within the Site. Sediments captured in the sediment traps will be analyzed for the full ROD suite of contaminants of concern (COCs) for sediment (see ROD Table 17, relisted in Table 3 of the PDI Work Plan), TOC, and grain size.

1.3 Data Quality Objectives

Data quality objectives (DQOs) for surface water and sediment trap sampling are detailed in the QAPP Table 3 (AECOM and Geosyntec 2018a). The objectives of PDI surface water and sediment trap sampling are to 1) baseline the river conditions in 2018 with synoptic data (sediment and fish tissue), 2) investigate current surface water conditions and changes over time, and 3) update study area conditions to refine the CSM for future remedial design purposes, as described in the PDI Work Plan (Geosyntec 2017). In addition, sediment trap sampling will provide data regarding upstream conditions and contaminant loading into the Site.

2. SAMPLING DESIGN AND APPROACH

This FSP provides the additional details necessary to ensure that the execution of the study will achieve the project-specific DQOs and data use objectives set out in Section 1.3 of this FSP and Section 3.2 of the QAPP (AECOM and Geosyntec 2018a). This section of the FSP presents the details of the study design including the methods, locations, and approach of sampling.

The purpose of surface water sampling is to characterize the flow and quality of surface water passing through the river's cross section at each location and evaluate chemical concentrations immediately upstream of the Site that could be contributing to incoming contaminant loads. One cross-sectional composited sample will be collected per transect (similar to the RI Round 2A approach).[1] The sample design will be vertically composited and horizontally composited along the transect, with equal volume across the cross-sectional area of the segment. Surface water sampling will be conducted over three events targeting different months and flow conditions to capture seasonal and flow-dependent variability of surface water conditions (high-flow, low-flow and a stormwater event; Section 2.4).

Sediment traps will be placed along two of the upstream transects to evaluate incoming sediment loads (settling particulate matter). These sediment traps will also be deployed over similar seasonal conditions as the surface water sampling to capture high-flow, low-flow, and stormwater events (three events). However, sediment traps will be deployed over a period of 3 months, compared to a 1-week sampling schedule for surface water. The goal of sediment trap sampling is to overlap with the surface water sampling sometime during each seasonal event, but the interval/collection durations are not the same. Please refer to Section 2.4 for further details of the sampling schedule.

Methods for surface water and sediment trap sampling are generally consistent with the following:

- EPA-approved sampling plans from the RI (Integral Consulting [Integral] 2004a, 2004b, 2006b, and 2006c)
- San Francisco Estuary Institute's *Field Sampling Manual for the Regional Monitoring Program for Trace Substances* (David et al. 2001)
- *Interagency Field Manual for the Collection of Water-Quality Data* (United States Geologic Survey [USGS] 2000)
- EPA Method 1669, *Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels* (EPA 1996)

[1] Ethylbenzene samples will be collected as a series of discreet samples from the three near-bottom locations across each transect and will not be composited.

- EPA guidance on collecting and evaluating sediment data (EPA 2014)
- Puget Sound Estuary Program (PSEP) protocols (PSEP 1986)

Previous study designs are briefly discussed below. Variation in sample design or collection from the site-specific RI documents is provided in Section 2.5.

2.1 Surface Water

2.1.1 Surface Water Sampling Method Selection and Rationale

Surface water samples will be collected by two methods: 1) a PP, and 2) a high-volume pumping system (Gravity PR2900) consisting of a series of filtration (vortex separator and GFF filter) to capture the particulate phase and an XAD-2 resin column to capture the dissolved fraction of target constituents. The PP method is appropriate for non-organic chemicals and those that do not require ultra-low detections limits. The PP method will be used to collect samples for total concentrations of constituents (particulate and dissolved combined; whole water samples) and dissolved metals (i.e., as the filtrate of water passed through a 0.45 µm in-line cartridge filter in the field). The high-volume surface water sampling method (herein referred to as the high-volume method) will be used to collect samples for analysis of hydrophobic organic compounds by ultra-low detection limit analytical methods (Table 1). Analysis of surface water samples collected via the high-volume method is more likely to detect lower concentrations of focused COCs resulting in method detection limits (MDLs) that are at or below applicable or relevant and appropriate requirement-based cleanup levels (ARAR-based cleanup levels) provided in the ROD (Table 17 of ROD and Table 3 of the PDI Work Plan).

Based on the RI dataset, the high-volume method consistently obtained 99% or greater detection frequency for focused COCs and resulted in MDLs that were consistently lower than PP samples (Table 1). The high end of the range of MDLs for PP samples was above the ARAR-based cleanup levels for all focused COCs. High-volume samples resulted in MDLs that were below ARAR-based cleanup levels for dichlorodiphenyltrichloroethane (DDT) and its derivatives (DDx) and total polychlorinated biphenyls (PCBs). The ARAR-based cleanup level for total polycyclic aromatic hydrocarbons (PAHs) is based on benzo(a)pyrene equivalents, which do not have a specified MDL for high-volume samples; however, individual PAH MDLs[2] were below ARAR-based cleanup levels for all PAHs with the exception of benzo(a)pyrene and dibenz(a,h)anthracene. The ARAR-based cleanup level for the dioxin 2,3,7,8-tetrachlorodibenzodioxin (2,3,7,8-TCDD) toxic equivalency is unachievable for MDLs under the PP method and achievable using high-volume sample methods only if 1,000 liters (L) or more of surface water is pumped in the field.

[2] PAHs will be analyzed using the isotopic dilution method, which is characterized by sample-specific Estimated Detections Limits rather than MDLs.

The PDI target volume is 400 L per composite sample, to be collected within a 12-hour field day. A sampling volume of approximately 1,000 L was collected during the first sampling events of the RI to achieve ultra-low detection limits. However, the testing laboratory (AXYS) indicated that the background interferences in the XAD-2 resin when sampling such large volumes during the RI forced a dilution series that essentially negated the positive effect of the larger volume. In addition to the interferences, at a flow rate of 1.5 liters per minute (L/min) (maximum rate), the sampling would take over 12 hours of pumping. Combined with transit time to the transect locations, set-up time at each location across the transect, and filter changes, monitoring, etc., there is not adequate daylight to safely perform a larger volume effort. Based on the detection limits for the XAD resin provided by AXYS for the PDI work, a 400 L composite sample, with the extract split 75% for dioxin/furan (D/F), PCBs, and pesticides, and 25% for PAHs, meets the ARAR-based cleanup levels for all COCs with the exception of D/F.

2.1.2 Chemistry and Rationale for Sampling Locations

Surface water will be collected from seven transect locations over three sampling rounds to provide spatial coverage across the study area and evaluate a range of river dynamics (high-flow, low-flow, storm events). Approximate transect locations are depicted on Figure 2 and listed on Table 2 as follows:

- Transect 1: RM 1.8 at the downstream boundary (within the Site)
- Transect 2: Downstream boundary of the Multnomah Channel; entrance to channel is near RM 3
- Transect 3: RM 4
- Transect 4: RM 7
- Transect 5: RM 8.8
- Transect 6: RM 11.8, just upstream of the Site, near the Downtown Reach boundary
- Transect 7: RM 16.2, further upstream, near the boundary between the Downtown Reach and the Upriver Reach

These transect locations were selected to provide representative coverage from each of the four segments of the Site: RMs 1.9 to 5 (Segment 4); RMs 5 to 7.5 (Segment 3); RMs 7.5 to 9 (Segment 2); and RMs 9 to 11.8 (Segment 1).

Composite surface water samples will be analyzed in the laboratory for conventional parameters and chemical testing for the ROD COCs presented in Table 3a, with the exception of ethylbenzene, which will be collected as a series of discreet samples. Concentrations of organic compounds with low detection limits will be collected with the Gravity PR2900 using a vortex solids separator and GFF filter to capture the particulate phase, and an XAD-2 resin column to capture the dissolved fraction. These constituents (PCB congeners, select pesticides, PAHs, and D/F) will be reported by the laboratory as concentrations in the particulate phase (from the solids

collected by the vortex solids separation system and a laboratory grade 0.5 µm GFF filter) and the dissolved phase (from the XAD-2 resin column); total surface water concentrations will be calculated from these fractions, consistent with RI methods. Filtered PP samples in the field will be analyzed for select dissolved metals, hardness as calcium carbonate, and dissolved organic carbon (DOC). Unfiltered PP samples will be analyzed for select total metals, ethylbenzene, MCPP, select SVOCs, tributyltin, and conventional analytes including TSS, total dissolved solids (TDS), and TOC. The COCs to be analyzed under each collection method are outlined in Table 3a and compared in Table 3b.

Field parameters of the river will include temperature, pH, dissolved oxygen, turbidity, conductivity using a multi-probe YSI, flow rate velocity using a hand-held acoustic Doppler current profiler (ADCP), and particle size distribution and particle concentrations using a Laser *In Situ* Scattering and Transmissometery (LISST). LISST is a submersible multi-parameter system for *in-situ* measurements of particle size distribution and concentration and will be used during surface water sampling. The ADCP measures water flow rates, and hand-held instruments will be used during surface water sampling. At a minimum, data from both instruments will be recorded in the field at three water depths per station (see next section). The SOPs for 1) measuring water quality parameters including particle size distribution and particle concentrations using LISST measurements and 2) performing the handheld acoustical Doppler current profiler measurements are provided in Appendices B-1 and B-2, respectively.

2.1.3 Sample Types, Locations, Depths

One composited sample will be collected per surface water transect (similar to the RI approach during RI Round 2A). The sample will be vertically composited and horizontally composited along the transect. Composite samples will be collected by sampling nine equal volumes from three locations along each transect (east shore, middle of the navigation channel, and west shore) and at three depths per location: upper depth (3 feet below water surface), near bottom (3 feet above sediment surface), and middle (equal distance between upper and bottom). The objective of the composite sample design is to collect a sample volume that is representative of the cross-sectional area of the transect.

Prior to sampling, the depths across the river at each location will be measured and recorded. If the nearshore subsample locations have shallow water depths (i.e., less than 10 feet), fewer subsamples may be collected and more volume collected per subsample. If fewer subsamples are collected, volumes will be adjusted such that equal volume of surface water is collected from the east shore, navigation channel, and west shore. Target water depths based on 2009 bathymetry are listed in Table 2.

As shown on Table 3a, four types of samples will be collected per event and per transect (one at each of the seven transects):

- High-volume surface water samples as the particulate phase collected using a vortex separation system and 0.5 µm GFF filter

- High-volume surface water samples as the dissolved phase in XAD-2 resin beads that adsorb hydrophobic compounds
- PP-filtered using 0.45 µm in-line cartridge filter (dissolved phase) surface water samples
- PP-unfiltered (total) surface water samples

A total of 21 of each of the four sample types listed above will be collected for the PDI study.

2.2 Sediment Trap

2.2.1 Selection and Rationale for Sampling Locations and Chemistry

A total of four discrete traps will be deployed per event, and all will be placed at upriver locations to assess incoming contaminant loads to the Site. Two sediment traps will be deployed at upriver transect RM 11.8 (the target placement is actually at RM 11.81 just above the boundary of the Site), and two additional traps will be placed at upriver transect RM 16.5 (Figure 2, Table 2). Sediment traps will be sampled in coordination with the surface water sampling program (three events over 1 year, concurrent with the surface water sampling program); the traps and surface water sampling events will temporally overlap.

A total of 12 samples will be collected for the PDI study (four samples, three events). Retained sediments (settled particulate matter) will be analyzed for the full ROD suite of sediment COCs, TOC, and grain size (Table 3a).

2.2.2 Sediment Trap Design, Sample Types, Locations, Depths

The sediment trap dimensions, ratio and cluster design, and deployment methods are consistent with methods used in the RI (EPA 2016a). Sediment traps will consist of four glass tubes sized 15 centimeters in diameter and 80 centimeters long (Figure 3).[3] Baffles will not be used. Each tube will contain approximately 1 L of high salinity water (dense salt) and sodium azide or formalin preservative to help maintain the integrity of the samples and confirm that the cylinder has remained upright during deployment (i.e., check the salinity of the water). The top of the trap is oriented perpendicular to the direction of the flow, so that the surface water will pass over the opening of the tube, lose energy, and settle inside the tube. Sediment traps are designed with a 5:1 height-to-diameter ratio consistent with PSEP methods (PSEP 1997). The sediment trap is secured above the mudline with the open top of the cylinders 3 feet above the mudline. This height was determined to ensure sediments are collected settling from the water column and not from re-suspension of bedded sediments and has been used effectively at other sites (Norton

[3] The currently planned design for sediment traps may be reconsidered during project planning should additional information regarding hydrodynamics and sediment transport at the Site indicate a wider diameter sediment trap may be needed; a 5:1 height-to-width ratio will be maintained.

2001). Glass tubes will be placed inside protective polyvinyl chloride rings; the rings will be fastened together and secured to a rebar post driven into the sediment floor by divers, consistent with RI methods.

The traps will be deployed for a period of approximately 3 months, then repeated for two additional 3-month deployments to reflect the same targeted flow patterns for surface water sampling. Traps will be installed and retrieved by commercial divers, consistent with methods described in the RI. The material from each of the four tubes (four subsamples per station) will be composited together into one sample per location and per event for chemical analyses.

2.3 Sample Nomenclature

Sample identification will be performed in a manner similar to the RI Round 1 FSP (Integral 2002, Section 4.2) and described in the QAPP. All samples will have a unique identifying sample identification number (ID), including the following:

- Project phase (PDI)
- Sample matrix (surface water [WS]; sediment trap [ST])
- Unique, sequential transect number or station number (T01 to T07 for surface water transect; ST-XXX to ST-XXX for sediment trap)
- For ethylbenzene, the transect number will be followed by "E," N," or "W" to indicate location along the transect where E = east, N = navigation channel, and W = west.
- Sampling Round Identifier using YYMM designation (1803 for 2018 event in March)

For example, a surface water sample collected from the first transect will be assigned the sample ID of PDI-WS-T01-1807 during the low-flow summer season in July 2018 from Transect #01. The ethylbenzene sample collected from the navigation channel at that transect would be identified as PDI-WS-T01N-1807. As another example, a sediment trap sample from the first upriver transect (Transect 06) during the first sampling round in March 2018 will be assigned the sample ID of PDI-ST-T06a-1803 from station "a" along that transect. See Section 4.2.1 of the QAPP for nomenclature associated with field duplicates and other quality assurance (QA)/quality control (QC) samples.

Additional data fields will be populated in the database with unique features associated with each sample or subsample, such as sampling depth of equipment, sampling equipment, subsample locations, RM, etc. The sample IDs will not be different for the specific fractions of surface water (i.e., whole water, filtered water, particulate phase or XAD-2 adsorbed dissolved phase). Rather, the matrix field within the database will be used to identify the specific fraction (for example, "XAD" to represent the dissolved phase of the organic constituents collected using the PR2900 or "F" for field-filtered samples collected using the PP). See the QAPP (AECOM and Geosyntec 2018a) for details.

2.4 Sampling Schedule

The overall project schedule is outlined in the PDI Work Plan. The anticipated schedule for the surface water and sediment trap sampling is mid-summer (July/August) through early spring (February/March 2019). Surface water and sediment trap sampling will be conducted over three events targeting different months and flow conditions to capture seasonal and flow-dependent variability of surface water conditions. Sediment traps will not be deployed or retrieved on the same days as surface water sampling to avoid disturbance of bedded sediment during surface water sampling.

2.4.1 Surface Water Sampling Schedule

The scheduling of sampling events will be based on two criteria 1) actual flow and storm conditions (primary) based on the conditions described below, and 2) target months (secondary) based on consistency with historical data. The target months reflect the most likely timing for sampling and provide the laboratories and vessel support with a target schedule for preparation of field equipment. However, if desired conditions are not met during anticipated sampling months, then alternate options will be discussed with EPA (e.g., relaxation of target criteria or sampling in a later month). Ideally, PDI sampling would be in the same months as historical data for seasonal comparability, since seasonal differences in the river system may affect study area conditions and concentrations.

During the RI, three sets of surface water sampling events occurred: Round 1, Round 2A, and Round 3A (EPA 2016a). Each set of sampling events targeted low-flow, high-flow, and/or stormwater-influenced conditions (Table 4a). The flow and storm conditions targeted for sampling are provided in the RI Round 3A FSP:

- **Low-flow events** are characterized by sustained[4] daily average flows less than 20,000 cubic feet per second (cfs) for the PDI sampling. These conditions can occur throughout the year. During the RI, Round 2 low-flow events occurred in November 2004, March 2005, and July 2005; the Round 3 low-flow event occurred in September 2006. Historically, low-flow conditions are reliable in the summer during the months of July, August, and mid-September, but can occur as early as March and as late as November. For Round 2, the lowest low-flow event was in July, with an average flow of 8,604 cfs (range of 20,519 to 8,604 cfs monthly average among low-flow sampling events [Integral 2006a]). Based on historical average flows (Figure 4), the months of July to October typically have average flows of < 20,000 cfs. The PDI target sampling schedule for low-flow conditions is mid-summer (e.g., July/August 2018).
- **High-flow events** are characterized by sustained, non-storm-induced flow of greater than 50,000 cfs for the PDI sampling. For safety considerations, sampling should not occur if

[4] Sustained flow conditions are considered to be flow conditions lasting greater than 24 hours.

flows exceed 100,000 cfs. During the RI, high-flow events occurred in January 2006 and January 2007. The January 2006 high-flow event occurred during average flows of 168,000 cfs (Integral 2006b). During the January 2007 event, sampling was done in two phases. Sampling occurred from January 15 to 18, 2007, and was halted due to reduced flows < 50,000 cfs. Sampling resumed from February 21 to March 10 when flows were elevated again (Integral 2007). Based on historical average flows (Figure 4), the months of January to April typically have average flows > 50,000 cfs. However, this is highly variable by year, with some years (e.g., 2013) not having any high-flow events and other years (e.g., 2015) only having high flows in early winter (November/December). Because of schedule constraints, the PDI target sampling schedule for high-flow conditions is November 2018 to February 2019.

- **A stormwater event** is characterized for the PDI sampling as an event where sustained flows are ideally less than the low-flow trigger (i.e., 20,000 cfs) averaged over the month, and the presence of a substantial rain event causes an increase in river flow up to (and possibly greater than) 40,000 cfs to capture solids that may be mobilized during these episodic events. The RI Round 3A FSP characterized a target storm event when a rainfall of greater than 0.2 inches for more than 3 hours occurred with, ideally, a period of rain lasting 2-3 days. The goal of the stormwater event is to collect surface water samples from a period with substantial flow contributions from major outfalls located within the study area. Achieving this scenario requires consideration of both appropriate rainfall and flow rates. During the RI, one stormwater-influenced sampling event occurred in November 2006, during which average flow was 19,750 cfs and rainfall averaged 0.77 inches per day over the 4-day sampling event (Integral 2007). The flow rate for this stormwater event was lower than average flow rates of the November 2006 low-flow event. Stormwater events were particularly difficult to capture in the RI, as the single stormwater event failed to meet the flow criteria. The PDI target sampling schedule for stormwater winter high-flow conditions is October to December 2018.

Flow conditions will be monitored relative to the USGS Real Time National Weather Information System (NWIS) Database for the Morrison Bridge station 14211720 located at RM 12.7. Surface water average monthly discharge, velocity, height, and rainfall from this station are shown in Figure 4 for 2010 through the most recent data available in 2016.

The sampling for each surface water sampling event is anticipated to occur over a 1-week period. Two vessels will be deployed during each event to minimize collection times and improve the concurrency of the data. Each team (vessel) will collect a minimum of one transect per day. During summer months with extended daylight hours, the field team may be able to collect two transects per day, if time and health and safety considerations allow.

2.4.2 Sediment Trap Sampling Schedule

Sediment trap deployment will overlap with surface water sampling, conditional on sediment traps being deployed for approximately 3 months. The goal for sediment trap scheduling is to

reflect seasonal conditions and capture the same low-flow, high-flow, and stormwater events as the surface water sampling program. The surface water sampling will overlap with trap deployment (samples collected at some time during trap deployment) to the extent practicable. Sediment traps will be deployed initially during the low-flow surface water sampling event (targeting August) and left in place for 3 months. Sediment traps deployed in late August will represent summer low-flow conditions and will be concurrent with the low-flow surface water sampling event (also targeting August).

Sediment traps will be collected in October, cleaned at the field processing lab, and prepared for re-deployment. After decontamination, sediment traps will be re-deployed from early October to December to represent storm-flow winter events. Sediment traps will be sampled and removed in December concurrent with the stormwater surface water sampling event (targeting November/December but dependent on flow conditions). Sediment traps will be collected, cleaned, and prepared for re-deployment in December/January targeting winter flows. Traps will be re-deployed for 3 months and retrieved in February/March, depending on flow conditions. Based on historical average velocity (Figure 4), these months should capture the remaining winter high flows.

Based on reported sediment accumulation during the RI, less than 20 centimeters (~8 inches) of solids is expected per trap for each 3-month deployment. The Round 3 sampling events retrieved sediment traps at the end of January 2007 (Q1), end of April (Q2), mid-August (Q3), and mid-November (Q4) (Integral 2008). In some of the late fall sampling events (October/January), some of the traps contained insufficient volume (only a few centimeters) for the full suite of chemical testing (Table 4b). Each sediment trap deployment and retrieval field event is expected to take 1 to 2 days of field work.

2.5 Key Changes from Previously Approved RI FSPs

Surface water sampling and sediment trap sampling during the RI was performed in accordance with EPA-approved project plans (Integral 2004a, 2004b, 2006c). During the RI Round 1 sampling event, the PP method was used, but many of the MDLs were elevated compared to the ARAR-based cleanup levels. During the RI Round 2 and Round 3 sampling events, the high-volume method was used for ultra-low detection limit samples for selected COCs. PDI sampling will be conducted in accordance with those plans (both PP and high-volume methods) except where noted.

Key PDI changes from the *Round 2A FSP – Surface Water* (Integral 2004b) and the *Round 3A FSP – Surface Water* (Integral 2006d) include the following:

- Previous RI sample events collected horizontally composited samples (but unique depths) or vertically composited samples (but unique locations). During another RI event, transect-composited samples were collected (horizontally and vertically). Differences in methods occurred throughout the RI based on changing specific data use objectives for

each sampling event and per specific requests from EPA at that time. For the PDI study, only cross-sectional river transect samples will be collected. These samples will each consist of a single composite across the horizontal and vertical sampling points.

- Discrete sample locations will be collected for ethylbenzene only. Ethylbenzene will be collected from the near-bottom depth at each of three locations along each transect (i.e., east bank, west bank, and mid-channel). For all other analytes, only transect composite samples will be used for chemical testing.
- Samples will be analyzed for the analytes listed in Table 3a of this FSP.
- During the RI data collection, surface water samples were collected using a modified equal discharge increment sampling approach (USGS 2000; see Appendix B of the RI Round 2 FSP [Integral 2004a] and Appendix A of the RI Round 3A FSP [Integral 2006d]) where samples were collected from two depths, with volumes rated to the flow at each depth (near surface and near bottom). As a modification to this approach, the PDI samples will be collected using an equally weighted volume from each of three spatially distinct locations along each transect, from three depths. For the PDI study, composite samples will be collected by sampling equal volumes from three stations along each transect. At each station, three vertical depth positions will be sampled (targeting 3 feet below surface, mid-depth, 3 feet above mudline). The total number of sampling positions for each transect should be nine. At stations with less than 10 feet of water depth, only two vertical positions will be sampled (see Table 2). The total volume of water to be collected for each sample (peri-pump filtered/unfiltered and high-volume) will be divided by the total sampling positions per transect to determine the volume of water per vertical position at each location on a transect.
- The SOP for surface water sampling calls for vertical integration of samples by raising and lowering the pump at each equal-discharge-increment zone and compositing into one cross-sectional sample. For the PDI study, samples will be collected from two to three discrete depths and composited into one cross-sectional sample as described above.
- The RI high-volume method during Round 2A was performed with an Infiltrex 300 sampling unit. The RI high-volume method during Round 3A was performed using a PR2900 sampling unit. For the PDI study, a PR2900 unit will be used to collect all samples, with slight modification from the RI sampling event. Surface water will be pumped through Teflon-lined polypropylene tubing, vortex separator (instead of a 140 µm stainless steel pre-filter used during the RI), 0.5 µm GFF filters, and XAD-2 resin beads packed inside stainless steel canisters. To address concerns with accumulated water during sampling, water retention on the GFF filters will be minimized; should any “perched” water be noted during filter changes or at the end of sampling, the 0.5 µm GFF filter will be covered with a new clean lab-weighed and numbered filter to sandwich the solids and absorb any perched water. The amount of water used to “purge” the vortex will be minimized.

- The SOP for the Multi-probe YSI reflects an older model. A newer model of the YSI will be used during the PDI study (see new SOP in Appendix B-1).

- The PP surface water sampling method used glass and polycarbonate carboy containers for the composite sample; all PP water will be pumped to a single Teflon-lined polycarbonate carboy for this FSP. The material should be acceptable for both organic and inorganic samples.

- Consistent with the RI, AXYS Laboratory will prepare and analyze all of the GFF filters and XAD-2 resin columns. A static spike (carbon-labeled target compounds) will be added to the XAD-2 resin at the laboratory prior to shipping to the field facility for sampling. The static spike recoveries will be reported for informational purposes (i.e., no qualification of results during validation based on the recovery) to monitor analyte retention and potential desorption from the XAD-2 resin during sampling. For other COCs and conventional parameters, the selected labs will be ALS Environmental (ALS) and TestAmerica Laboratories (TestAmerica). Analytical laboratories are included as described in Section 5.

- Particle size in the water column will be measured *in situ* using a LISST (model 100x). The LISST uses a laser and an annular ring detector that records scattering at 32 angles (bins). These measurements are mathematically inverted to obtain size distribution and scaled to obtain the volume scattering function. The size distribution is presented as concentration with units of microliters per liter in each of the 32 log-spaced size bins (see SOP in Appendix B-1).

Key PDI changes from the RI *Round 3 FSP – Sediment Traps* (Integral 2006c) include the following:

- The RI used divers for deployment of traps at 12 locations throughout the river, including downstream locations. The PDI will also use divers, but traps will only be placed at four upriver stations (to capture what is entering the Site) at two transects.

- For the RI, sediment traps were deployed for approximately 1 year (four events, 3 months each). They were recovered quarterly, and the accumulated sediment collected for analysis. The PDI study will deploy traps over an approximate 1-year period but will target seasonal river flows (high, low, storm) in parallel with surface water sampling.

- Sediment traps were not placed along surface water transects during the RI. The PDI will place traps along the transects.

- Sediment trap samples will be analyzed for the analytes listed in Table 3a of this FSP. Analytical laboratories are included as described in Section 5.

3. PROJECT ORGANIZATION/FIELD TEAM

3.1 Team Organization and Responsibilities

Team organization is presented in Section 2.2 of the QAPP (AECOM and Geosyntec 2018a). As it relates to this FSP, AECOM and Geosyntec are coordinating activities including management of all subcontractors, field sampling, analysis, and reporting scoping tasks.

The PDI Project Coordinator, Mr. Ken Tyrrell, and PDI Project Manager, Dr. Jennifer Pretare, Ph.D., (AECOM) will be responsible for overall project coordination and providing oversight on planning and coordination, work plans, all project deliverables, and performance of the administrative tasks needed to ensure timely and successful completion of the project. Ms. Anne Fitzpatrick (Geosyntec) will serve as the project's senior technical lead for this study and will audit the field events.

Ms. Nicky Moody (AECOM) and Mr. Keith Kroeger (Geosyntec) will be the Project Field Coordinators (FCs) responsible for managing field activities and general field QA/QC oversight. They will ensure that appropriate protocols for sample collection, preservation, and holding times are observed and oversee delivery of environmental samples to the designated laboratory for chemical analyses. This task will be led by Ms. Kristen Durocher (AECOM), who conducted similar sampling on the Lower Passaic River. Project Chemists include Ms. Julia Klens-Caprio (Geosyntec) and Ms. Amy Dahl (AECOM). The Project Chemists are responsible for coordination with labs regarding sample receipt, requested analyses and turn-around times. The Project Chemists will also answer technical and logistical questions related to the analyses requested, including issues related to limited sample availability which impacts detection limits and matrix interferences.

Gravity Marine Services (Gravity), of Fall City, Washington, will provide the XAD samplers, vessel platforms, sampling equipment, and experienced field staff for the project, with Mr. Shawn Hinz acting as a point of contact. Gravity will also build the sediment traps. Analytical laboratories include ALS in Kelso, Washington; AXYS in British Columbia, Canada; and TestAmerica in Fife, Washington, Sacramento, California, and Knoxville, Tennessee (see Section 5 for details). Diving support for sediment trap deployment and retrieval will be provided by Global Diving & Salvage, Inc. (Global), Portland, Oregon.

3.2 Communication/Information Flow

The communication strategy is outlined in Section 2 of the QAPP (AECOM and Geosyntec 2018a). The FCs will be the points of contact for field staff during the implementation of this FSP. Deviations from this FSP or the project-specific QAPP will be reported to the PDI Project Manager for consultation. Significant deviations from the FSP/QAPP will be further reported to representatives of the Pre-RD AOC Group and EPA.

3.3 Coordination with EPA

The PDI Project Coordinator will notify the EPA Project Manager 1 to 2 weeks prior to beginning any field activities so that EPA can schedule any oversight activities required. EPA should provide an indication of the number of split samples and reasonable notification (24 hours) for collection of samples to allow field staff to accommodate the request with minimal disturbance to the field schedule. The PDI Project Coordinator will also notify the EPA Project Manager once field activities have been completed.

Split whole water samples for chemical analyses can be provided to EPA upon their request. EPA's Project Manager should contact the PDI Project Coordinator to coordinate this activity and determine appropriate logistics. Split samples for high-volume samples require advanced notice and discussion due to additional required preparation to ensure extracts can be split by the lab. Currently, it is anticipated that the entire extract will be used during analysis. If EPA elects to collect split samples on high-volume samples, a second PR2900 sampler may need to be deployed simultaneously to ensure adequate extract can be generated. Typically, this is done so that EPA's comparison samples are evaluated relative to the field and analytical variability measured by the project team; however, given the nature of the high-volume sampling, it is logistically very challenging to take two samples at a single location.

4. SAMPLE COLLECTION PROCEDURES

The following sections describe the procedures and methods that will be used during surface water and sediment trap sampling. These procedures include sampling methods; recordkeeping; sample handling, storage, and shipping; and field quality control procedures. Field forms are provided in Appendix A. Project-specific SOPs for peristaltic-pump sampling and high-volume sampling are provided in Appendix B-3 and B-4, respectively. All work will be performed in accordance with the project Health and Safety Plan (AECOM and Geosyntec 2018b). A task hazard analysis specific to surface water sampling and sediment trap sampling will be attached as an addendum to the project Health and Safety Plan.

4.1 Sampling Vessels and Equipment

Surface water sampling will be conducted concurrently per event from two sampling vessels, R/V *Cayuse* and R/V *Tieton*, provided by Gravity. The R/V *Cayuse* is a 24-foot research vessel with landing craft design, crew cabin, and forward working area. The R/V *Tieton* is a 32-foot research vessel with landing craft design and crew cabin, pilot house, and forward working area. Both vessels have an A-frame assembly with a custom winch for deployment and retrieval of sampling equipment, and dynamic positioning system. Each vessel is equipped with a virtual anchoring system, which incorporates an autopilot and two small motors to keep the vessel on station without needing to set fixed anchors. Supplemental vessels are available if additional or backup support for in-water sampling is needed. All vessels will be mobilized from Swan Island Launch.

For sediment trap sampling, divers will be used for deployment and retrieval. Diving support will be provided by Global. Global is a commercial marine services provider founded in 1979 with extensive experience working on complex technical projects in and around the Columbia River and in Portland. Global stages its vessel, the 36-foot DSV *LOON*, in the Swan Island Basin for rapid response in and around Portland and has local personnel available to staff projects in the area.

Equipment and supplies will include all equipment for positioning, sampling, processing, recording, and shipping samples. Equipment lists are included in the SOPs for sampling. Sample containers and preservatives, as well as coolers and packing material, will be supplied by the analytical laboratory.

4.2 Station Positioning and Vertical Control

Station positioning and vertical control will be performed as outlined in the SOP provided in Appendix B-5 and the PDI Data Quality Management Plan (DQMP; AECOM and Geosyntec 2018c). A differential global positioning system (DGPS) unit will be used to confirm the horizontal sampling locations to an accuracy of 1 to 2 meters, per the RI. The DGPS accuracy will be confirmed each morning and evening to a known land-based survey point. Confirmed station locations will be recorded to the nearest whole foot in North American Datum (NAD) 1983 Oregon State Plane North horizontal datum.

Vertical control will be established using an on-board fathometer or lead line to measure depth to mudline at sampling locations. Water depths will be converted to elevations in North American Vertical Datum of 1988 (NAVD88) based on the river stage at the time of sampling as recorded at the Morrison Street Bridge located at RM 12.7. Elevations in the local Columbia River Datum (CRD) will also be calculated in the project database. Water levels will be recorded to the nearest one tenth of a foot in the datum specified in the DQMP and the RI. See Section 5.2 of Integral (2002) for further details.

4.3 Sample Collection and Processing

In general, sample collection will be performed as described in the RI Round 1 FSP (Integral 2002), RI Round 2A FSP for Surface Water Sampling (Integral 2004b), and RI Round 3 FSP for Sediment Traps (Integral 2006c) with modifications as described in Section 2.5 of this FSP.

Methods for surface water sampling using PP and clean hand-dirty hand sampling (EPA 1996) are described in the SOP for Surface Water Sampling (Integral 2004b and 2006c) provided in Appendix B-3. The SOPs include lists of needed supplies and equipment and methods for equipment decontamination. As the SOP for high-volume surface water sampling from the RI was focused on the Infiltrex 300 system and this sampling effort will be using the PR2900 system, a new SOP for this sampling method is provided (Appendix B-4). The Gravity PR2900 system was selected for this sampling effort because of its mechanical simplicity, ease of use,

lower rate of malfunction in the field, and lower operational costs. Additional details on sampling and recordkeeping are provided in the PDI QAPP.

4.3.1 Surface Water – High-Volume Method (Low Detection Limit)

Surface water samples will be collected using a PR2900 high-volume pumping system connected to a vortex solids separation system and 0.5 µm GFF filter and XAD-2 resin column to collect hydrophobic organic compounds for analysis by ultra-low detection limit analytical methods (consistent with RI approaches and methods).

Details of the high-volume field sampling methods are provided in the High-Volume Surface Water Sampling SOP (Appendix B-4). The PR2900 uses a peristaltic pump with Teflon-lined dedicated tubing to draw water through a vortex solids separation system with a laboratory grade 0.5 µm GFF filter to capture remaining solids. The solids captured in the vortex separation system and the solids on the GFF filter(s) are combined to represent a single total particulate solids sample for subsequent extraction and analysis. The water is then passed through the XAD-2 sorption media columns to capture organic analytes from the dissolved phase. Dissolved-phase hydrophobic organic compounds diffuse into the XAD-2 resin and are retained for subsequent solvent extraction and analysis. Each column is its own sample, representing the dissolved phase of constituents in the transect sample. The resin columns from the high-volume sampling are not being composited per laboratory instructions for XAD. The GFF filters and sediments from the vortex separator will be placed into one sample container and shipped to the laboratory. The laboratory will handle this as one sample representing the separated solids phase of constituents in the transect sample.

The high-volume samples will be generated as the particulate phase fraction (i.e., vortex + GFF filter) and the dissolved phase fraction (i.e., the XAD-2 resin). Each fraction will be analyzed for chlorinated pesticides + hexachlorobenzene, PCB congeners, PAHs, and D/F. The concentration data from the particulate and the dissolved fractions will be used to mathematically calculate whole water concentrations. Whole water concentrations will be calculated using the following equation:

COC pg/L = {[Particulate Phase (pg)] + [XAD-2 (pg)]}/Sample Volume (L)

Where:

- Particulate phase is the analytical sample consisting of the solids from the vortex and GFF filters (pg/sample);
- XAD-2 is the dissolved fraction of the sample (pg/sample); and
- Sample volume is the total amount of water passed through the PR2900 during sample collection.

A target volume of approximately 400 L of water will be pumped through the system. Flow rates will be low (approximately 1.5 L/ min) to allow for adsorption of dissolved phase COCs to the

XAD-2 resin column. To meet the ultra-low detection limits required for the target COCs (see Table 2c in the QAPP), it is necessary to sample large volumes of water over several hours. The target volume (400 L) will be collected equally from up to nine points at each transect (i.e., if a shallow depth at one location along a transect may preclude collection from three depths). Each composite sample will consist of equal volumes collected from the subsample locations (i.e., equal across all depths and locations across each transect). For example, assuming a 400 L composite sample, equal volumes of approximately 45 L will be collected at each distinct vertical/transect subsample location assuming nine subsample locations. Specifically, the water depths at each location will be measured in the field with an onboard fathometer and lead line as a backup measure.

At locations with greater than 10 feet of water depth, three vertical positions will be sampled (3 feet below surface, mid-depth, 3 feet above mudline); at locations with less than 10 feet of water depth, only two vertical positions will be sampled (see Table 2). The number of vertical positions at each of the three transect locations will be determined first, and the total number of sampling positions for the transect summed. The total volume of water to be collected for each sample (400 L for high-volume sampling) will be divided by the total sampling positions per transect to determine the volume of water per vertical position at each location on a transect.

The target volume was selected based on an evaluation of the RI data collected using high-volume methods, and the practical quantitation limits (PQLs) provided by AXYS for the XAD-2 resin. Based on the sample specific (ng/sample) PQL, a sample volume of 400 L is estimated to be adequate to meet the ROD cleanup numbers for all constituents, with the noted exception of 2,3,7,8-TCDD toxic equivalency. An estimated 1,000 L would be required to achieve the ROD cleanup number for 2,3,7,8-TCDD, which is not feasible due to time and analytical constraints as discussed in Section 2.1.2. The MDLs based on the sampling of 400 L are provided in the PDI QAPP.

During the stormwater sampling event, consistent with the RI efforts, volumes should be decreased to 100 – 150 L per sample.

Vessel traffic and turbidity will be monitored, and the pump will be shut off should a passing vessel or other disturbance cause an increase in turbidity (estimate of > 50 Nephalometric Turbidity Units [NTUs] above ambient background based on best professional judgement and recent experience), indicated by the YSI Multiprobe turbidity monitor. As total system pressure approaches 15 pounds per square inch, the PR2900 system will be shut down and the 0.5 µm GFF filter will be changed. Each 0.5 µm GFF filter that is used during the sampling will be added to the labeled sampling jar for the particulate phase.

4.3.2 Surface Water – Peristaltic Pump Method (Standard Detection Limit)

Surface water samples will also be collected via the PP method in accordance with RI procedures for the analysis of specific SVOCs, specific VOCs, MCPP, tributyltin, specific metals, and non-chemical conventional parameters (e.g., TSS and TOC). Surface water will be drawn through

pre-cleaned acid-washed Teflon tubing, following purging of at least five times the required sample volume. The PP will run side-by-side and at the same time as the high-volume sampler. Surface water from each vertically integrated location will be combined into a single sample for analysis.

The sampling for VOC analysis, however, will be a series of three discreet samples to avoid loss of VOCs (ethylbenzene) during compositing. Samples for VOC analysis (ethylbenzene) will be sampled from the near-bottom depth at each location (east shore, navigation channel, west shore) for all transects (total of 21 samples). For VOC analysis, surface water will be collected directly into the sampling container and will not be composited. The samples will be collected using the PP and will be sampled at approximately the mid-point of the time pumping at that depth for the other parameters.

The whole water sample for these parameters will be collected at each transect by pumping approximately 15 L of water into a Teflon-lined high-density polycarbonate carboy at a rate that will ensure the carboy is filled in the same amount of time (pumped during the same time period) as the XAD sample. Total volume to be collected per substation will be determined as described above for the high-volume sampling, which depends on the number of substation points that will comprise a composite.

Flow rates for the PP will be estimated based on the total volume and flow rate for the XAD.[5] Flow rates will be calibrated at the beginning of sampling and will be monitored in the carboy every 15 minutes using a graduated cylinder and stop watch.

Once all locations on a single transect have been sampled (up to nine equal volume subsamples), surface water in the carboy will be homogenized using a 3-inch Teflon-coated stir bar and stir plate on the sampling vessel. Water from the carboy will be sub-sampled (divided) to individual laboratory-provided sample containers using a PP and sent to the laboratory for analysis. Both filtered (dissolved) and unfiltered (total) surface water samples will be analyzed for metals at all locations. As needed, samples will be pre-filtered for dissolved metals from the carboy using an in-line 0.45 µm cartridge filter. To allow filters to be purged prior to collection of the sample for DOC analysis, containers for dissolved metals will be filled first and the sample bottle for DOC will be filled last.

PP samples are expected to reach MDLs at or below ARAR-based cleanup levels for all metals with the exception of arsenic. Select organics measured via PP are expected to achieve MDLs similar to those in the RI; however, some remain above ARAR-based cleanup levels. The specific SVOCs will not be analyzed via high-volume sampling due to analytical interferences

[5] For example, flow rate would be calculated by dividing 15 L (target fill volume of water in 20 L carboy) by the volume of water to be sampled using the PR2900 (e.g., 400 L) and multiplying the result by 1.5 L (the maximum desired flow rate of the PR2900). In this example, the flow rate would be 5% of 1.5 L/min, or 0.05 L/min for the PP.

and to remain consistent with RI methods. However, lower MDLs than those listed in the QAPP may be achievable in coordination with the selected laboratory.

Samples will be placed in the appropriate laboratory-provided sampling containers (Table 5a) and stored in a cooler to maintain the samples at a temperature of 0 to less than 6 degrees Celsius (°C) until transport to the laboratory.

4.3.3 Surface Water – Field Parameters

During field sampling, continuous *in-situ* monitoring of dissolved oxygen, pH, specific conductivity, temperature, turbidity, salinity, and oxidation reduction potential of the water column will be recorded at all sampling stations using a multi-parameter water quality meter connected to a datasonde array consisting of water quality probes, depth sensor, and turbidity sensor (YSI 6820 V2 or equivalent) per the SOP provided in Appendix B-1. These measurements will be made by lowering the datasonde into the water at the appropriate depth. At each station, an anchor-type weight will be attached to the two lengths of Teflon-lined tubing (for the PR2900 and the PP) and the water quality meters (a YSI datasonde and LISST sensing unit) with zip ties, to help keep the instruments "on station." The meter will be co-deployed with the intakes of the water sampling equipment, but will be kept separate (i.e., tubing will be approximately 6 inches lower than the sonde housing to avoid potential contamination of the surface water sample).

At the station of interest, the datasonde (and sampling tubing) will be lowered through the water column until it is approximately 3 feet off the mudline bottom as determined by the shipboard fathometer. If the operator "feels" the bottom with the weight,[6] the instrument should be raised and data collection delayed to allow any resuspended sediment to dissipate as determined by monitoring real-time turbidity readings. The anchor weight should be kept suspended above the bottom sediment. Based on the water depth provided by the datasonde, field technicians will determine the water column structure and define the desired depths for data and sample collection. The datasonde should be allowed to equilibrate at bottom depth for at least 1 minute (or until readings for all parameters stabilize) before beginning water column profiling. River flow measurements will be conducted in a similar manner using a hand-held mechanical flow meter or ADCP device; a minimum of three measurements will be recorded per location—upper, lower, and mid-point of the water column.

Field technicians will then create a new logging file for that station/profile and initiate data logging. The datasonde will then be slowly retrieved by hand at a rate of approximately 1 foot

[6] The type of weight used will be a lead weight housed in an aluminum cylinder that has been covered in a rubber coating. The rubber coating minimizes contact with metals. In addition, the tubing will be positioned to sample up-current of the weight and sensor set allowing it to pump water that has not come in contact with any of the sensor/weight array.

per second, per the manufacturer's specifications for the response time of the sensors, as indicated by the real-time display. Once the initial profile is complete, field technicians will return the instrument package to the sampling point and conduct water sampling according to the appropriate SOP. Prior to initiating the sample collection and upon completion at a depth, water quality measurements will be recorded on appropriate Field Logs (Appendix A). The datasonde will continue to log data throughout the sampling activity. After the conclusion of all sampling at a station, a second profile will be collected in the same manner as the first (full water column profile) in order to document any changes in the water column.

4.3.4 Sediment Trap

Sediment traps will consist of four glass tubes per station, with settling particulate material collected in each glass tube (as described in Section 2.2.2). For deployment, the vessel will maneuver to the proposed location then deploy the sediment trap assembly using an A-frame winch with diver assistance. The diver will drive rebar into the sediment then affix the sediment trap assembly to the rebar so that the open tops of the cylinders are 3 feet above the mudline elevation and perpendicular to the direction of flow. Sediment traps will be placed with the bottom of the sediment trap approximately 1.5 feet (45 centimeters) above the mudline. An anchor will be connected to the rebar with approximately 30 meters of anchor line. The sediment trap set up is shown in Figure 3 and is consistent with RI methods excerpted and provided here in Appendix B-6.

For recovery (3 months later), a diver will cover the tops of each glass tube with foil, detach the trap assembly from the rebar, and the trap will be raised to the surface using the vessel's winch. The glass tubes will be removed from the assembly, kept upright, and allowed to resettle, if needed. The thickness of accumulated sediment will be measured at multiple points around each tube to account for sloping of sediment within the tube and recorded on the Field Logs (Appendix A). Overlying water will then be siphoned or pumped off from each glass tube. Sediments from each tube will be characterized and described on the Field Logs (Appendix A) prior to composting. Once characterized, sediments will be collected in a stainless-steel mixing container and homogenized until uniform color and consistency is achieved via mixing with a stainless-steel spoon. Once homogenized, sediments will be placed in the appropriate laboratory-provided sampling containers (Table 5b) and stored in a cooler at 0 to 6°C until transported to the laboratory.

4.4 Sample Handling and Transport

Since samples collected under this FSP will be used in support of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) activities, the processes described in the QAPP and previously approved plans will be followed to ensure samples are traceable from their collection through data delivery.

Chain-of-custody procedures, storage, transport, packaging, and shipping details will be followed as detailed in the PDI QAPP (AECOM and Geosyntec 2018a). Samples will be stored on ice at

4°C in a field cooler and shipped to appropriate laboratories. These methods are generally consistent with Sections 5.8.1, 5.8.2, and 5.8.3 of the RI Round 1 FSP and associated SOPs. Additional details are provided in Section 4.3 of the PDI QAPP (AECOM and Geosyntec 2018a).

4.5 Field Logbook and Forms

All field activities will be recorded in a field logbook as detailed in the PDI QAPP (AECOM and Geosyntec 2018a). The information recorded will be consistent with the RI Round 1 FSP (Integral 2002); see Section 5.3 for details. Project-specific PDI field forms are provided in Appendix A and will be completed as described in the PDI QAPP (AECOM and Geosyntec 2018a).

4.6 Decontamination Procedures

All equipment decontamination procedures will be performed as detailed in the RI Round 2A FSP Appendix C Surface Water Sampling SOP (Integral 2004b) provided as Appendix B-3 of this FSP, and the RI Round 3 Sediment Traps FSP (Integral 2006c) excerpted as Appendix B-7 of this FSP. Decontamination procedures specific to the high-volume sampling equipment proposed for this PDI study are provided in Appendix B-4 of this FSP. Disposable equipment used in the high-volume sampling (e.g., tubing, GFF filters) will be decontaminated by the laboratory. Decontamination of field sampling equipment will occur between stations.

4.7 Waste Disposal

Waste disposal will follow procedures described in the Investigation-Derived Waste SOP (Appendix B-7). In general, any excess water or sediment remaining after processing will be returned to the vicinity of the collection site. Any water or sediment spilled on the deck of the sampling vessel will be washed into the surface waters at the collection site before proceeding to the next station. Phosphate-free detergent-bearing liquid wastes from decontamination of the sampling equipment will be washed overboard or disposed into the sanitary sewer system.

Tyvek, gloves, paper towels, plastic sheeting, and other waste material generated during sampling will be placed in heavyweight garbage bags or other appropriate containers and placed in a normal refuse container for disposal at a solid waste landfill.

4.8 Field Quality Control

All QA/QC procedures are detailed in the QAPP (AECOM and Geosyntec 2018a).

Blind field duplicates are additional samples collected at the same location to characterize variability in sampling results. Field duplicates for PP samples will be collected as described in Section 4.6.1 of the QAPP. Field duplicates of high-volume samples and sediment traps are not planned.

Other field QC samples, such as trip blanks, temperature blanks, and rinsate blanks, will be collected as outlined in Section 4.6.1 of the QAPP. Split samples for EPA will be determined at the time of sampling. Rinsate blanks will be conducted once per event for sediment trap and high-volume samplers. Sediment trap rinsate blanks will be collected using deionized water (DI) poured over the sediment trap equipment after field decontamination. Rinsate blanks for the high-volume sampling equipment (PR2900) will be collected as described in the surface water sampling SOP (Appendix B) and QAPP. Three blank samples will be collected per surface water event: 1) run DI water through the PR2900 equipment with tubing, vortex separator, 0.5 µm GFF filter, and XAD-2 cartridge and collect a "particulate phase" blank and an XAD-2 resin blank; and 2) run DI water through PP into carboy, and using PP from the carboy, collect a total water sample (Table 6).

5. LABORATORY ANALYSIS

All physical and chemical analysis of surface water samples will be performed by the following laboratories:

- AXYS in British Columbia, Canada, will analyze the high-volume samples (both particulate phase as solids collected by the vortex solids separator and 0.5 µm GFF filter and XAD-2 resin column samples) for chlorinated pesticides + hexachlorobenzene, PCB congeners, PAHs, and D/F.
- AXYS is also responsible for the preparation and decontamination of all disposable high-volume sampling equipment including preparation of XAD-2 resin cartridges, decontamination of GFF filters, and decontamination of sample tubing (PP sampling does not require laboratory decontaminated tubing).
- ALS in Kelso, Washington, will analyze the PP samples for bis-(2-ethylhexyl) phthalate (BEHP), pentachlorophenol, and tributyltin.
- TestAmerica in Fife, Washington, will analyze the PP samples for ethylbenzene, MCPP, and metals (total and dissolved). At all stations, unfiltered surface water samples will be analyzed for conventional parameters including TDS, TSS, and TOC. Unfiltered samples for TDS and TSS will be filtered at the analytical laboratory, consistent with the Round 3 RI sampling (Integral 2006c). Filtered samples will be analyzed for conventionals, including DOC and hardness, consistent with the RI.

All physical and chemical analysis of sediment trap samples will be performed by the following laboratories.

- ALS in Kelso, Washington, will analyze for chlorinated pesticides, PAHs, BEHP, tributyltin, and total solids.
- TestAmerica in:

- Fife, Washington, will analyze total petroleum hydrocarbons as diesel range organics, metals, TOC, grain size, and total solids
- Sacramento, California, will analyze D/F
- Knoxville, Tennessee, will analyze PCB congeners

Approximately 1,000 grams (wet weight) of sediment are required for the full ROD Table 17 Sediment COC analyte list. If the recovered volume of sediment in sediment traps is insufficient for all analytes, the prioritization of analyses will be focused on COCs (PCBs, D/F PAHs, and DDx), then metals, then other SVOCs, then conventionals (grain size and TOC). Additional details on the analytical methods, QA/QC requirements and procedures, and laboratory-specific QA/QC requirements are detailed in Section 4.6 of the QAPP (AECOM and Geosyntec 2018a). All samples will be placed in laboratory-supplied sample containers and preserved according to analytical protocols. Sample containers, preservation requirements, holding times, and sample sizes are provided for all analyses in Table 5a for surface water samples and Table 5b for sediment trap samples.

6. DATA MANAGEMENT AND REPORTING

6.1 Field Data Management

The procedures and activities outlined in this FSP and the QAPP are designed to ensure DQOs are met, consistent with previous RI studies. Field record-keeping details can be found in the QAPP (AECOM and Geosyntec 2018a). A bound field logbook will be assigned to and maintained by field team members for the duration of sampling and will be kept as permanent records. A series of QA/QC steps described in the QAPP will be implemented to ensure data integrity. Data quality management procedures performed in the field will include the following:

- All samples will be given a unique identifier (Section 2.3 of this FSP).
- All samples will be collected and transported under chain-of-custody control (Section 4.4 of this FSP).
- Field logbooks and data sheets will be maintained (Section 4.5 of this FSP).
- Field QA/QC samples will be collected according to the QAPP and SOPs provided in Appendix B to this FSP.

6.2 Post-Analysis Data Management and Reporting

Analytical laboratories will be required to adhere to all QA/QC procedures outlined in the QAPP. Laboratories will provide all data for field investigations in electronic format and QA/QC reports, including a narrative of the standard QA/QC protocols. Data validation and data management will be performed according to the QAPP and DQMP; see the QAPP for details on data validation procedures. Following data validation, all data, supplementary information, and

validator qualifiers associated with samples will be compiled into an SQL Server database for the project. Tabular data files will be provided to EPA as they become available after data validation and database management.

Data summaries will be included in the PDI Evaluation Report as attachments. Attachments will include a summary of field sampling activities, including sampling locations, analyses, sample collection methods, and any deviations from the FSP. Methods, analysis, and results for all testing procedures will be documented and presented in standard scientific reporting format. An electronic data deliverable (EDD) of the project database will accompany the PDI Evaluation Report.

7. REFERENCES

AECOM (AECOM Technical Services) and Geosyntec (Geosyntec Consultants, Inc.). 2018a. Quality Assurance Project Plan. Draft. Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling, Portland Harbor Superfund Site. Portland, Oregon. March 2018.

AECOM and Geosyntec. 2018b. Programmatic HAZWOPER Health and Safety Plan. Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling. Portland Harbor Superfund Site. March 2018.

AECOM and Geosyntec. 2018c. Data Quality Management Plan. Final. Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling, Portland Harbor Superfund Site. Portland, Oregon. February 2018.

David, N., D. Bell, and J. Gold. 2001. Field Sampling Manual for the Regional Monitoring Program for Trace Substances. San Francisco Estuarine Institute, San Francisco, California. February.

EPA (United States Environmental Protection Agency). 1996. Method 1669. Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels. U.S. Environmental Protection Agency, Office of Water Engineering and Analysis Division (4303). Washington, DC. July.

EPA. 2014. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846), Third Edition, Update V.

EPA. 2016a. Portland Harbor RI/FS, Final Remedial Investigation Report, Portland Oregon. United States Environmental Protection Agency Region 10, Seattle, Washington. 8 February.

EPA. 2016b. Portland Harbor RI/FS, Final Feasibility Study, Portland Oregon. United States Environmental Protection Agency Region 10, Seattle, Washington. June.

EPA. 2017a. Record of Decision Portland Harbor Superfund Site, Portland Oregon. United States Environmental Protection Agency Region 10, Seattle, Washington. January.

EPA. 2017b. ASAOC between USEPA and the Pre-RD AOC Group for Pre-Remedial Design Investigation Studies, Portland Harbor Superfund Site, Portland Oregon. United States Environmental Protection Agency Region 10, Seattle, Washington. 19 December.

Geosyntec 2017. Work Plan. Portland Harbor Pre-Remedial Design Investigation Studies; Portland Harbor Superfund Site, Portland, Oregon. Prepared for the Pre-RD AOC Group for submittal and approval by EPA Region 10. Attachment to the PDI Statement of Work. 19 December.

Integral (Integral Consulting). 2002. Round 1 Field Sampling Plan. Prepared for the Lower Willamette Group (LWG) for submittal and approval by EPA Region 10. 14 June.

Integral. 2004a. Round 2 Field Sampling Plan - Sediment Sampling and Benthic Toxicity Testing Prepared for the Lower Willamette Group (LWG) for submittal and approval by EPA Region 10. 22 March.

Integral. 2004b. Round 2A Field Sampling Plan - Surface Water. Prepared by Integral Consulting Inc. for the LWG for submittal and approval by EPA Region 10. August.

Integral. 2005. Round 2 Groundwater Pathway Assessment Sampling and Analysis Plan. Attachment 2 Transition Zone Water Field Sampling Plan. Prepared by Integral Consulting Inc. for the LWG for submittal and approval by EPA Region 10. July 8.

Integral. 2006a. Round 2A Surface Water Site Characterization Summary Report. Prepared by Integral for the LWG for submittal and approval by EPA Region 10. April.

Integral 2006b. Round 3 January 2006 High-Flow Field Sampling Report. Prepared by Integral for the LWG for submittal and approval by EPA Region 10. March.

Integral. 2006c. Round 3 Field Sampling Plan - Sediment Traps. Prepared by Integral for the LWG for submittal and approval by EPA Region 10. March.

Integral. 2006d. Round 3A Field Sampling Plan – Surface Water Sampling. Prepared by Integral for the LWG for submittal and approval by EPA Region 10. 18 September.

Integral. 2007. Round 3A Winter 2007 High-Flow Surface Water Data Report. Prepared by Integral for the LWG for submittal and approval by EPA Region 10. October.

Integral. 2008. Round 3A Sediment Trap Sampling Quarter 4 Field Report. Prepared by Integral for the LWG for submittal and approval by EPA Region 10. January.

Norton D. 2001. Contaminants Associated with Settling Particulate Matter and Bottom Sediments at Two Marinas in Thea Foss Waterway. Prepared for Department of Ecology. June.

PSEP (Puget Sound Estuary Program). 1986. Puget Sound Estuary Program: Recommended Protocols for Measuring Selected Environmental Variables in Puget Sound. Final Report. TC-3991-04. Prepared for U.S. Environmental Protection Agency, Region 10 and Puget Sound Estuary Program, Seattle, Washington. Prepared by Tetra Tech and HRA, Inc., Bellevue, Washington.

PSEP. 1997. Recommended Guidelines for Sampling Marine Sediment, Water Column, and Tissue in Puget Sound. Prepared for U.S. Environmental Protection Agency, Region 10 and Puget Sound Estuary Program, Seattle, Washington.

USGS (United States Geological Survey). 2000. Interagency Field Manual for the Collection of Water-Quality Data. Compiled by D.L. Lurry and C.M. Kolbe. U.S. Geological Survey, in cooperation with the U.S. Environmental Protection Agency. Open-File Report 00-213. Austin, Texas.

TABLES

Table 1. Comparison of Peristaltic Pump and XAD Methods for Measuring Focused COCs at the Site

Focused COC Contaminant	Method	RI Sample Number	# Detected	% Detected	MDL (µg/L)	Surface Water ARAR-based Cleanup Level
Total PAHs	Peristaltic	174	101	58%	0.0065 - 0.043	0.00012 (as carcinogenic PAHs)
	XAD - Total	174	174	100%	0.00029 - 0.00141	
PCB Aroclor	Peristaltic	53	6	11%	0.0025 - 0.0027	0.000006
PCB Congeners	XAD - Total	53	53	100%	0.000000024 - 0.0000007	
2,3,7,8-TCDD TEQs	Peristaltic	Not analyzed by this method				0.0000000005 (as TEQ)
	XAD - Total	121	121	100%	0.000000011	
Total DDx	Peristaltic	84	29	35%	0.000472 - 0.0016	0.001
	XAD - Total	84	83	99%	0.000012 - 0.000015	

General Notes:

1. Peristaltic Pump MDLs are reported as achieved based on description in the RI Section 5.4.
2. XAD-2 MDLs are based on 100 L of surface water pumped. During the R3 sampling, 100 L was pumped during the stormwater event and 500 L was pumped during the low-flow and high-flow events for stations with the full suite of analyses. MDLs are shown for XAD filtrate and particulate; MDLs for total concentrations are calculated as the sum of XAD filtrate and particulate. MDLs are from Integral (2006) Round 3A Field Sampling Plan.
3. XAD MDL for 2,3,7,8-TCDD shown for TCDD TEQs.
4. XAD MDL for PAHs and DDXs are minimum and maximum MDL for individual constituents.

Acronyms:

µg/L = microgram per liter
2,3,7,8-TCDD = 2,3,7,8-tetrachlorodibenzodioxin
ARAR = applicable or relevant and appropriate requirements
COC = contaminant of concern
DDx = dichlorodiphenyltrichloroethane and its derivatives
L = liter
MDL = method detection limit
PAH = polycyclic aromatic hydrocarbon
PCB = polychlorinated biphenyl
RI = remedial investigation
TEQ = toxic equivalency

Table 2. Station Location Coordinates, Target Depth, and Identification Scheme

Sample Type	Composite Sample ID	Transect	Transect Location	Sequential Sub Location ID	Expected Mudline Elevation (CRD - Feet) [a]	Target Surface Water Sampling Depths	Proposed Location Coordinates (NAD 1983; Intl Feet) [b]	
							Easting	Northing
Surface Water	PDI-WS-T01-MMYY	1	RM 1.8	1E	N/A	-- [c]	7618001	725315
				1Nav	-52.5	-3 ft., -25 ft.,-49 ft.	7617290	725842
				1W	-14.7	-3 ft., -6 ft.,-12 ft.	7616474	726447
	PDI-WS-T02-MMYY	2	Multnomah Channel	2E	-21.6	-3 ft., -9 ft.,-19 ft.	7613370	720591
				2Nav	-28.0	-3 ft., -13 ft.,-25 ft.	7613404	720321
				2W	-6.5	-2 ft., -4 ft.	7613436	720067
	PDI-WS-T03-MMYY	3	RM 4	3E	N/A	-- [c]	7618348	715910
				3Nav	-54.0	-3 ft., -26 ft.,-51 ft.	7617650	715649
				3W	N/A	-- [c]	7616809	715322
	PDI-WS-T04-MMYY	4	RM 7	4E	-12.9	-3 ft., -5 ft.,-10 ft.	7627723	704523
				4Nav	-44.1	-3 ft., -21 ft.,-41 ft.	7627307	704108
				4W	N/A	-- [c]	7626717	703493
	PDI-WS-T05-MMYY	5	RM 8.8	5E	-16.8	-3 ft., -7 ft.,-14 ft.	7634506	698140
				5Nav	-34.2	-3 ft., -16 ft.,-31 ft.	7633857	697446
				5W	N/A	-- [c]	7633267	696814
	PDI-WS-T06-MMYY	6	RM 11.81 (upriver)	6E	-59.1	-3 ft., -28 ft.,-56 ft.	7645633	687094
				6Nav	-61.0	-3 ft., -29 ft.,-58 ft.	7645425	686928
				6W	-17.6	-3 ft., -7 ft.,-15 ft.	7645200	686750
	PDI-WS-T07-MMYY	7	RM 16.2 (upriver)	7E	N/A	-- [c]	7646788	665117
				7Nav	-90.3	-3 ft., -44 ft.,-87 ft.	7646285	665150
				7W	N/A	-- [c]	7645696	665190
Sediment Trap	PDI-ST-T06a-MMYY	6	RM 11.81 (upriver)	ST6a	-63.3	Not Applicable	7645543	687022
	PDI-ST-T06b-MMYY			ST6b	-56.5		7645320	686845
	PDI-ST-T07a-MMYY	7	RM 16.2 (upriver)	ST7a	-66.9		7646544	665133
	PDI-ST-T07b-MMYY			ST7b	-44.7		7645995	665170

General Notes:

Conversion from CRD to NAVD88: Elevation(CRD)+5.38=NAVD88

Footnotes:

a) Vertical Datum: CRD (ft.); based on 2009 NOAA bathymetry. Target sampling depths may be revised/included following updated bathymetry survey.

b) Horizontal Projection: NAD 1983 Oregon State Plane North (Intl Feet)

c) For locations where current mudline elevations are not available, targeting depths will be determined in the field following measurement of water depth.

Acronyms:

CRD = Columbia River Datum; ft. = foot/feet; ID = identification number; N/A = not available; NAD = North American Datum; NAVD 88 = North American Vertical Datum of 1988; NOAA = National Oceanic and Atmospheric Administration; RM = river mile

Table 3a. Summary of Sample Types, Numbers, and Analytes

Sample Type	Number of Samples	Sampling Events	Total Number of Samples	Analyses
High-Volume Surface Water - Separated Solids [a]	7	3	21	PCB Congeners, Pesticides (Aldrin, chlordanes, Hexachlorobenzene and DDx), PAHs, and PCDD/Fs
High-Volume Surface Water - XAD-2 [a]	7	3	21	PCB Congeners, Pesticides (Aldrin, chlordanes, Hexachlorobenzene and DDx), PAHs, and PCDD/Fs
Surface Water - Peristaltic Pump - Filtered - Dissolved	7	3	21	Dissolved Metals (As, Ca, Cr, Cu, Mg, Zn), Hardness as $CaCO_3$, and Dissolved Organic Carbon
Surface Water - Peristaltic Pump - Unfiltered - Total	7	3	21	Total Metals (As, Cr, Cu, Zn), BEHP, Ethylbenzene, MCPP, PCP, Tributyltin, Total Suspended Solids, TOC, and Total Dissolved Solids
Sediment Trap	4	3	12	All ROD Table 17 Sediment COCs + TOC and Grain Size
Total Count			**96**	

General Notes:

1. Surface water samples for each transect will be equal-volume cross sectional composites. Vertically composited multi-depth (2 or 3 depths) samples from each of three sub-stations along a transect will be composited. One exception is ethylbenzene which will be sampled as discrete samples from near-bottom depths at all stations.

2. Since ethylbenzene will be sampled at the near-bottom depth at each sub-station along the transect there will be a total of 21 samples for VOC analysis per round, for a total of 63 samples for VOC analysis.

3. Field parameters and grain size will be measured *in situ.*

Footnotes:

a) High volume surface water samples will be reported as dissolved phase from the XAD, separated solids (particulate phase), and total (calculated) concentrations.

Acronyms:

As = arsenic, BEHP = bis(2-ethylhexyl)phthalate; CA = calcium; $CaCO_3$ = calcium carbonate; COC = contaminant of concern; Cr = chromium; Cu = copper; DDx = sum of dichlorodiphenyltrichloroethane and its derivatives; Mg = magnesium; PAHs = polycyclic aromatic hydrocarbon; PCBs = polychlorinated biphenyls; PCP = pentachlorophenol; PCDD/Fs = polychlorinated dibenzo-p-dioxins and furans; MCPP = meta-chlorophenylpiperazine; ROD = Record of Decision; TOC = total organic carbon; Zn = zinc

Table 3b. Selected Analytes Sorted by Surface Water Sample Collection Method

Analyte	High-Volume Surface Water			Surface Water - Peristaltic Pump	
	Separated Solids	XAD-2	Total	Filtered (Dissolved)	Unfiltered (Total)
Aldrin	X	X	X		
Arsenic				X	X
BEHP					X
Chlordanes	X	X	X		
Chromium				X	X
Copper				X	X
DDx	X	X	X		
Dissolved Organic Carbon				X	
Ethylbenzene					X
Hardness				X	
Hexachlorobenzene	X	X	X		
MCPP					X
PAHs	X	X	X		
PCB congeners	X	X	X		
PCDD/Fs	X	X	X		
Pentachlorophenol					X
Tributylin					X
Total Suspended Solids [a]					X
Total Dissolved Solids [a]					X
Total Organic Carbon					X
Zinc				X	X
Field Parameters	Measured continuously with YSI Water Quality Meter				
Grain Size	Measured *in situ* with LISST				

Footnotes:
a) Filtered by analytical laboratory

Acronyms:
BEHP = bis(2-ethylhexyl)phthalate
COC = contaminant of concern
DDx = sum of dichlorodiphenyltrichloroethane and its derivatives
LISST = Laser In-Situ Scattering and Transmissometery
MCPP = meta-chlorophenylpiperazine
PAHs = polycyclic aromatic hydrocarbon
PCBs = polychlorinated biphenyls
PCDD/Fs = polychlorinated dibenzo-p-dioxins and furans

Table 4a. Summary of Historical RI Surface Water Sampling Events

RI Sampling Round	Method	Number of Transects	Surface Water Sampling Scheme	Target Time of Year for Sampling	Actual Time of Year Sampled	Actual Sample Volume	References
Round 1	PP	3	Two stations per transect, two sampling depths--surface and near-bottom; plus discrete nearshore samples	Low flow (late summer to early fall) and high flow (late fall to early winter)[1]	N/A	~ 40 L for PP samples (target)	Striplin et al. 2002. Round 1 FSP, Portland Harbor RI/FS.
Round 2A	PP and Inflitrex 300 (XAD-2)	3	(1) cross-section river transect composite sample, spatially integrated across entire width and depth of channel based on a flow-weighted methods (USGS 2000)[2] and (2) discrete near-bottom (within 1 meter), and (3) single point vertically integrated samples	Nov 2004 (high-flow, winter, target); July 2005 (low-flow, summer), March 2005 (selected by EPA); a first flush stormwater runoff fall event was also targeted	Nov to Dec 2004; March 2005; July 2005	~ 1,000 L pumped for XAD samples	Integral 2004. Integral 2005a, 2005b, 2005c.
Round 3A	PP and Inflitrex 300 (XAD-2)	5	Three stations per transect, divided into east, west, and Navigation Channel samples; vertically integrated but horizontally discrete; near-bottom and near surface samples (10-foot minimum water depth); 12 point samples	Jan 2006 (winter, flooding, high-flow); Sept 2006 (summer, low-flow); Nov 2006 (storm event); Jan/Feb/March 2007 (winter, high-flow)	Jan 2006; Sept 2006; Nov 2006; Jan 2007, and Feb through March 2007[3]	~ 100L (storm event); ~ 500L (high-flow and low-flow events) pumped for XAD samples	Integral 2006 and 2006b. Integral 2007a and 2007b.

Notes:
General water quality measurements of ambient surface water were taken at all sampling locations including conductivity, pH, temperature, dissolved oxygen, and redox potential of the water column.

Footnotes:
(1) Low flow and high flow conditions, as determined by USGS field gauge readings at the Morrison Bridge.
(2) Vertically intergrated sample from 0.3 meters below water surface to within 1 meter of the river bottom in each sub-area, samples combined into river cross-section composite sample.
(3) The first phase took place January 15-18, 2007. On January 18, 2007, the high-flow surface water collection program was cancelled due to the flow of the Willamette River dipping below 50,000 cfs. The second phase resumed on February 21 through March 10, 2007.

Acronyms:
cfs = cubic feet per second; EPA = U.S. Environmental Protection Agency; FS = feasibility study; FSP = Field Sampling Plan; FSR = Field Sampling Report; Integral = Integral Consulting; L = liter; N/A = not available; PP = peristaltic pump; RI = remedial investigation; USGS = U.S. Geological Survey

References:

Integral 2004. Round 2A Field Sampling Plan Surface Water Sampling, Portland Harbor RI/FS. April 2, 2004.
Integral 2005a. Round 2A Surface Water FSR, Portland Harbor RI/FS. Jan 31, 2005.
Integral 2005b. Round 2A Winter 2005 Surface Water FSR, Portland Harbor RI/FS. May 16, 2005.
Integral 2005c. Round 2A Summer 2005 Surface Water FSR, Portland Harbor RI/FS. Sept 19, 2005.
Integral 2006a. Round 3A Field Sampling Plan Surface Water Sampling, Portland Harbor RI/FS. Sept 18, 2006.
Integral 2006b. Round 3A Summer 2006 Low-Flow Surface Water Event FSR. Dec 8, 2006.
Integral 2007a. Round 3A Fall 2006 Stormwater Surface Water Event FSR. Jan 15, 2007.
Integral 2007b. Round 3A Winter 2007 High-Flow Surface Water Event FSR. April 30, 2007.

Table 4b. Summary of Sediment Accumulated in Round 3A Sediment Traps at RM 11 and RM 16

Trap # (1)	Average Sediment Height (cm) in Glass Tubes (4)				SPM Material Description (4 events)
	Jan 2007 (6)	July 2007	Oct 2007	Jan 2008	
ST007	37	10.0	7.1	7.9	Gray silty sand; gray silty sand; gray silt; silty sand
ST008	69 (5)	16.0	2.9 (3)	12.5	Organic litter; mostly woody debris; light gray silt; grayish green silt
ST009	6.3	10.7	4.9 (2)	1.7 (2)	Organic litter with gray silt; brownish silt with significant grass litter; light gray silt; gray silt
ST010	52	9.7 (2)	1.4 (3)	6.0	Brownish gray sandy silt; light gray silt; grayish brown silt

Notes:

(1) Sediment Traps ST007 and ST008 are located near RM 11.8. Sediment traps ST009 and ST010 are located near RM 16.0.
(2) Insufficient volume to fill all sample jars for testing.
(3) Insufficient volume, traps redeployed without sample collection.
(4) Individual tube measurements were generally within +/- 2 cm from each other.
(5) Tube glass tube height at ST008 during Jan 2007 event was about 78 cm tall.
(6) Individual tube measurements in the Q1 Jan 2007 event compared baffle/no baffle design; results were less than 1 to 2 cm difference at 3 of 4 locations: ST007 (37.3, 37.4); ST008 (70.1, 68.0); ST009 (6.5, 6.1) and ST010 (49.1, 55.5).

Acronyms: cm = centimeter; RM = river mile; SPM = settled particulate matter

Table 5a. Sample Containers, Preservation, Holding Times, and Sample Volume - Surface Water

Surface Water Parameter	Analytical Method	Container	Preservation	Holding Time	Minimum Volume Needed
High-Volume Surface Water Samples					
PCB Congeners	EPA 1668A [a]	XAD-2 Column (1 gallon Ziplock bag and bubble wrap) + Separated Solid (8-oz jar)	Cool to 0-6°C store in the dark	1 year from collection to preparation; 1 year from extraction to analysis	400 liters (pumped through XAD)
Dioxins/Furans	EPA 1613B [a]	XAD-2 Column (1 gallon Ziplock bag and bubble wrap) + Separated Solid (8-oz jar)	Cool to 0-6°C store in the dark	1 year from collection to preparation; 1 year from extraction to analysis	400 liters (pumped through XAD)
PAHs	EPA 8270D SIM [a]	XAD-2 Column (1 gallon Ziplock bag and bubble wrap) + Separated Solid (8-oz jar)	Cool to 0-6°C	7 days from collection to preparation; 40 days from extraction to analysis	400 liters (pumped through XAD)
Chlorinated Pesticides + Hexachlorobenzene	MLA-028/EPA 1699 [a]	XAD-2 Column (1 gallon Ziplock bag and bubble wrap) + Separated Solid (8-oz jar)	Cool to 0-6°C	7 days from collection to prep; 40 days (1 year for HCB) from extraction to analysis	400 liters (pumped through XAD)
Surface Water - Peristaltic Pump Samples					
BEHP	EPA 8270D-LL	2x 1-L AG	Cool to 0-6°C	7 days from collection to preparation; 40 days from extraction to analysis	2 L
Ethylbenzene	EPA 8260C	3x 40-mL VOA vials	HCL to pH <2, Cool to 0-6°C, no headspace	14 days from collection to analysis	120 mL
MCPP	EPA Method 8151A	2x 1-L AG	Cool to 0-6°C	7 days from collection to preparation; 40 days from extraction to analysis	2 L
Pentachlorophenol	EPA Method 8041A and EPA 8270D-LL	2x 1-L AG	Cool to 0-6°C	7 days from collection to preparation; 40 days from extraction to analysis	2 L
Metals (Total)	EPA Method 6020B	1x 100-mL HDPE	HNO_3 to pH <2	180 days from collection to analysis	100 mL
Metals (Dissolved) + Hardness as $CaCO_3$	EPA Method 6020B	1x 100-mL HDPE	HNO_3 to pH <2	180 days from collection to analysis	100 mL
Tributyltin	Unger et al.	1-L AG	Cool to 0-6°C	7 days from collection to preparation; 40 days from extraction to analysis	2 L
Total Suspended Solids	Standard Method 2540D	1x 1-L HDPE	Cool to 0-6°C	7 days from collection to analysis	1 L
Total Dissolved Solids	EPA Method 160.1	1 x 500-mL HDPE	Cool to 0-6°C	7 days from collection to analysis	500 ml
Total Organic Carbon	EPA 9060	1 x 250-mL HDPE	H_2SO_4 to pH <2, Cool to 0-6°C	28 days from collection to analysis	250 ml
Dissolved Organic Carbon	EPA 9060	1 x 500-mL AG	H_2SO_4 to pH <2, Cool to 0-6°C	28 days from collection to analysis	500 mL
Field Parameters					
Temperature, pH, DO, turbidity, flow rate velocity, and conductivity	YSI™ 6820 (V2 or equivalent)	Measured *in situ*			
Particle Size Distribution	LISST	Measured *in situ*			

Table 5a. Sample Containers, Preservation, Holding Times, and Sample Volume - Surface Water

Notes:

1. Refrigerate preservation times consistent with PSEP protocols for Washington State.
2. Method detection limits presented in the project QAPP.
3. Concentration data from solids and dissolved fractions will be used to mathematically calculate whole water concentrations.
4. Whole water concentrations for XAD samples will be calculated using the following equation:

   COC pg/L = {[separated solids (pg)] + [XAD (pg)]}/Sample Volume (L).

Footnotes:

a) Analysis can be performed by splitting the extract from a single XAD column collected per sample.

Acronyms:

AG = amber glass
BEHP = Bis(2-ethylhexyl) phthalate
$CaCO_3$ = calcium carbonate
COC = contaminant of concern
DO = dissolved oxygen
EPA = United States Environmental Protection Agency
H_2SO_4 = sulfuric acid
HCB = hexachlorobenzene
HCL = hydrochloric acid
HDPE = high density polyethylene
L = liter
LISST = Laser In-Situ Scattering and Transmissometry
MCPP = meta-chlorophenylpiperazine
mL = milliliter
PAHs = polycyclic aromatic hydrocarbons
PCB = polychlorinated biphenyls
PSEP = Puget Sound Estuary Program
QAPP = Quality Assurance Project Plan

Table 5b. Sample Containers, Preservation, Holding Times, and Sample Volume - Sediment Trap

Sediment Trap Parameter	Container		Preservation	Holding Time	Minimum Sample Size (wet weight grams)
	Type	*Size*			
PCB Congeners	WMG	8 oz	Refrigerate, 4ºC Deep Frozen (-20ºC)	1 year, 1 year	100
PCDD/Fs	WMG	8 oz	Refrigerate, 4ºC Deep Frozen (-20ºC)	1 year, 1 year [a]	100
Pesticides	WMG	8 oz	Refrigerate, 4ºC Deep Frozen (-20ºC)	14 days, 1 year	100
PAHs	WMG	8 oz	Refrigerate, 4ºC Deep Frozen (-20ºC)	14 days, 1 year	100
BEHP	WMG	8 oz	Refrigerate, 4ºC Deep Frozen (-20ºC)	14 days, 1 year	100
Metals	G or P	8 oz	Refrigerate, 4ºC Deep Frozen (-20ºC)	6 months, 2 years	50
Mercury	WMG	8 oz	Refrigerate, 4ºC Deep Frozen (-20ºC)	28 days, 28 days	50
TPH Diesel	G	8 oz	Refrigerate, 4ºC Deep Frozen (-20ºC)	14 days, 40 days	50
Tributyltin	WMG	8 oz	Refrigerate, 4ºC Deep Frozen (-20ºC)	14 days, 1 year	100
Grain size	G or P	16 oz	Refrigerate, 4 ± 2ºC	6 months	100 to 150
Total organic carbon	WMG	8 oz	Refrigerate, 4ºC Deep Frozen (-20ºC)	14 days, 1 year	25
Total solids	G or P	8 oz	Refrigerate, 4ºC Deep Frozen (-20ºC)	14 days, 6 months	50

Notes:

1. Refrigerate preservation times consistent with PSEP protocols for Washington State.
2. Frozen preservation times provided from PESP 1996.
3. Method detection limits presented in the project QAPP.
4. Parameters are listed in general order of priority of analysis.

Footnotes:

a) stored in darkness.

Acronyms:

BEHP = Bis(2-ethylhexyl) phthalate; G = glass; oz. = ounce; P = plastic; PAHs = polycyclic aromatic hydrocarbons; PCB = polychlorinated biphenyls; PCDD/Fs = polychlorinated dibenzφ-dioxins and furans; PSEP = Puget Sound Estuary Protocol; QAPP = Quality Assurance Project Plan; WMG = wide mouth glass; TPH = total petroleum hydrocarbons

Table 6. Summary of QA/QC Sample Types, Numbers, and Analytes

Sample Type		Frequency	Number of Samples	Analyses
Blind Field Duplicates (Surface Water - Peristaltic Pump)	Filtered - Dissolved	1 per 20 samples (1 per event)	3	Dissolved Metals (As, Ca, Cr, Cu, Mg, Zn), Hardness as $CaCO_3$, and Dissolved Organic Carbon
	Unfiltered - Total	1 per 20 samples (1 per event)	3	Total Metals (As, Cr, Cu, Zn), BEHP, Ethylbenzene, MCPP, PCP, Tributyltin, Total Suspended Solids, TOC, and Total Dissolved Solids
Rinsate Blank (Surface Water - High-Volume Method)	Separated Solids	1 per event	3	PCB Congeners, Pesticides (Aldrin, Chlordanes, Hexachlorobenzene, and DDx), PAHs, and PCDD/Fs
	XAD-2	1 per event	3	PCB Congeners, Pesticides (Aldrin, Chlordanes, Hexachlorobenzene, and DDx), PAHs, and PCDD/Fs
Filter Blank (Surface Water - Peristaltic Pump Method)	Filtered - Dissolved	1 per 20 samples (1 per event)	3	Dissolved Organic Carbon, Dissolved Metals (As, Ca, Cr, Cu, Mg, Zn), Hardness as $CaCO_3$
Rinsate Blank (Surface Water - Peristaltic Pump Method)	Tubing, Carboy, and Stir Bar	1 per event	3	Total Metals (As, Cr, Cu, Zn), BEHP, TOC, Ethylbenzene, MCPP, PCP, and Tributyltin
Rinsate Blank (Sediment Trap Equipment)		1 per 20 samples (1 per event)	3	ROD Table 17 Sediment COCs
Trip Blank		One per cooler	21	Ethylbenzene (VOC)
Total Count			**42**	

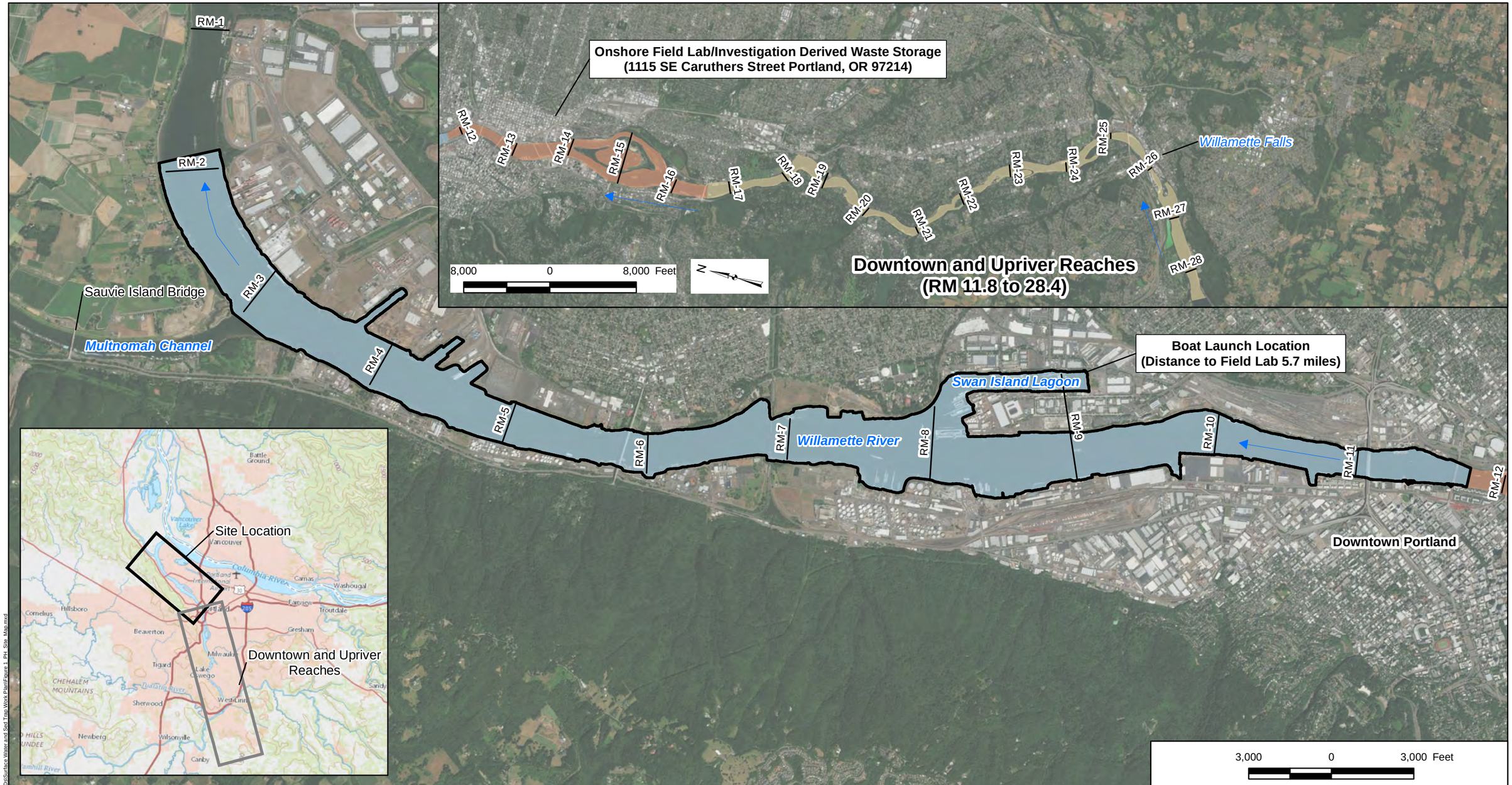
Footnotes:

a) High-Volume Surface water and sediment trap samples will not be analyzed for field duplicates.

Acronyms:

As = arsenic, BEHP = bis(2-ethylhexyl)phthalate; COC = contaminant of concern; CaCO3 = calcium carbonate; Ca = calcium; Cr = chromium; Cu = copper; DDx = sum of dichlorodiphenyltrichloroethane and its derivatives; MCPP = meta-chlorophenylpiperazine; Mg = magnesium; PAHs = polycyclic aromatic hydrocarbon; PCBs = polychlorinated biphenyls; PCP = pentachlorophenol; QA/QC = quality assurance/quality control; ROD = Record of Decision; TOC = total organic carbon; VOC = volatile organic compound; Zn = zinc

FIGURES



Legend

- Flow Direction
- River Mile Marker
- Superfund Site Boundary (RM 1.9 to 11.8)

Study Area

- Site Area (RM 1.9 to 11.8)
- Downtown Reach (RM 11.8 to 16.6)
- Upriver Reach (RM 16.6 to 28.4)

Note:
1. Aerial Imagery provided by ESRI Basemaps 2016

Portland Harbor Site Map

Portland Harbor Superfund Site
PDI Surface Water and Sediment Trap FSP

AECOM | Geosyntec consultants

MI/SEA | March 23, 2018

Figure 1

Path: P:\Projects\Portland Pre-Design\PN\0767A\900\GIS and CAD\MXDs\Surface Water and Sed Trap Work Plan\Figure 1_PH_Site_Map.mxd

2,000 0 2,000 Feet

Legend

- Proposed Surface Water Sample Location (n = 21)
- Proposed Sediment Trap Sample Location (n = 4)
- Proposed Surface Water Transect
- Capped Area (Existing)

6E Surface Water Station Location ID
ST6a Sediment Trap Station Location ID

N

Note:
1. Aerial Imagery provided by ESRI Basemaps 2016
2. One composite surface water and sediment trap sample will be collected per transect.
3. Surface water samples will be both vertically and horizontally composited.

Surface Water and Sediment Trap Sampling Locations

Portland Harbor Superfund Site
PDI Surface Water and Sediment Trap FSP

AECOM Geosyntec consultants

Figure 2

MI/SEA | March 2018

Path: P:\Projects\Portland Pre-Design\PN\G0767A\90\GIS and CAD\MXDs\Surface Water and Sed Trap Work Plan\Figure 2_SurfaceWaterSampLocs.mxd

Notes:
1. Source: Gravity Marine

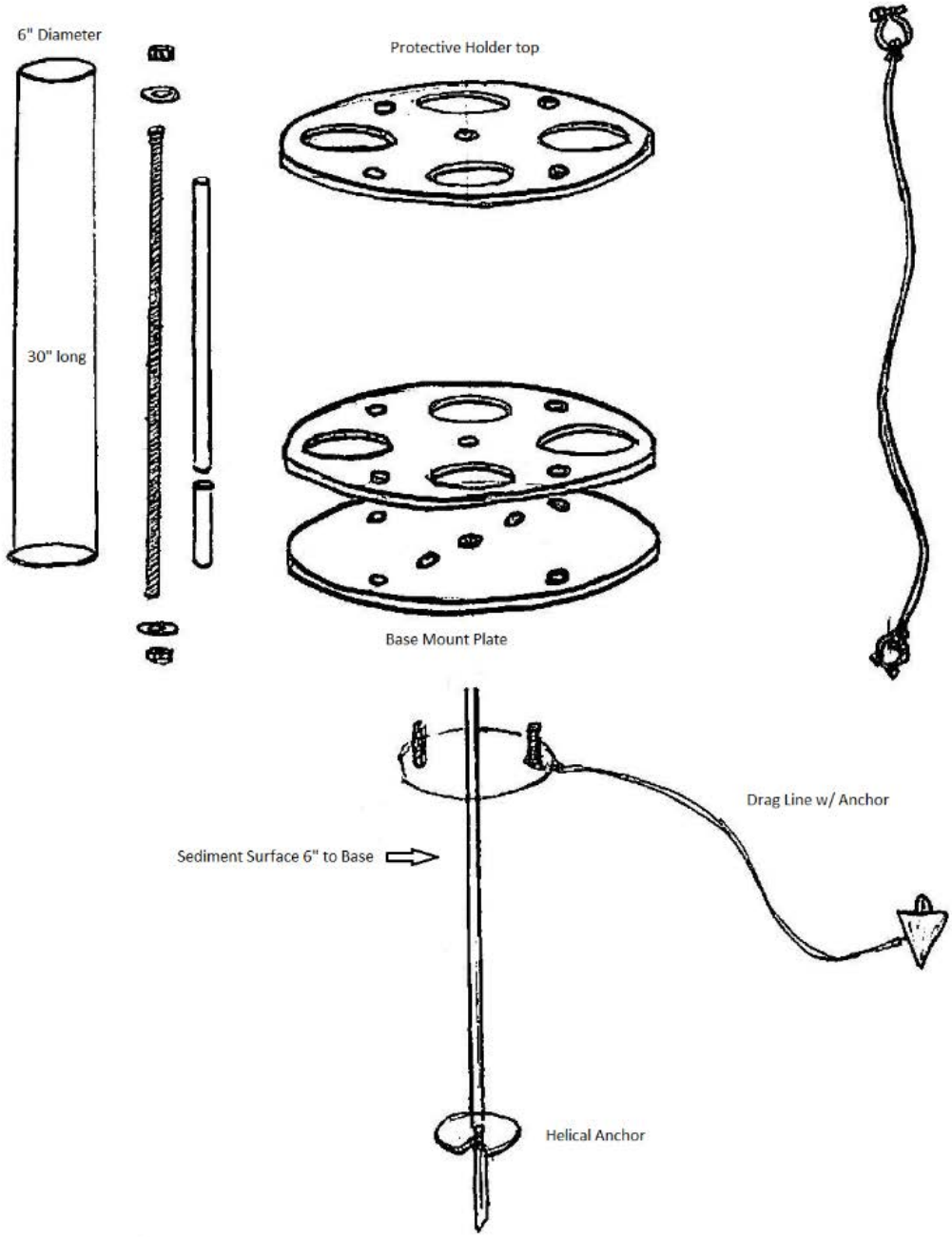
Sediment Trap Photos

Portland Harbor Superfund Site
PDI Surface Water and Sediment Trap FSP

Geosyntec consultants | AECOM | Figure 3a

Portland, Oregon | March 2018

internal info: path, date revised, author



Notes:
1. Source: Gravity Marine

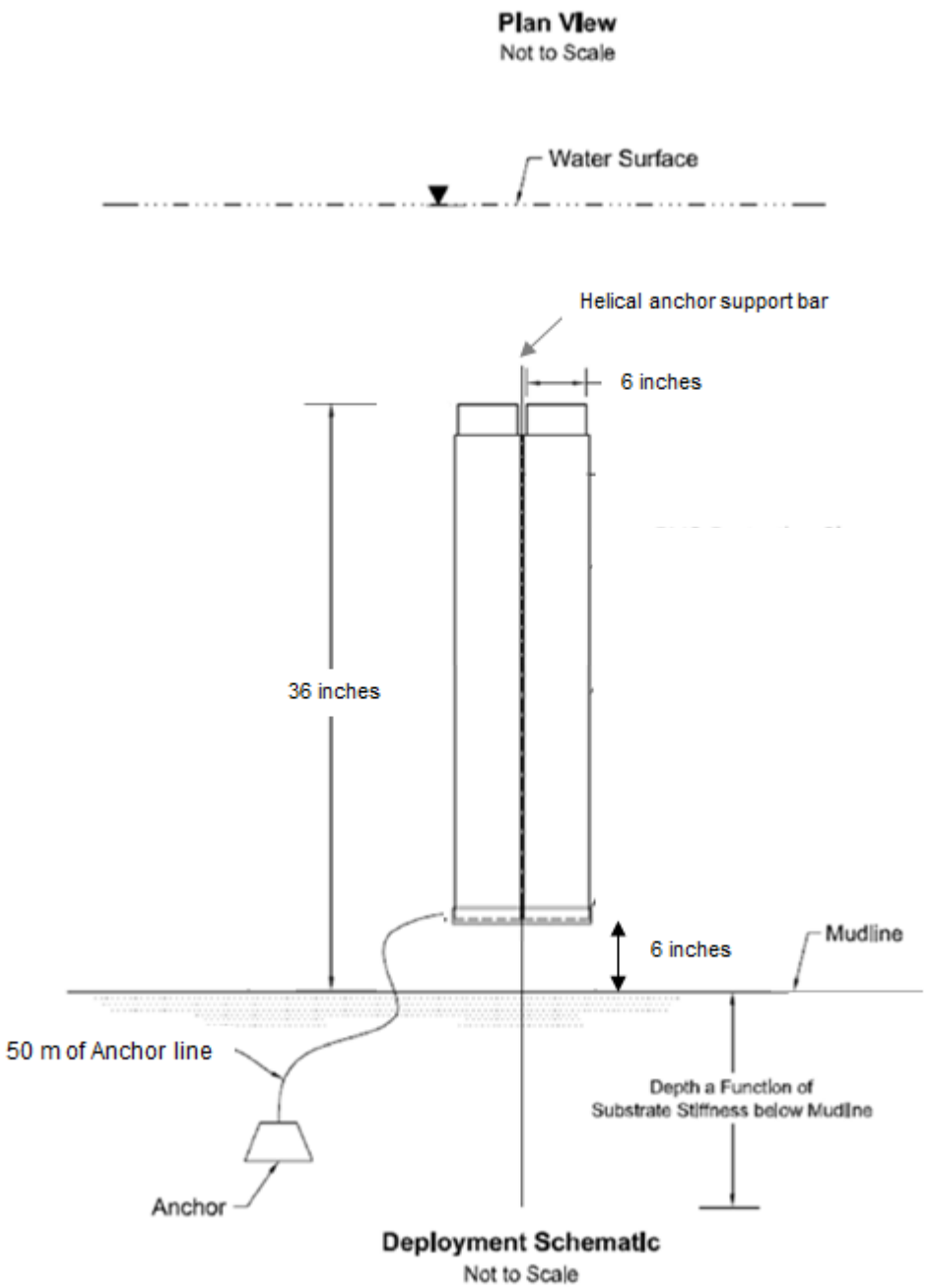
Sediment Trap Schematic - Unassembled

Portland Harbor Superfund Site
PDI Surface Water and Sediment Trap FSP

Geosyntec consultants | AECOM | Figure 3b

Portland, Oregon | March 2018

internal info: path, date revised, author



Notes:
1. Source: Adapted from Figure 3-1, Portland Harbor RI/FS, Round 3 Field Sampling Plan; Sediment Trap Construction and Deployment Schematic; Anchor Environmental, LLC.

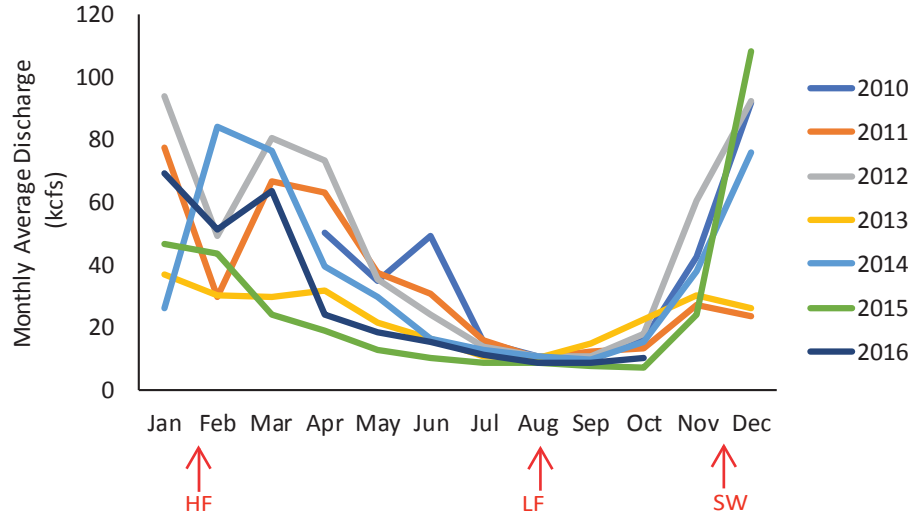
Sediment Trap Schematic - Deployment

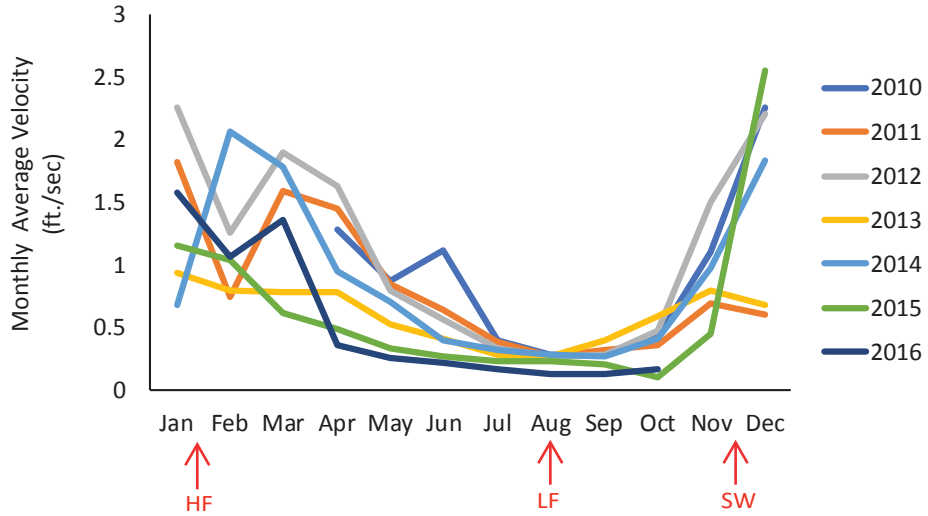
Portland Harbor Superfund Site
PDI Surface Water and Sediment Trap FSP

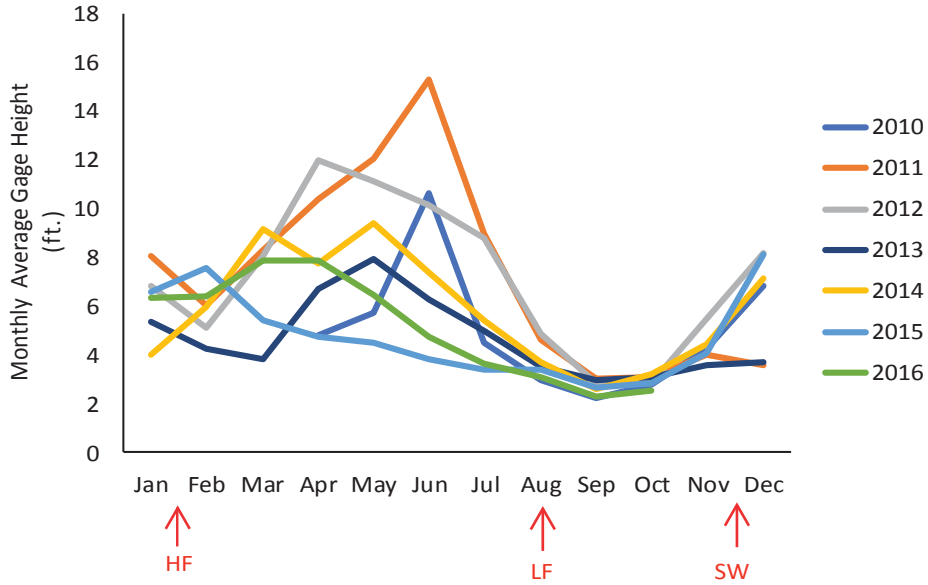
Geosyntec consultants | AECOM | Figure 3c

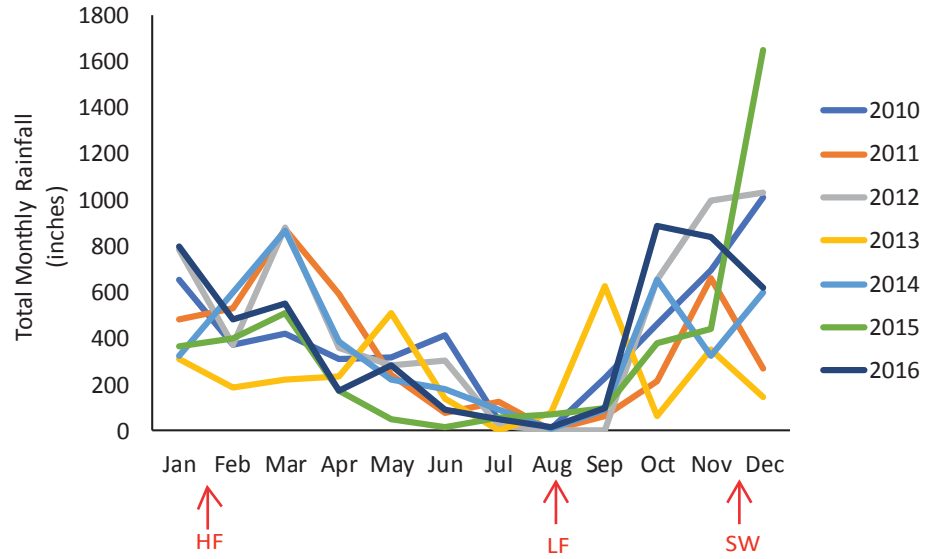
Portland, Oregon | March 2018

internal info: path, date revised, author









Notes:
kcfs – thousand cubic feet per second
ft./sec. – feet per second
ft. – feet
Red arrows indicate proposed PDI sampling events (HF = high-flow, LF = low-flow, SW = stormwater).
1. Data were obtained from USGS Oregon Water Science Center for Station ID 14211720 Willamette River at Portland, OR near the Morrison Bridge at River Mile 12.6 (https://or.water.usgs.gov); and provisional, uncorrected raw data obtained from the Swan Island Pump Station Rain Gauge for the City of Portland Hydra Network (https://or.water.usgs.gov/precip/swan_island_pump.rain).

Historical Surface Water Discharge Flow by Month
Portland Harbor Superfund Site
PDI Surface Water and Sediment Trap FSP

Geosyntec consultants | AECOM | Figure 4

MI/AGF/SEA | August13, 2018

Monthly Average Discharge etc_PNG767.ai

APPENDIX A

Field Forms and Checklists

A-1: Water Quality Parameter Log

A-2: ACDP Deployment Log

A-3: PR2900 Sampling Log

A-4: Sediment Trap Sampling Log

Surface Water Sampling - Water Quality Parameter and Sample Collection Log
Portland Harbor PDI Studies

Transect #:_____

Date: _____ **Recorded by:**_____

Position East/West/Nav	Depth	Time [1]	Temp. (°C)	pH (SU)	DO (mg/L)	ORP (mV)	Conductivity (µS/cm)	Turbidity (NTU)	Flow (cfs)	LISST [2]	
										Solids concentration	Median particle size

Notes:
1: Record at start, in 10 minute intervals, and stop times
2: Record total volume concentration & median particle size from LISST data

Surface Water Sampling - Water Quality Parameter and Sample Collection Log
Portland Harbor PDI Studies

Transect #:_____

Date: _____ **Recorded by:**_____

West **Coordinates:**_**Northing:**_____**Easting:**_____

NavChannel **Coordinates:**_**Northing:**_____**Easting:**_____

East **Coordinates:**_**Northing:**_____**Easting:**_____

High Volume Sample Collection:

Target Sample Volume:_____ **Target Substation Volume:** _____ **Target Volume per Depth:** _____

High Volume Sample

Position East/West/Nav	Depth	Tide	Sampling Depth (ft)	Pump Start Time	Pump Stop Time	Volume Sampled per Substation/Depth (L)	Notes	Total Volume Sampled (L)

Final High Volume Composite Sample ID: _____ **Sample Date/Time:** _____

Peri-pump Sample Collection:

Target Sample Volume:_____ **Target Substation Volume:** _____ **Target Volume per Depth:** _____

Peri-Pump Sample

Position East/West/Nav	Depth	Tide	Sampling Depth (ft)	Pump Start Time	Pump Stop Time	Volume Sampled per Substation/Depth (L)	Notes/Visual Description	Total Volume Sampled (L)

Final Peri-Pump Composite Sample ID: _____ **Sample Date/Time:** _____

East VOC Sample ID: _____ **Sample Date/Time:** _____

NavChannel VOC Sample ID: _____ **Sample Date/Time:** _____

West VOC Sample ID: _____ **Sample Date/Time:** _____

GRAVITY Consulting LLC

Bottom Mounted Aquadopp Deployment & Recovery Log

Project:			Technician:		
Deployment No.	Site Name	Planned Site Depth (m)	Location	UTC Local 14:29	
			Lat:	Lon:	
In Water Date (mm/dd/yyyy)	In Water Time (24h)	Final Water Depth (m)	Anchor		
			Lat:	Lon:	

Frame, Buoy, & Recovey System

Type of Bottom Mount	Length of Rope	Type of Rope Samson	Type of Buoys and flotation
Sensor height from bottom of frame	Recovery System:	☐Rope Packed?	☐Ends of Rope Shackled & Attached?

Acoustic Release

Serial No.	Receive Frequency (kHz)	Transmit Frequency (kHz)	Enable Code	Enable Time (hrs)	Release Code
Battery Fresh Date (mm/dd/yyyy)	Battery Voltage	☐O-rings cleaned ☐O-rings greased	Zinc Anode Condition? Desiccant ☐	**ARMED?** ☐	

Nortek AQUADOPP

Serial No.	Transmit Frequency (kHz)	☐Pressure Port Clean?	☐Bolts tight on current meter
Battery Fresh Date (mm/dd/yyyy) Number: Voltage: /	☐Desiccant ☐External battery pack:	☐Battery cable connected	☐Bolts tight on External Battery

Aquadopp Pre-Deployment Functionality Tests

☐Communication>Serial port: make sure "hard break" is NOT checked	☐Currents Tab: When pinging in air, amplitudes ~15-30
☐Communication>Terminal Emulator>Send Break	If placed in water YES / NO ☐Should be > 100 counts
Did instrument wake with "Prodropp" firmware version, etc	☐Sensor Tab: Pitch/Roll ☐Heading ☐Pressure ☐Temp
☐If NO click stop data collection; then -communications>serial port: check search	Calibrate Temp and Pressure if necessary
☐Communication>Terminal Emulator>Send Break	☐Online>Temperature calibration ☑Online>Set Pressure Offset
Did instrument wake with "Prodropp" firmware version, etc	☐Check Status Tab Error code should contain only Zeros (see page 63)
Deployment>Planning>use existing	☐Stop data collection ☐Click "start recorder data collecting" icon
☐Uncheck "Waves" ☑Uncheck "Use Advanced Settings"	☐Collect data for a short period: click "stop data collection" icon
☐Set Profile Interval to 01 seconds ☐Click "Start Data Collection"	☐Deployment>Recorder Data Retrieval (Confirm Data Collection)
☐Calibrated compass?	

Aquadopp deployment set up

Exisiting deployment file: File name:

Deployment>planning>use exisiting ☐File Loaded: Deployment>planning>load from file

Standard Tab | Advanced Tab

Current profile		Instrument		Deployment Planning		Current profile		Power level	Analog Inputs	
Profile Interval(s)		Frequency:	1 mHz	Assumed Duration (days):		Average Interval (s):			Input 1:	
Number of cells:				Estimated Depth (m):		Blanking Dist. (m):			Input 2:	
Cell Size (m):				Battery Utilization (%):		Measurement load (%):	☐Auto		☐Waves - Static Mode	
☐ Waves				Memory required (MB):		Compass upd. Rate (s):		Coord. System	Velocity cell size (m):	
Number of samples:				Vertical vel. Prec. (cm/sec):		Speed of sound	ENU / XYZ / BEAM		AST window start (m):	
Sampling rate:				Horizont. Vel. Prec. (cm/sec):		☑Measured			AST window size (m):	
Interval (s):						Salinity (ppt)			☐Find First Peak	
☐SUV Data Collection				Compass update rate (s):		☐Fixed (m/s):			AST threshold	
☐Use Advanced Settings				Power level:		File Wrapping			(Usually **No**)	

☐Deployment File Modified: File>save as: .dep	☐Start Deployment: Deployment>Start Recorder Deployment	Start date / time:
☐Compass Calibrated ☐Heading Verified	Deployment Name (6-character name):	
Screen Capture of Calibration - File Name:	☐Set Aquadopp Time to Laptop Time ☐Install Dummy Plug	
☐Laptop Synced to GMT	☐Antifouling ☐ Desitin ☐Housing Wrapped ☐Pinging Confirmed	

RECOVERY

Initials _____

Recovery Date (mm/dd/yyyy)	Time off bottom (24h UTC and Local)	Time out of water (24h UTC and Local)	☐ Pinging Fouling:
Aquadopp Shut Down date / time	Lat: Same Lon: Same	Lat: Lon:	Comments: heavy growth on mooring line, low growth on instrument/frame

Data Recovery ***DO NOT DISCONNECT BATTERY*** until all data is downloaded and verified

☐Laptop Synced to GMT		☐Communication>Serial Port: Upload Baud Rate Set to 115,200 kb
☐ Computer Power management set to OFF		☐Deployment>Recorder Data Retrieval: Select Files, Select "Retrieve"
☐ Using AWAC AST: Deployment>Stop Recorder Deployment		File names:
Computer Time	Instrument Time	☐Open Data File in Storm Software ☐Save Data File to a secondary Location
		☐Data is Verified

Comments

Gravity PR2900 - Water Sample Log

Transect_____ Crew_____ Date_____

Location ID	Start Time	End Time	RPM	Flow Rate (mL/min)	Volume Sampled (L)	Pressure (15-20 psi)	Filter Change #	Filter ID #s	Comments

Sequential Sub Location ID: _____
Transect Number: _____
Transect Location (River Mile): _____

Deployment Information		
Deployment Date:	Vessel Name:	
Start / End Time:	Weather:	
Sampler Personnel (AECOM/Geosyntec): Oversight Personnel:	Global Dive Personnel:	Gravity Captain / Deckhand
Tube Decontaminaton/Prep Method:		
Description of Location and Channel Bottom:		
Proposed Coordinates Easting: Northing:	Acutal Deployment Coordinates Easting: Northing:	Water Depth (ft): Method: *AirMar Echo Sounder (Bow Mounted)*

Checklist ("X"):	30" Anchor Rod Drive:	1 L Dense Salt Solution:	Sodium Azide:	Diver Confirmation Upright:
Glass Tube 1:	☐	☐	☐	☐
Glass Tube 2:	☐	☐	☐	☐
Glass Tube 3:	☐	☐	☐	☐
Glass Tube 4:	☐	☐	☐	☐

Additional Comments:

Retrieval Information		
Retrieval Date:	Vessel Name:	
Start / End Time:	Weather:	
Sampler Personnel (AECOM/Geosyntec): Oversight Personnel:	Global Dive Personnel:	Gravity Captain / Deckhand
Water Depth (ft): Method: *AirMar Echo Sounder (Bow Mounted)*	Analytical Suite: Full ROD Table 17 COCs	

Final Composited Sediment Trap Sample Description
Color, Minor/Major Constiuent, Debris, Odor, and Sheen:

Sample Information			
Sample ID	Sample Time	Sample Type (Primary, Duplicate, MS/MSD, EPA Split)	# of Containers

Sequential Sub Location ID: _____

Transect Number: _____

Transect Location (River Mile): _____

Glass Tube #1 Sediment Description	
Observations (biofouling, staining on tube, other):	
Sediment Mass:	Sediment Recovery Thickness (4 measurements in cm): 1) 2) 3) 4)
Color, Minor/Major Constiuent %:	
Organics, Biota, and Other:	
Odor and Sheen:	

Glass Tube #2 Sediment Description	
Observations (biofouling, staining on tube, other):	
Sediment Mass:	Sediment Recovery Thickness (4 measurements in cm): 1) 2) 3) 4)
Color, Minor/Major Constiuent %:	
Organics, Biota, and Other:	
Odor and Sheen:	

Glass Tube #3 Sediment Description	
Observations (biofouling, staining on tube, other):	
Sediment Mass:	Sediment Recovery Thickness (4 measurements in cm): 1) 2) 3) 4)
Color, Minor/Major Constiuent %:	
Organics, Biota, and Other:	
Odor and Sheen:	

Glass Tube #4 Sediment Description	
Observations (biofouling, staining on tube):	
Sediment Mass:	Sediment Recovery Thickness (4 measurements in cm): 1) 2) 3) 4)
Color, Minor/Major Constiuent %:	
Organics, Biota, and Other:	
Odor and Sheen:	

APPENDIX B

Standard Operating Procedures

B-1: Water Quality Parameters SOP (LISST and YSI)

B-2: Acoustic Doppler Current Profiler (ADCP) SOP

B-3: Surface Water Sampling with Peristaltic Pump SOP (Integral 2004b)

B-4: High-Volume Surface Water Sampling with PR2900 SOP

B-5: Horizontal and Vertical Location Control SOP (August 2018)

B-6: Excerpts from Round 3 Sediment Trap FSP (Integral 2006c)

B-7: Investigation-Derived Waste SOP (March 2018)

APPENDIX B-1

STANDARD OPERATING PROCEDURE

WATER QUALITY PARAMETERS (LISST & YSI)

STANDARD OPERATING PROCEDURE (SOP)

LISST AND YSI FIELD PROBE MEASUREMENTS AND CALIBRATION

Scope and Application

This Standard Operating Procedure (SOP) describes the protocols for collecting *in situ* water quality data in the field with Laser *In Situ* Scattering and Transmissometery (LISST) Particle Analyzer and YSI multi-probe conductivity, temperature, turbidity and dissolved oxygen (CTD) sensors.

Definitions

pH: pH is the negative log10 of the hydronium ion concentration.

Dissolved Oxygen (DO): The concentration of oxygen dissolved in water, expressed in milligrams per liter (mg/L) or as percent saturation, where saturation is the maximum amount of oxygen that can theoretically be dissolved in water at a given barometric pressure and temperature.

Specific Conductivity (Cond): The measure of water's ability to conduct electricity, and therefore a measure of the water's ionic activity and content, normalized to a temperature of 25 degrees Celsius (°C).

NIST: National Institute of Standards and Technology.

Safety and Hazardous Materials Management

General Lab Safety – All general laboratory safety practices should be complied with, including wearing a laboratory coat, safety glasses, and gloves. Samples must be treated with regard to possible toxicity and microbiological potential.

This method may involve the use of corrosive and caustic reagents as well as chemicals that pose contact hazards. Care should be taken to avoid skin contact or inhalation of these chemicals.

Analysis – From a Vessel – Sampling personnel will follow standard safety procedures while onboard the sampling vessel. The vessel skipper has ultimate responsibility for safety while the vessel is underway. During deployment of equipment, the YSI sonde operator and the skipper must communicate with one another to avoid potential loss of the instrument due to propeller interface with the underwater field cable.

Analysis – Streams/Rivers – Sampling personnel will always enter streams/rivers cautiously and follow standard safety procedures when entering these flowing bodies of water. There are many hazards associated with streams and rivers sampling. Some of these hazards include traffic, fast moving or deep water, steep slopes to sampling sites, and hostile dogs or people. Use extreme caution when exiting sampling vehicles, walking along busy highways or sampling on bridges. Fast moving water can cause the sampling personnel to lose balance and fall into the water. This

can result in injury or drowning. Many of the sampling sites require personnel to walk over riprap or other extremely rough and slippery terrain. Again, extreme caution combined with slow movements can minimize potential injury. Be aware of your surroundings and potential presence of other people, especially under bridges or in culverts.

Equipment

Two instruments will be used for field measurements: a LISST Particle Analyzer and a YSI multiprobe.

The LISST 100X is a submersible multi-parameter system for *in situ* observations of particle size distribution and volume concentration. While *in situ*, LISST monitors particle size distribution, particle volume concentration, volume scattering function, optical transmission, depth, and temperature in both fresh and marine waters.

The YSI 6600 Sonde is an *in situ* detector of temperature, pH, dissolved oxygen, specific conductivity, turbidity, and depth in fresh and marine waters. The YSI 600XLM is a smaller version of the 6600 series and is identical in use and function. The YSI 6600 EDS is a 6600 sonde equipped with a rotating brush that periodically wipes the individual sensors to prevent biofouling during extended deployment periods.

Water Quality Measurements

Physical and chemical water parameters will be collected at surface water stations. Several physical and chemical water parameters are best measured in the field because of the unstable nature of the parameter or because the information is needed to direct further sampling. It is frequently preferable to perform these analyses in the field, especially if the samples will not be immediately transported to the analytical laboratory (pH, in particular, should be measured in the field if feasible).

It is best to place the instruments directly into the surface water body at the station location at the desired water depth instead of collecting a sample and measuring parameters in a container. However, if this is not possible, a flow through chamber may be most feasible for sample collection.

The sensors will run for the full duration of the sampling event to observe any potential changes in the physical parameters of the sample that may be caused by site changes or perturbations (such as vessel traffic, storm events, outflows, etc.).

Documentation of instrument information will include at a minimum the name(s) of the person(s) making the measurement and the field equipment used to make that measurement must be recorded in the field logbook and on any field forms used during the sampling event. Equipment maintenance and calibration records must be kept in logbooks and field records so that the procedures are traceable. Field records will be recorded in the project notebook.

The following sections provide protocols and calibration specific to each instrument.

LISST

Calibration

The LISST uses lasers for the measurement of particle volume and size; therefore, the calibration requirements are less substantial than for YSIs as degradation of the calibration does not occur; only the lens requires calibration. LISST calibration will be performed on the first and last day of field sampling at the AECOM Technical Services (AECOM) field laboratory. Calibration will be performed as a blank water calibration by submerging the sensors in only fresh distilled water to collect a background particle calibration.

The background scattering measurement is critical to good instrument performance. It is especially critical for clean water applications where the optical transmission is greater than 90% over the 5 cm path. The background scattering will also check the overall health of the instrument. It will verify that all of the systems are functioning and that the optics is still in alignment. To collect the background file, open the calibration function and collect 20 samples. After all 20 are collected the average will be displayed. If the values are acceptable the values can be saved to a file. All data collected in the field will be compared back to this new background file. If there is a problem with the instrument or if the water or windows are not clean, error messages will be displayed. Dirty water or windows will generally cause higher values across the middle rings. Large bubbles or particles in the water can cause higher values on the inner rings or left hand side of the display. High values on the inner rings combined with a lower Laser power value can also be an indication of optical misalignment.

Operation

1. At the start of sampling, log the LISST file name in your logbook.
2. Set the LISST to average 10 samples every 0.3 seconds and collect until shutoff with the magnetic strip.
3. Install LISST with other sensors at the targeted depth where the chemical samples will be collected and commence data collection in conjunction with the start of related sampling.
4. Stop sampling of the LISST at the conclusion of the sampling event.
5. Decontaminate LISST with Liquinox and DI water between stations.
6. Download LISST file to Trimble YUMA after each station is sampled.
7. Process files with daily background scatter calibration.

YSI MULTIPROBE

Calibration

Prior to start of sampling, conduct a calibration of the instrument:

1. Save with date of sampling.
2. See below for full calibration method and quality control (QC) requirements.
3. Collect and review calibration and verify acceptability.

Operation

1. At the start of sampling, log the YSI file name in your logbook.
2. Set the YSI to collect samples every 1 second.
3. Install YSI with other sensors at the targeted depth where the chemical samples will be collected and commence data collection in conjunction with the start of related sampling (see details below for Live Data Recording and Data Logging).
4. Stop sampling of the YSI at the conclusion of the sampling event.
5. Decontaminate YSI with Liquinox and DI water between stations.
6. Download YSI file to Trimble YUMA after each station is sampled.
7. Process files and save to USB backup.

The YSI multiprobe can be used for both attended discrete data collection (live data recording) and unattended longer-term data collection (data logging).

Live Data Recording

After calibration has been completed, completely rinse the probes with reverse osmosis (RO) water. Pour a small amount of tap water into the calibration cup to keep the sensors in a moist environment during transit to the first sampling locations. Be sure to bring check standards, RO water for rinsing, the probe guard and a 650 MDS datalogger with sufficient battery power to last for the sampling run. The YSI 650 MDS runs on four C cell batteries. Remaining battery life is always on display at the bottom right hand corner of each screen. See KCEL SOPs # 02-02-002, #02-02-004 and # 02-02-003 for measurements made in marine and freshwater systems.

Remove the calibration cup and install the slotted sensor guard. Place the YSI into the sampling environment; wait for parameters to equilibrate and record measurements, including time to the nearest minute, directly onto the field sheet.

Datalogging (Unattended Monitoring)

The YSI 6600 and 600XLM have onboard memory and power. These sondes can log readings to sonde memory for days or weeks at a time. If monitoring for DO, remember to re-enable the RS-232 sleep mode to conserve battery power and excess wear of the DO probe following the calibration of the sonde.

Setting Up Unattended Monitoring Using the 650 Datalogger

From the 650 main menu, select “Sonde Menu” then “Run” and then choose “Unattended”. The screen will show the Unattended Setup menu, which includes the following choices (use the arrow key to toggle down and highlight each selection for editing):

- Interval: Enter the desired sampling interval in hours, minutes, and/or seconds.
- Start date: Enter the sampling start date.
- Start time: Enter the sampling start time.
- Duration days: Enter the length of time, in days, that the sonde will be deployed.
- File: Enter a file name of no more than eight characters.
- Site: Enter the name of the location where the sonde will be deployed.
- Bat volts: This value is the voltage of the batteries inside the sonde (informational only).
- Bat life: This value is the number of days the sonde can log before the batteries will deplete (informational only).
- Free mem: The value is the number of days the sonde can log before the internal memory will be full (informational only).
- A - Tells the amount of time before the first sample will log.
- View Parameters: if selected, a list appears of what parameters will be logged.
- Start logging: When you have finished setting up for the unattended deployment you must select this. After you press enter, the screen will ask you if you really want to start logging. Enter yes and the screen will return to the Unattended Setup menu. Logging will begin at the next even multiple of your logging interval. The sonde can now be unconnected from the datalogger and is ready for unattended monitoring.

Setting Up Unattended Monitoring Using a PC Equipped with EcoWatch

From the main menu, select 1 – Run, then 2 – Unattended sample to bring up the Unattended Sample Menu. Select either the letter or number of the following options to edit:

- 1 – Interval: Enter the desired sampling interval in hours, minutes, and/or seconds.
- 2 – Start date: Enter the sampling start date.
- 3 – Start time: Enter the sampling start time.
- 4 – Duration days: Enter the length of time, in day, that the sonde will be deployed.
- 5 – File: Enter a file name of no more than eight characters.
- 6 – Site: Enter the name of the location where the sonde will be deployed.
- 7 – Bat volts: This value is the voltage of the batteries inside the sonde (informational only).
- 8 – Bat life: This value is the number of days the sonde can log before the batteries will deplete (informational only).
- 9 – Free mem: The value is the number of days the sonde can log before the internal memory will be full (informational only).
- A – Tells the amount of time before the first sample will log.

- B – Tells what parameters will be logging.
- C – Start logging – When you have finished setting up for the unattended deployment, you must select this. After you press the C key, the screen will ask you if you really want to start logging. Enter yes and the screen will return to the Unattended setup menu. Logging will begin at the next even multiple of your logging interval. The sonde may now be unattached from the PC and is ready for unattended monitoring.

  The probe must be capped during the time between the last field measurement and arrival at the laboratory and must be stored with sufficient ambient water in the cap to maintain high humidity but not cover the individual probes. The sonde must be returned to the lab within 12 hours of the last field measurement so that post-deployment calibration checks can be performed.

Uploading Files from the Sonde to the PC

When the unattended monitoring period is over, the file stored in the YSI sonde may be transferred to a laptop PC loaded with EcoWatch software by following these steps:

- Connect the sonde to the PC and open the EcoWatch software. Use the Sonde button on the toolbar to communicate with the sondes software.
- Type "menu" after the prompt and select 1 – Run. If the sonde is still logging, select the option to stop logging and return to the main menu.
- From the main menu, select 3 – File menu and 3 – Quick upload. Choose to upload in PC6000 format. After the upload is complete, the data will be in a .DAT file on the PC.
- Open the .DAT file to view the data using the EcoWatch software.
- To export the file to an Excel spreadsheet, activate the File dropdown menu on the EcoWatch main toolbar and highlight Export. Save the file in .xls format.

YSI – Additional Calibration Information

Individual probes for the specific parameters of interest are calibrated before field use. The sondes are equipped with internal memory and programmable logging functions which allows unattended data collection for variable time frames. Post-deployment calibration verification checks are performed on each sonde returning from the field to help verify the accuracy of data collected. Records are kept on both pre-deployment calibration and post-deployment checks. In addition to these, notes are kept on probe electrical response, maintenance, and replacement. Calibration procedures are provided in Attachment 2 of this SOP.

The YSI model 650 data loggers are hand-held microcomputers that allow the user to display sonde readings, calibrate and configure sondes, store and recall data, and upload data from sondes.

EcoWatch for Windows is the PC software interface to YSI's 6-Series environmental monitoring sondes. With EcoWatch, the user can program field equipment, upload data collected on the equipment, and format data into graphs, tables, and spreadsheets.

Attachment 1. Field Equipment List

- High volume peristaltic pump with vortex separator
- Teflon® tubing
- Surface water parameter multi-meter capable of measuring pH, reduction/oxidation (redox) potential, temperature, specific conductance, turbidity, and dissolved oxygen
- Teflon®-lined polyethylene sample tubing (length is site dependent)
- Platinum cured silicone tubing
- Plastic zip-ties
- Water Sampling Log forms
- Sample tags/labels and appropriate documentation (e.g., chain-of-custody forms)
- Insulated cooler(s), chain-of-custody seals, Ziploc® bags
- Sample containers (PUF cartridges, vortex separator vials)
- Coolers
- Wet ice
- Nitrile gloves
- First aid kit
- Eye wash kit
- Duct tape
- Clear tape
- Packing tape dispenser
- Tool box
- Coated weights for water samplers
- Non-metallic wire for winch spool
- 2000-watt power generator or inverter
- Paper towels
- Dilute solution of Liquinox
- Deionized water
- Extension cord
- Power strip
- Resealable plastic bags (i.e., 1 gallon and 1 quart)
- Yuma Trimble
- IDW containers
- Hexane
- 0.45 micron in-line filters

Attachment 2.

1. YSI DETAILED PROCEDURES

1.1 CALIBRATION

Calibration for DO, Cond, turbidity and pH are to be done within 12 hours of deployment. Depth should be checked prior to deployment and calibrated to relative zero (local water surface) as needed. Temperature need only be checked annually since there is no means of calibrating the YSI thermistor, which is integral to the conductivity probe. If temperature values are found to be inaccurate beyond prescribed standards, the entire conductivity probe must be replaced

Pre-deployment calibration is done in the following order of increasing conductivity: DO, Cond, pH. This allows for an accurate calibration and control check for the very low conductivity standard used in this procedure (a standard that best reflects the actual conditions found in our fresh water sampling sites). In the calibration laboratory, the YSI Sonde should be properly supported on the bench so that solutions can be easily added to the calibration cup while also being able to properly rinse the sonde between calibration solutions.

1.1.1 Calibrating using the YSI 650 Datalogger

- Connect the YSI 650 datalogger to the sonde using the 8-foot 6090 field cable and press the green "power" button to activate the logger. The screen will automatically power to the "650 Main Menu" screen. Toggle down to "Sonde menu" and engage this menu by pressing the enter arrow key.
- Toggle down to the "Advanced" menu and press enter. In the "Advanced" menu, toggle down to "Setup" and press enter. To properly calibrate the DO probe, it is best to deactivate the "Autosleep RS232" protocol. This can be done by toggling down to this item on the "advanced setup" menu screen and pressing enter.
- You are now ready to begin calibration. Escape out twice from these menu layers and toggle up and enter "Calibrate" on the main Sonde menu.

1.1.1.1 Dissolved Oxygen

- With the sonde oriented so that the sensors are pointed upward, place enough RO or tap water in the calibration cup to raise the level to within approximately 3 millimeters (mm) (1/8th inch) of the o-ring on the DO probe. Make sure that the DO membrane is free of bubbles, tears, or creases and not immersed in water, and remove any water

droplets from the DO membrane surface with a kimwipe. Loosely cover the open top of the calibration cup with the lid.

- Select "Dissolved Oxygen" from the calibration menu. Select "% saturation" and enter the barometric pressure in mm Hg. This information is obtained using the digital barometer (7.4) in the calibration room.
- Wait approximately 10-20 minutes for the air in the calibration cup to become water-saturated and for the temperature to equilibrate. Record the pre-calibration value on the YSI calibration worksheet.
- Press "Enter" to calibrate and record the initial calibration check (post calibration value). This value should be within 1% of the calibration set point of 100%.
- Record the DO charge value to log a record of probe response and possible drift, which may indicate a need for probe maintenance. If the DO charge value falls outside of the 25-100 range, the electrodes need to be resurfaced and the membrane changed. See Section 5: Preventative Maintenance for the procedure to service the DO probe.
- Press the "Escape" key to return to the calibration menu

1.1.1.2 Conductivity

- Rinse and fill the calibration cup repeatedly with RO water until the conductivity reading is as close to zero as possible. This ensures that there are no lingering buffer salts on the probes or calibration cup that may contaminate the conductivity calibration standard.
- Rinse the chamber with reclaimed 73.9 μS/cm solution and then fill the calibration cup (enough to cover the conductivity probe) with fresh 73.9 μS conductivity standard. Select "conductivity" from the calibration menu and then "spCond". Enter the value in millisiemens (divide microsiemens by 1,000 and the result is 0.0739) and record the pre-calibration number (which will be reported in microsiemens).
- Press Enter to calibrate and record the post-calibration number. Discard the calibration solution and add the calibration check standard and record the response. The calibration check standard should be within 10% of the true value otherwise the sonde must be recalibrated with fresh standards and rechecked with fresh check standard solution.

1.1.1.3 pH

A two-point calibration procedure is most commonly used. First determine the approximate pH of the water body to be analyzed. If the majority of the water will be greater than 7.0, use the high range. If the pH values are expected to be below 7.0, use the low range.

1.1.1.3.1 High Range

- Rinse the sensors with a small portion of the pH 7.0 buffer and fill the cup to above the sensors with fresh pH 7.0 buffer and allow at least one minute for temperature equilibration and the response to stabilize before proceeding. Insure that there are no bubbles on the pH bulb or clinging to the bulb guard.
- Select ISEI pH from the calibration menu and select a two-point calibration.
- Enter the pH 7.0 buffer and record the pre-calibration value. Allow 2- 5 minutes for the reading to stabilize. Sometimes there will be a slow drift on the sensor readings, so be certain that the reading has equilibrated prior to calibration. Press Enter to calibrate and record the post-calibration number. Record the pH mV value to track the probe response and to help determine the need for maintenance and/or replacement. This value should be between 0 and +/- 50 mV.
- Escape once to enter the second point for the calibration curve, in this case using the pH 10.0 buffer. Rinse the probes and cup well with RO water and then with reclaimed pH 10 buffer. Fill the calibration cup with fresh pH 10.0 buffer. Repeat steps as above. For the pH 10 response, the pH mV constant should be -177 from the pH 7 mV value.
- Rinse well with RO water and reclaimed pH 6.86 check standard, and then pour in a pH 6.86 calibration check standard. The response of the check standard must be within +/- 0.2 pH units of the expected value, otherwise the sonde must be recalibrated with fresh standards and rechecked with fresh check standard solution.

1.1.1.3.2 Low Range

- Rinse the sensors with a small portion of the pH 7.0 buffer and fill the cup to above the sensors with fresh pH 4.0 buffer and

allow the response to stabilize. Select ISEI pH from the calibration menu and select a two-point calibration.

- Enter the pH 7.0 buffer, allow the readings to stabilize, and record the pre-calibration value. Press Enter to calibrate and record the post-calibration number and the pH mV value.
- Escape once to enter the second point in the calibration curve, in this case the pH 4.0 buffer. Rinse the probes and cup well with RO water and reclaimed pH 4 buffer, then pour in fresh pH 4.0 buffer. Repeat steps above and record the pH mV value. This value should be +177 from the pH 7 mV value.
- Rinse well and pour in a pH 6.86 calibration check standard. The response of the check standard must be within +/- 0.2 pH units of the expected value, otherwise the sonde must be recalibrated with fresh standards and rechecked with fresh check standard solution.

1.1.1.4 Turbidity

- The first step is to confirm that the turbidity probe is functioning properly. Confirm that the wiper parks correctly. It should be positioned at approximately 180° opposite the optics. The wiper must reverse direction during the wipe cycle. The output of the probe must increase when you place your finger in front of the optics. If the wiper does not park correctly or reverse direction, then make sure that the underside of the wiper is clean and free of mud, sediment, or other fouling. Replace the wiper or pad with a spare if needed. If the probe does not show an increase in output or the wiper does not park correctly, then you must stop the calibration and determine the cause of the problem.
- Calibrating turbidity is best done in a lab environment; calibrations in the field can result in errors. It is better to post-calibrate a sonde back in the lab than to attempt the calibration of an optical probe in the field, especially if you are working out of a small boat or in less than clean conditions.
- Never use plastic or glass containers for your calibration unless the sensor guard is installed on the sonde. Use of the supplied calibration/storage cup with its black endcap is strongly recommended.

- Always ensure that the submerged parts of the sonde and wipers are clean before beginning any turbidity calibration. Remove any brush wipers and replace with a clean, standard (no brush) wiper. Sediment or other contaminants will compromise the standard if not removed prior to calibration. Make especially sure the optics are clean, no fingerprints!
- Always start with the zero (0) NTU standard first. Pour the 0 NTU cal standard into the calibration cup -- pour down the side so you do not aerate the sample. Secure the sonde into the calibration cup. Verify that there are no air bubbles on the probe face, run the wiper at least once, and wait out the probe's sampling period before accepting the first calibration point.
- Calibrate the second point, using 50 NTU. Again, wipe the probe at least once before pressing the enter button.

1.1.2 Calibrating Using a PC equipped with EcoWatch Software

- Connect the YSI to the PC using the 6067B calibration cable and attach the DB-9 connector of the cable to the Com port of the computer.
- Open the EcoWatch software program. Select the Sonde icon button from the EcoWatch toolbar and type "menu" at the # prompt on the terminal screen to bring up the main menu. Navigate through EcoWatch by typing in the number preceding each selection option at the prompt and pressing enter. Type in "0" or use the escape key to return to a previous menu.
- From the main menu, select the "Advanced" by typing in "8" at the prompt menu and press enter. In the "Advanced" menu, select 2- "Setup" and press enter. To properly calibrate the DO probe, it is necessary to deactivate the "Autosleep RS232" protocol. This can be done by selecting "5" in the "advanced setup" menu screen and pressing enter.
- You are now ready to begin calibration. Escape out twice from these menu layers to return to the main menu and select 2 – Calibrate to bring up the Calibration menu.
- Follow the steps outlined above in sections 1.1.1.1 through 1.1.1.3 to complete the calibration.

1.1.2.1 Temperature

Temperature probe calibration is factory-set and requires no daily re-calibration. Annually, the calibration must be verified as described in the QC section.

1.1.2.2 Depth

If data is to be collected at a particular depth and the YSI's depth reading is used to confirm the depth of the probe, the calibration of the depth sensor must be checked. The user should check that the reading above the water reads zero, and that immersion at one meter yields a correct reading. The sonde should be immersed such that the base of the probe is at one meter. A measuring device such as a marked Secchi disk line can be used to determine the accuracy. If the depth needs recalibration, remove the probe guard and re-attach the calibration cup so that the probes are in water saturated air. From the calibrate menu, select number 3-Pressure-Abs to access the depth calibration procedure. Input 0.00 and press Enter. Monitor the stabilization of depth readings with time. When no significant change occurs for approximately 30 seconds, press Enter to confirm the calibration.

2. QA/QC REQUIREMENTS

2.1 IN FIELD QC FOR ATTENDED MONITORING

When the YSI sonde is used for attended monitoring, both a field replicate (FREP)and field check standards (CS) for pH and conductivity are run at a frequency of 5% of field measurements or once per sampling run. A field replicate is defined as a separate in-situ measurement made immediately following all procedures done for an individual sample. The probe would typically be removed from the water body then returned to the same depth and position used in the original measurement. To meet project requirements, checks using calibration check standards may also be performed in the field. A pH calibration check standard and a conductivity calibration check standard may be taken into the field for each sampling run. The calibration checks should be analyzed at the same frequency as the field replicates (a minimum frequency of 5% of measurements or once per day).

The following table describes the acceptance limits for field replicates and calibration check standards.

Parameter	Replicate Samples	Field Calibration Check Standards
Dissolved Oxygen	RPD ≤ 20%	Not applicable
Temperature	± 0.3 °C	Not applicable
Conductivity	RPD ≤ 10%	± 10 %
pH	± 0.2 pH units	± 0.2 pH units

Notes:

RPD = Relative Percent Difference = $100 \times [(r_1 - r_2)] / ((r_1 + r_2)/2)$
where r1 = result 1 r2 = result 2

2.2 POST-DEPLOYMENT CALIBRATION CHECK

After either an attended or unattended monitoring period, sondes returned to the laboratory must have a calibration check performed within 12 hours of the last field measurement. The post-deployment checks must be done in the same order used for initial calibration and must be done before any maintenance or calibrations are performed.

2.2.1 DO Post-Deployment Check

Set up the sonde as described in the SOP. Measure the % DO in the saturated air and record the value and DO charge. Be sure to allow enough time (add an estimated time, i.e., 5 minutes) for the DO to truly equilibrate to the saturated air inside the calibration cup before recording the response.

2.2.2 Conductivity Post-Deployment Check

Immediately after the DO check, rinse the cup with reclaimed 73.9 µS/cm solution, and then fill the calibration cup with the calibration check standard and record the measured value and the Conductivity Calibration Constant.

2.2.3 pH Post-Deployment Check

Immediately after the Conductivity check, fill the calibration cup with the calibration check standard and record the measured value and the pH mV value.

2.2.4 Time Post-Deployment Check

After an extended deployment, the internal YSI clock will be re-checked against the atomic clock to ensure the accuracy of the interval and actual time of logged samples.

If any parameter falls outside the acceptance limits shown below, the field data collected with the sonde may be qualified.

Attended Monitoring (or less than 24 hours from Calibration to End Check):

Parameter	Post-Deployment Calibration Check Acceptance Limits
Dissolved Oxygen	±4 %
Temperature	See below
Conductivity	±10 %
pH	±0.2 pH units

Unattended Monitoring (more than 24 hours from Calibration to End Check):

Parameter	Post-Deployment Calibration Check Acceptance Limits
Dissolved Oxygen	±10 %
Temperature	See below
Conductivity	±10 %
pH	±0.3 pH units

Temperature probe calibration is confirmed annually with a side-by side comparison of the probe response to an NIST-traceable thermometer. The YSI probe and NIST-traceable thermometer are placed in an insulated beaker of RO water that was allowed to equilibrate for 1 hour at room temperature. Once the response has stabilized, the probe and thermometer readings are recorded in the calibration logbook. The temperature should also be checked at approximately 4°C by checking the temperature vs the NIST thermometer using the insulated beaker after allowing it to equilibrate overnight in the walk-in cooler. The probe responses must be within ± 0.2 °C of the measured response of the NIST thermometer. If not, the conductivity/temperature probe should be replaced and checked against the NIST traceable thermometer.

2.3 CORRECTIVE ACTION

If calibration verification or precision of duplicate field measurements do not meet specifications, these QC measurements should be immediately repeated. Calibration failures that are detected in the field may be corrected by re-calibrating then repeating the calibration verification. If this second verification or duplicate fails, the instrument should not be used for field measurements until the problem is fixed and acceptable performance has been verified. If QC failures are observed, lab analysis may also be used in place of field measurements. It may be necessary to flag the data or repeat the measurements with a properly functioning meter if other corrective actions cannot be performed.

Changing field conditions rather than a malfunction of the field meter may affect replicate field measurements. No corrective actions will be based on field replicates when acceptable field duplicates are observed. Significant changes in barometric pressure may affect the post-calibration values. This change should be documented.

DAF forms should be used when there is any failure of the QC requirements that could influence the data produced by the YSI, when there are unusual field conditions that may

affect the expected data, or if any described procedures were not able to be followed for whatever reason.

3. CONTAMINATION AND INTERFERENCES

Aside from algal growth, there are several factors that may cause inaccurate sensor readings. Calibration drift can occur on all sensors. Weekly maintenance and recalibration of sondes used for unattended deployments are required whenever starting a new project to ensure frequent validation of data collected. Time between maintenance may be increased depending on the environment being sampled. For example, the use of a YSI 6600 EDS in a static body of water stationed below the photic zone will experience much less biofouling than a sonde in a shallow stream during summer.

4. PREVENTATIVE MAINTENANCE

Multiprobes must be cleaned of algae and debris garnered during extended deployment. Use Kimwipes and RO water to gently remove buildup on probes and casings prior to storage and/or re-calibration. Sondes must be stored in a moist environment to prevent dehydration of the probes. After rinsing the sonde well with both RO water and tap water, pour a small amount of tap water into the calibration cup and hand tighten the cup onto the sonde. Storage caps and field connection guards appropriate for each sensor must be in place during storage and transport to and from the field.

4.1 DO SENSOR MAINTENANCE

The DO sensor membrane should be checked for air bubbles, tears or other imperfections and be replaced accordingly. To replace the membrane, remove the old membrane and rinse the electrodes with RO water. If either electrode shows signs of corrosion or buildup, dry the probe completely with a lens cleaning tissue.

Use the small sanding disc included in the 6035 DO probe conditioning kit to gently sand the electrodes in a motion similar to lighting a match. Always sand in a direction parallel to the gold electrode and continue until both electrodes are free of corrosion.

After completing the sanding procedure, rinse the probe face with RO water and then rinse with a small amount of the KCl solution included in the 6035 DO probe conditioning kit. Clamp the sonde so the probes are in a vertical position and apply KCl solution to the DO probe completely filling the moat around the electrodes and forming a positive meniscus on the tip of the sensor. Be sure no air bubbles are stuck to the face of the sensor and carefully place a Teflon® membrane over the sensor. Roll the o-ring over the end of the probe being

careful not to touch the membrane sensor surface with your fingers. There should be no wrinkles or trapped air bubbles under the membrane. Trim off excess membrane with scissors and rinse the sonde several times with RO water.

4.2 CONDUCTIVITY SENSOR MAINTENANCE

The openings that allow fluid access to the conductivity electrodes should be cleaned occasionally. Use the small cleaning brush included in the 6570 Maintenance Kit to scrub the inside of each hole 15-20 times. The temperature portion of the probe requires no maintenance.

4.3 PH PROBE MAINTENANCE

Cleaning of the pH probe is required whenever deposits or contaminants appear on the glass surface of the probe, or when the response of the probe becomes slow. Use a clean moistened cotton swab to remove all foreign material from the glass bulb. Carefully remove any material that may be blocking the reference electrode junction of the sensor.

4.4 DEPTH SENSOR MAINTENANCE

The depth sensor modules are factory installed options that are located between the bulkhead and the sonde tube. For the 600 XLM sonde, there is a circular protective cap with two small holes. The cap cannot be removed, but a syringe supplied in the maintenance kit can be used to clean the pressure port. For the 6600 sondes, the depth sensor is a through-hole on a module just above the sonde bulkhead that is also cleaned using the syringe. Fill the syringe with either tap or RO water, place the tip of the syringe into one of the holes and gently force water through the pressure port. Ensure that the water comes out of the other hole. Flush until the water comes out clean.

Slow or drifting responses during calibration or field measurements would indicate probe maintenance or replacement might be necessary. See the YSI instrument manual for more detailed troubleshooting and maintenance procedures. Post-deployment maintenance must be recorded on the calibration sheet and in the instrument log for each probe.

4.4.1 Training Outline

New technicians must successfully perform initial calibration, QC checks, file creation and download, and post-deployment checks under the direct supervision of an experienced analyst. New analysts will familiarize themselves with this SOP and the Sensor Operating Manuals before using the equipment.

4.4.2 References

USGS (United States Geologic Survey). Various dates. National field manual for the collection of water-quality data: U.S. Geological Survey techniques of water-resources investigations, Book 9, Chap. A1-A9. Available online at

http://pubs.water.usgs.gov/twri9A. U.S. Geological Survey. Accessed February 5, 2008, at http://water.usgs.gov/owq/FieldManual/index.html#Citation.

APPENDIX B-2

STANDARD OPERATING PROCEDURE

ADCP

STANDARD OPERATING PROCEDURE (SOP)

ACOUSTIC DOPPLER CURRENT PROFILER (ADCP) OPERATION AND DEPLOYMENT

Scope and Application

This document is was prepared by Gravity Consulting Inc. to describe the Standard Operating Procedure (SOP) for calibrating, preparing, deploying, and recovering fixed-point submerged (e.g., bottom-mounted) and vessel (surface-mounted) acoustic Doppler current profilers (ADCPs). ADCP current meters allow the direct measurement of water velocity that can be used to calculate fluxes of constituents of concern (i.e., suspended sediments) in aquatic environments.

The ADCP operates by transmitting bursts of sound (called pings) at fixed intervals and frequency into the water column. These "pings" are reflected from suspended particles in the water and the echoes produced from these reflections are received ("listened" to) by the ADCP. As the particles move with the water current, the echoes produce a Doppler shift or a change in the frequency between the transmitted sound and the sound reflected back to the ADCP. It is the Doppler shift, along with the timing of the returned echoes, from which the ADCP calculates water velocity, current direction, and the depth within the water column the velocity occurred. The ADCP also produces a longer-pulsed ping which is used to track the seafloor in the case of downward pointed vessel-mounted applications. This is used to determine the overall depth of the water column and to determine the relative speed and direction of the ADCP as it moves along a transect.

All of these data are calculated and recorded within the ADCP itself or transmitted via cable to a laptop computer. The data is stored in files and can be "played back" and post-processed, allowing the user to refine the data. The fixed-point (bottom) mounted and vessel (surface) mounted applications are somewhat different, and are subsequently treated separately below.

Vessel-mounted ADCP surveys are covered in this SOP. An ADCP will be mounted to the side of a survey vessel and transects will be driven near site transects.

This SOP should be followed for calibrating, preparing, deploying, and recovering ADCPs utilized in marine monitoring. It includes the approved methods for any of the following:

- Preparation for deployment with Teledyne RD Instrument's Plan ADCP software so that battery life and data storage issues are properly addressed.
- Calibration to remove one- and two-cycle magnetic deviations from the internal magnetic fluxgate compass after adding a new battery. The ADCP has no moving parts, but it contains internal sensors that are sensitive to electromagnetic fields.

Fixed-mounted vs. Vessel-mounted

For dredge monitoring activities, both fixed-mounted and vessel-mounted ADCP surveys will be conducted. The following section describes the differences between the two current profiling techniques in greater detail.

Fixed-Mounted

A fixed-mounted ADCP includes any application consisting of an ADCP unit that is designed to sample below the water surface for an extended period at a fixed location. Typical sensors consist of four send-and-receive Doppler transducers – three for measuring velocity (u, v, and w) with one redundant transducer for error checking, a temperature cell, a tilt sensor, a fluxgate compass, and an optional pressure transducer. These units are typically mounted in a weighted cage, tethered with a lanyard, and outfitted with a multi-mode recovery system – acoustic releases.

Normal recovery is accomplished with the aid of an acoustic release, which can be tripped with a hydrophone from the surface to release a buoyant float with a line attached.

Vessel Mounted

A vessel mounted ADCP is any application consisting of an ADCP that is attached to a moving platform (i.e., a boat). The package consists of four Doppler transducers (send and receive) – three for measuring velocity (u, v, and w) and one for error checking, a temperature cell, a tilt sensor, and a fluxgate compass. The ADCP should have bottom-tracking engaged. The ADCP is secured to a mounting pole with two hose clamps and a back-up lanyard. In addition, the laptop collecting results from the ADCP via a powered cable can also receive GGA-mode (or GSA-mode) data sentences from a differential GPS.

Equipment and Personnel

This type of field servicing typically requires two technicians to safely perform the survey, in addition to the boat operator.

Training in the use of ADCP equipment and software as well as experience with water sampling are required. Personnel must have adequate experience using ADCP. Training in safety procedures for working on floating structures and near/over open water and on boats as well as experience working with hazardous chemicals (anti-foul paint on ADCP transducer heads).

For fixed-mount deployments, the following equipment is necessary:

- De-Gaussed ADCP battery pack
- Calibration equipment (lap top, cables, lazy Susan, and tilting block)
- Dedicated laptop, unless starting data acquisition beforehand after calibration

- Mounts, shackles, tackle, and recovery system
- Field Logs (see FSP Appendix A)
- Recovery line and tackle (station dependent)

For vessel-mount deployments:

- Dedicated laptop computer equipped with ADCP software
- Interface for DGPS from ship (if desired)
- ADCP communication cables, power cord
- Field Logs (see FSP Appendix A)

Calibration Procedures

The following section describes the calibration procedure for an ADCP. Typically, the ADCP should only need to be calibrated when battery packs are being exchanged. Calibration commands should be conducted using specific manufacturer software and commands.

The ADCP with the new battery must be calibrated away from stray magnetic fields (AX command). Required equipment includes a laptop with the software, the cables, and a non-magnetic lazy Susan. The ADCP must be set to Pacific Standard Time (PST).

The lazy Susan operator must:

- Brush the heads in order 1-2-3-4.
- Rotate flat, 360 degrees on primary axis.
- Rotate pitch/roll – lift by 10–20 degrees up on side 3 with a non-magnetic tilting.
- Block, rotate 360 degrees on primary axis.
- Rotate roll/pitch – lift by 10-20 degrees up on adjacent side, 360 degrees on primary axis.
- Final rotation – not as critical. Rotate somewhere between (and not as much), 360 degrees on primary axis.
- Erase the old data, use ErAsE.

ADCP Preparation, Deployment, and Recovery

The proposed deployment location must be free of marine cables, and if man-made electrical fields are present, the operator should consider collecting the data in beam coordinates rather than relying on the internal fluxgate magnetometer to rotate the results into east-west (u), north-south (v), and up-down (w) components.

Typically, data is collected at six-minute intervals, averaging 90 one-second pings, and then the ADCP should be shut down for 4.5 minutes to save on battery life. The duration, vertical resolution (bin size), and battery life can all be estimated using the PlanADCP software.

Prepare the ADCP as follows:

- Add a fresh battery pack. To change the batteries, open the back of the ACDP (away from the heads). Don't remove the back until you have identified beam 3 on the casing, and the position of the heads, so that you can put it back together the same way! Remove the bolts on the battery end of the unit; remove the old battery and desiccant pack. Take note of the position of the rubber band and the way it secures the desiccant away from the circuit boards. The seals on either side are the same; however, every time an end cap is opened, there is potential for negative pressure inside the ADCP which can cause a vacuum effect. This vacuum effect can pull moisture into the ADCP.
- Be sure to add new desiccant.
- Flip beam 3 so that it is to your right when you remove the back; mount the battery so that the white ponytail (and often the degauss sticker) is to your left. Feed the white ponytail through the rubber band on the battery pack so that it is tightened (and feeds through from the left).
- Add the backing plate, washers, and then wing nuts (to hand tight). Attach the desiccant with a rubber band wound around the wing nuts so that it does not get loose and touch the circuit board.
- Re-grease the o-ring with Dow Corning 111 valve lubricant and sealant (or equivalent) silicone grease. Be sparing and remove all particles of sand or dirt.
- Add the outside bolts so the nuts face the inside, and the bolt heads project toward the end(s). Put one washer under the head of each bolt and two under the nut.

Retrieval of Instrument

The preferred method to retrieve the ADCP gear is to trip the acoustic release by ensonifying the water column using the deck box. A hydrophone is included in the kit, and this must be plugged into the deck box by a knowledgeable operator. The hydrophone should be lowered into the water typically as deep as possible to get below the pycnocline, if present. Sound can easily be diffracted by density differences in the water column. In an extreme case (heavily stratified), one can be right over the release and not be able to get sound to it. Be aware that each release has a specific frequency (e.g., 10 kHz) and a release code (e.g., 'A') that have to be selected by the operator in order for the release to work. Try the procedure several times and keep watch for the float (it may come up under the boat, so don't have the propeller in gear).

If the acoustic release does not work, the grapple hook should be tried if weather conditions permit.

In the event this is unsuccessful, the next trip should be timed shortly after the time-release is set to go off. With luck the buoy will be waiting for you at the surface. If not, the grapple hook and possibly SCUBA or even submarine (ROV) assistance may be required.

Data Recovery and Processing

Data can either be download via the WinSC software with the powered data cable attached to the ADCP (memory is non-volatile, so this works with a dead ADCP battery) or by removing the ADCP transducer-side head (everything stated previously about re-packing o-rings applies here) and extracting the PCMIA data cards. These can be inserted in most laptops for a quick download. Serial downloads via the data cable may take an hour but has the advantage of not having to remove the beam heads.

Raw data from the instrument should be processed through the manufacturer's proprietary software (i.e., WinADCP, WinRIVER, etc.), which will extract internally logged data and convert to useful metrics such as current speed, direction, depth, etc. Processed data files should be saved as ASCII files for each specific location. File naming convention should include data type, monitoring location, and date of data recovery. The data file name should match the following template:

"LOCATION ID_INSTRUMENT_RECOVERYDATE (DDMMYYY).xlsx"

For example, data from a bottom-mounted ADCP at station "B04" on July 4, 2014 should be saved as "B04_ADCP_04072014.xlsx". If possible, data will be uploaded daily via the internet to survey manager on shore. Data will be backed up on a removable thumb-drive and transferred with crew shifts.

All gear should be hosed down with fresh water, decontaminated, and dried prior to storage. Biofouling may need to be scrubbed or even scraped off, but care should be taken with the ADCP, especially the beam heads.

For each site where fixed-mount ADCPs are installed, the standardized field log sheets provided in Appendix A should be used to record station information such as field conditions, location, serial numbers of equipment, and other relevant information that is considered necessary. For vessel-mounted applications, likewise use the field log sheets provided in Appendix A. Upon returning, gear must be cleaned and dried for long-term storage. Log sheets should be scanned and entered electronically into an ADCP database.

Data QA/QC

The fourth transducer head on the ADCP provides a built-in error estimate of the errors in measuring the three dimensions of water velocity: u, v, and w. Because the geometry of the transducer heads is fixed (e.g., 20 degree rotation out of the horizontal plane) the uncertainty

estimates of the upwelling/downwelling term (w), will be larger than for the horizontal components (u [east-west] and v [north-south]). Depending on the study design, multiple passes along a survey may be advisable for vessel-mounted applications. It is often better to make several passes along a single transect than a single pass along multiple transects.

Each log sheet that is entered into the database by one of the field staff is rechecked for errors by other staff after entry. Date and the technician who entered the data is written on the log sheet for reference after entry. Log sheets should be stored together in a project file.

Additionally, processed data should be reviewed to validate the instrument is reporting correct date and times, and values seem reasonable given the observed weather conditions and environment of deployment. Observance of unrealistic values (i.e., a velocity magnitude of -999) could indicate an electrical issue within the instrument or poor connection with data cable. Instrument should be inspected for any signs of wear or damage for each deployment and recovery.

Reporting

During ADCP survey activities, a brief daily summary report should be completed at the end of each day and submitted electronically to the onshore survey manager. Progress reports should include information on survey activities, locations of deployed/recovered ADCPs, locations of vessel mounted ADCP survey transects, and any issues encountered with survey progress or instrumentation.

Field log sheets should also be scanned and sent as PDF documents and/or entered electronically and submitted to onshore survey manager.

If possible, a brief overview of the data logged should also be included in progress reports. Information such as average velocity direction, magnitude, and any other notable observations should also be included.

References

Nortek ADCP Users Manual

APPENDIX B-3

STANDARD OPERATING PROCEDURE

SURFACE WATER SAMPLING

(Integral 2004b)

Note: Appendix C, Surface Water Sampling SOP, excerpted herein is from EPA-approved Round 2 Field Sampling Plan (August 2004); to the best of AECOM/Geosyntec knowledge, Integral did not release updated appendices following EPA approval. Therefore, SOP contains draft language (i.e., "Do Not Quote or Cite") that was retained in the source document.

APPENDIX C

SURFACE WATER SAMPLING SOP

DO NOT QUOTE OR CITE
This document is currently under review by US EPA and its federal, state, and tribal partners,
and is subject to change in whole or part.

SURFACE WATER SAMPLING AND PROCESSING

The purpose of this standard operating procedure (SOP) is to define and standardize the methods for collecting surface water samples from freshwater or marine environments using a peristaltic pump and Teflon™ tubing. For this SOP, surface water is defined as water collected from 0.3 meter (1 foot) below the water surface and within 1 meter (3 feet) above the bottom. The actual definition of surface water is typically program-specific and is dependent on the purpose of the study and the regulatory criteria (if any) to which the data will be compared.

This SOP utilizes and augments the procedures outlined in the San Francisco Estuary Institute's *Field Sampling Manual for the Regional Monitoring Program for Trace Substances* (David et al. 2001), the *Interagency Field Manual for the Collection of Water-Quality Data* (USGS 2000), and U.S. Environmental Protection Agency (EPA) Method 1669, *Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels* (EPA 1996). A goal of this SOP is to ensure that the highest quality, most representative data be collected, and that these data are comparable to data collected by different programs that follow EPA guidelines.

While sampling for trace metals, trace clean sampling techniques will be used for the collection of unfiltered organic compounds and conventionals, such as total suspended solids, dissolved organic carbon and dissolved suspended solids. By following this SOP, the collection of other samples besides trace metals guarantees a high level of sample integrity and minimizes contamination during sample handling.

SUMMARY OF METHOD

Surface water samples for standard chemical and conventional analyses will be collected using a peristaltic pump with an extended sampling tube lowered to the desired depth. These samples do not require the ultra-low detection units of other hydrophobic analytes.

Samples are collected using the two-person "clean hands – dirty hands" method (EPA 1996). The peristaltic pump's water intake is placed 15 feet away from the bow of the boat with a long pole. The outflow of the pump is directed through a Y-splitter into two composite mixing containers for sampling. Equal volumes will be pumped into two large, pre-cleaned 10-liter or 20-liter mixing containers equipped with magnetic stirring devises (Figure C-1). The first container, made of polycarbonate, will be used for compositing and mixing samples for subsequent analysis of trace metals, TBT, and conventionals. The second stainless-steel or glass container will be used for compositing and mixing samples for subsequent analysis of organic compounds.

Following sample compositing in the mixing containers, appropriate sample bottles will be filled using a second peristaltic pump, with the outflow directed into the bottle. The sample jar is held near the pump outlet, and the sample container is rinsed several times and then filled. The sample containers are capped, labeled, and placed in clean, double Ziploc™ bags, and then placed inside a cooler.

Two types of surface water samples will be collected: unfiltered and filtered. For filtered samples, the 0.45-µm filter is placed inline near the tubing outlet to filter samples immediately before the water is discharged into the sample bottle.

Surface water collected at cross-sectional stations using the flow-weighted method (see Appendix B) will be composited by collecting water using the same technique described above. Integrated samples of the water column are collected by lowering and raising the sample tubing intake while pumping water from near surface to near bottom and back for a predetermined period at a predetermined rate.

SUPPLIES AND EQUIPMENT

The general types of equipment that are required are described in this section. A detailed supply and equipment list is provided in Table 1-1. Additional equipment may be required depending on the project.

Two peristaltic pumps will be used for collecting surface water samples. The first pump will fill the mixing containers, and the second pump will collect unfiltered and filtered split samples from the mixing container. A workbox made of PVC pipes and plastic sheeting will be used to house two stir plates and a small peristaltic pump. A polycarbonate and a glass or stainless steel 20-liter mixing containers will be placed over the two stir plates. Each mixing container will be equipped with a 5-inch-long Teflon™ coated stir-bar at the bottom and a lid containing an inflow, outflow, and vent Teflon™ spouts. For each sampling station, a filtering kit (laboratory pre-cleaned 0.45-µm filter with C-Flex™ and Teflon™ tubing placed in a double Ziploc™ bag) will be assembled and attached to a peristaltic pump and mixing containers. A 10-µm pre-filter may be attached in-line to prolong the filtering capacity of the 0.45-µm filter. Four types of sampling tubing are required:

1. Shallow-water (near bottom sampling) intake tubing requires a 4-meter long Teflon™ tubing.

2. Deep-water (integrated water column sampling) intake tubing requires a 25-meter Teflon™ tubing.

3. Intake tubing kit for the mixing containers is composed of 30-cm C-Flex™ tubing, 1-meter Teflon™ tubing, and a 10-cm C-Flex™ tubing, placed sequentially.

4. Outlet tubing kit from the mixing containers is composed of 10-cm C-Flex™ tubing, 0.5-meter Teflon™ tubing, 30-cm C-Flex™ tubing and 30-cm Teflon™ tubing, placed sequentially.

Two filtering kits (0.45- and 10-µm) will be composed of 10-cm C-Flex™ tubing, the filter cartridge, and another 10-cm C-Flex™ tubing, placed sequentially.

A 10-µm air filter kit will be attached to the mixing container vent spout.

A portable 3000-Watt power generator will be used if on-board electricity is not available.

PROCEDURES

EQUIPMENT DECONTAMINATION

Each participating laboratory is responsible for preparing their equipment prior to the sampling cruise. Pre-designated commercial laboratories will do decontamination of sample tubing, mixing containers, and sampling jars according to their specific SOPs (see attachments in the forthcoming Round 2 QAPP). Additional field equipment will be cleaned and decontaminated by Integral Consulting, Inc. (Integral), Olympia WA as described below.

Surface Water Sampling Equipment Preparation

A sufficient amount of decontaminated sampling tubing and filtering kits will be brought to the field in order to avoid performing decontamination procedures between stations. The following steps will be taken to setup the peristaltic pump system.

A Plastic Processing Chamber

A 3- by 3- by 3-foot cube will be built with ¾ inch PVC tubing and covered with a 6-mil plastic sheet. One side of the box will be left open for placing sampling equipment and sample containers. The chamber will be placed over a pan, which will be connected to a drain that will carry excess pumped water outside the boat. All components will be washed with Alconox™, tap water rinsed, acid washed, and deionized water (DIW) rinsed.

Stands and clamps used to secure the receiving Teflon™ tubing and filter cartridge are made of non-metallic components or resin-coated stainless steel and will be soap washed, tap-water rinsed, acid washed, and DIW rinsed.

A Near Bottom Sampling Device

When near-bottom surface water samples are required to be sampled at a fixed depth from the bottom, a "near bottom sampling device" is used. Figure C-2 illustrates how the Teflon™ tubing inlet is attached to a vane, which will keep the water intake into

the flow and elevated at a constant height from the bottom. The device, made of PVC tubing and a polypropylene vane, is weighted by PVC-coated lead weights and attached to the boat by a nylon or Kevlar rope. All components will be washed with Alconox™, tap-water rinsed, acid washed and DIW rinsed.

Conventional Field Parameter Equipment Preparation

A YSI 5563 multiprobe will be used for measuring surface water parameters, such as temperature, pH, dissolved oxygen, conductivity, oxidation-reduction potential. The unit will come pre-calibrated from the laboratory and will be checked daily for proper functioning and drift. If necessary, the multiprobe can be calibrated in the field. The proper handling of the multiprobe is described in detail in Appendix E.

Except for the probe sensor, all components will be soap washed (Alconox™), and tap water rinsed. Since this equipment will not be used in surface water sample collection, there is no need for a thorough decontamination. The handling of this equipment will be done exclusively by the DH person.

SURFACE WATER SAMPLE COLLECTION

Clean Hands/Dirty Hands Techniques

CH/DH techniques require two or more people working together. At the field site, one person is designated as "clean hands" (CH) and a second person as "dirty hands" (DH). Although specific tasks are assigned at the start to CH or DH, some tasks overlap and can be handled by either as long as contamination is not introduced into the samples. Both CH and DH wear appropriate non-contaminating, disposable, powderless nitrile gloves during the entire sampling operation and change gloves frequently, usually with each change in task (wearing multiple layers of gloves allows rapid glove changes).

CH takes care of all operations that involve equipment that comes into contact with the sample, including the following responsibilities:

- Handles the surface-water sample bottle
- Handles the discharge end of the surface-water sample tube or line
- Prepares a clean workspace (inside boat)
- Sets up the processing and preservation chambers

- Sets the equipment (i.e.,, the sample bottles and the filtration and preservation equipment) inside the chambers
- Works exclusively inside the chambers during collection, processing, and preservation
- Changes the chamber covers as needed.

DH takes care of all operations that involve contact with potential sources of contamination, including the following responsibilities:

- Works exclusively exterior to the processing and preservation chambers
- Prepares and operates the sampling equipment, including the pumps and discrete samplers, peristaltic pump switch, pump controller, and manifold system
- Handles the generator or other power supply for samplers
- Handles the tools, such as hammers, wrenches, keys, locks, and sample-flow manifolds
- Handles the single or multiparameter instruments for field measurements
- Sets up and checks the field-measurement instruments
- Measures and records the water depths and field measurements.

Surface Water Sampling

Two persons are needed to conduct the sampling and a third person to keep track of sample logging and sample processing. In addition, the third person may be responsible for taking surface water parameters.

The following steps will be taken in order to set up the surface water collection system and processing of samples:

1. Assemble and secure a Flexframe™ support rod and base onto the starboard rail and leave in place for the day.
2. Determine the correct position of the sampling station, have the captain anchor the vessel at the sample site and switch off the engines.
3. Set up a clean area for the workbox (done by CH).
4. Set up a workbox made of PVC pipes and plastic sheeting in a secure table or bench top on board the sampling vessel to house two stir plates and a small peristaltic pump. Provide enough space inside the workbox for a stand to hold

the outlet tubing and filter and for collecting surface water and processing sample jars.

5. Place two stirring plates inside the workbox and two mixing containers on top of each plate. Each container (a polycarbonate for metals and conventionals, and glass or stainless steel for organics) will be checked to ensure:

    - Containers were properly wrapped by the labs and do not contain rips or holes that may have occurred during shipment to the field
    - Each container contains a 5-inch stir-bar at the bottom
    - All components, such as inflow and outflow tubing are intact and securely placed on the cap.

6. Attach the outlet tubing kits to the mixing containers (Figure C-1). The kits are composed of 10-cm C-Flex™ tubing, 0.5-meter Teflon™ tubing, 30-cm C-Flex™ tubing and 30-cm Teflon™ tubing, placed sequentially.

7. Place the small peristaltic pump inside the workbox but do not place tubing inside the pump head until all mixing containers have been filled.

8. Place a stand inside the working chamber and secure each tubing outlet from both mixing containers by clamps.

9. Attach a 4-meter (25-meters for deep water) Teflon™ tubing (collecting end) to 30-cm C-Flex™ tubing and a 1-meter Teflon™ tubing, sequentially, and then connect it to a mixing container (polycarbonate for metals and glass or stainless steel for organics). Clamp the C-Flex™ tubing section is firmly into place inside the large peristaltic pump head, which is placed outside the workbox.

10. Attach the intake part of the Teflon™ tubing to the end of a long aluminum pole. Take care not to remove a protective cap from the tip of the collecting tube until ready for submersion.

11. Secure the pump and pump speed controller just below the Flexframe™ assembly (by the DH) and connect them to the vessel's power source with an extension cord. If vessel power is not available, the pump can be operated under its own battery power supply.

12. Assemble an aluminum sampling pole with the sample tubing inlet secured to one end and with the tubing tip hanging loose approximately 2 feet off the pole end.

13. Remove the protective cap from the sampling tube and lower the pole gently below the water surface.

14. To sample water near-surface, submerge the sample tubing inlet approximately 0.3 to 1 meter (1-3 feet) below the surface of the water column.

15. To sample water near-bottom, submerge the sample tubing inlet approximately 0.3 to 1 meter (1-3 feet) above the bottom with the help of the near-bottom sampling device, which in turn is tethered to a nylon rope and looped through the vessel's davit. If sampling near-bottom surface waters at depths greater than 2 meters is required, a device such as illustrated in Figure C-2 will maintain the sample tubing inlet into the current and at a constant depth (1 meter) above the sediment-water interface and 15 feet away from the boat with the help of the aluminum pole.

16. Switch the pump on and pump surface water through the sample tubing and into the mixing containers (done by DH). Once the water reaches one-third the container's volume, turn on the stir plates.

17. Turn off the pump once the mixing containers have been filled to ½ inch below the inflow spout.

18. Place the outflow tubing kit from the first container to be sampled inside the small peristaltic pump head and clamp firmly.

19. Make final adjustments to the stand holding the outflow spout before the small pump is turned on (done by CH).

    Note: The DH person assists the primary CH sampler by controlling the flow controller for the peristaltic pump, holding on to or adjusting the sample pole, adjusting the outlet tubing or filter cartridge, and handing sample containers to the CH person.

20. For trace element samples, drain the ultrapure water from the pre-cleaned sample bottle onto the bottle cap and pour the remaining ultrapure water over the bottle threads several times (done by CH). Rinse the sample container with the sample water 5 times, then fill up to the "neck" with sample water. The CH/DH system is not critical for the ancillary samples, and these bottles may be rinsed just 3 times with sample water before collecting the sample.

21. Without touching the trace-metal clean bottles, the DH person opens the Ziploc™ bags so that the CH person may remove them from the bags. The CH person, wearing at least one pair of polyethylene gloves, does not touch anything with her/his hands except the inner Ziploc™ bag, the bottles, and the water.

22. Use the following sample collection sequence for total trace metals (unfiltered) sampling:

- Total suspended solids
- (TSS) Total bulk metals, total arsenic (As), selenium (Se)
- Total mercury (Hg).

23. After the above samples are collected, attach the filter cartridge to the sample tubing outlet and secure it to the stand with a clamp. Drain the storage solution inside the filter, and flush the entire sample tubing and filter assembly with sample water for 5 minutes. The sample collection sequence for dissolved trace metals (filtered) sampling is as follows:

    - Dissolved bulk metals
    - Dissolved As, Se
    - Dissolved Hg
    - Dissolved organic carbon
    - Total dissolved solids.

24. As soon as a sample container is filled up, the DH turns off the peristaltic pump, and the CH seals the container and writes the label. The sampling label should contain the date, time, project name or number, sample ID, type of analysis required, and sampler initials.

The 0.45-µm filtration cartridge and 10-µm prefilter cartridge are changed after each sampling site.

The appropriate number of sample replicates and splits are predetermined prior to starting the field sampling event and assigned to specific sampling stations.

After all sampling is done, surface water field parameters are measured by the DH using a hand-held YSI 5563 MPS multi probe sensor with a 20-meter cable. Detailed explanations on how to take measurements with the multi probe are described in Appendix E.

SAMPLE PROCESSING

Once a surface water sample container is properly closed, labeled, and then sealed inside a Ziploc™ bag by the CH person, the DH person seals the second Ziploc™ bag and places it inside a large plastic bag, which in turn is placed inside a cooler containing wet ice.

All samples will be stored in sealed coolers with wet ice on board the vessel and transferred to the field laboratory at the conclusion of the cruise. Integral personnel will then transfer the samples to the laboratory. The field leader is responsible for maintaining sample integrity throughout the cruise. Once at the field lab, sample contamination is avoided by handling the double-bagged sample containers with clean gloves, and transferring the samples into clean refrigerators immediately after samples are brought back from the field.

Storage Temperature Quality Control

Each storage freezer or refrigeration unit is monitored daily to ensure temperature compliance. Each unit will have a separate log form containing date, time, and temperature information.

CHAIN-OF-CUSTODY

Field

The cruise leader or other designated field sample custodian is responsible for all sample tracking and chain-of-custody procedures until sample custody is transferred to the laboratory. Custody procedures in the field are as follows:

1. Record all field and sample collection activities (including sample identification number, collection time and date) in the field logbook. While being used in the field, the logbook remains with the field team at all times. Upon completion of the sampling effort, the logbook should be reproduced and then kept in a secure area.
2. Complete a chain-of-custody form whenever samples are being transferred or removed from the custody of field sampling personnel. A sample form is provided in Appendix C (Integral 2004). Record each individual sample on the form. Include additional information to assist in sample tracking such as collection date and time, number of containers, and sample matrix. The chain-of-custody may also serve as the sample analysis request form, with the required analysis indicated for each individual sample.
3. Sign the form and ensure that the samples are not left unattended unless secured.
4. Store, pack, or ship samples as described in the following section. Place the original completed chain-of-custody form in a

sealed plastic bag inside the shipping container. A copy is retained by the shipping party.

5. Complete a separate custody form for each individual shipping container or a single form for all samples in multiple shipping containers in a single shipment, with the number of containers noted on the custody form.
6. Attach completed custody seals to any shipping container that will be sent to the laboratory by delivery service or courier. Delivery personnel are not required to sign the custody form if custody seals are used. Custody seals are used to detect unauthorized tampering with the samples. Gummed paper or tape should be used so that the seal must be broken when the container is opened. The laboratory sample custodian (or other sample recipient) will establish the integrity of the seals.
7. The laboratory custodian (or other sample recipient) acknowledges receipt of the samples by signing, dating, and noting the time of transfer on the chain-of-custody form. The condition of the samples and any problems or irregularities (e.g., cracked or broken jars, loose lids, evidence of tampering) should also be recorded. Return a copy of the completed custody form to the project manger or designated sample coordinator.

Laboratory

The laboratory will designate a sample custodian who is responsible for receiving samples and documenting their progress through the laboratory analytical process. Each custodian will ensure that the chain-of-custody and sample tracking forms are properly completed, signed, and initialed on transfer of the samples. Specific laboratory chain-of-custody procedures should be in writing, included in the laboratory QA plan, and approved prior to beginning sampling and analysis. Laboratory custody procedures should include the following:

- A designated laboratory person initiates and maintains a sample tracking log that will follow each sample through all stages of laboratory processing and analysis.
- The laboratory tracking log includes, at a minimum, the sample number, location and type of storage, date and time of each removal, and signature of the person removing or returning the sample.

The final disposition of the sample is recorded.

CHAIN-OF-CUSTODY QUALITY CONTROL PROCEDURES

Complete and correct chain-of-custody is essential to ensure and demonstrate sample integrity. Errors in entering information or transferring custody can result in analytical or data reporting errors. Inaccuracies or errors in sample tracking and custody records can compromise data usability, particularly as legal evidence.

Quality control procedures include the following:

- Allow adequate time to take accurate and complete field records and to carefully complete chain-of-custody forms.
- When possible, work in pairs or more to complete the chain-of-custody form and check for accurate information entry.
- Complete all custody records in ink; errors should be neatly crossed out and corrected and initialed by the person making the change.
- Immediately notify the project manager of any deviation from required custody procedures.

PACKING AND SHIPPING SAMPLES

Environmental samples are packed in a manner to reduce the chance of sample breakage, ensure sample integrity, and prevent material leakage and potential exposure to hazardous materials in the event of breakage. Samples are placed in sealed plastic bags and packed in a sturdy container with adequate packing material to prevent breakage. Ice or dry ice may be included to maintain sample storage conditions. Samples are transported by field personnel or shipped via courier or common carrier. Shipping procedures are in accordance with U.S. Department of Transportation regulations (49 CFR 173.6 and 49 CFR 173.24).

All preserved samples should be shipped as soon as possible after completion of sampling. This minimizes the number of people handling samples and protects sample quality and security.

Sample Packing

Upon completion of final sample inventory by the field sample custodian and completion of chain-of-custody, samples are packed as follows:

1. Line a cooler bottom with bubble wrap and place a large 30-gallon bag inside another bag of same size and place it inside the cooler. The cooler should have the drain sealed with duct tape.

2. Wearing disposable powderless nitrile gloves, wrap each doubly wrapped glass sample container in bubble wrap or place it in a bubble wrap plastic bag. [Note: When samples are being transported by field personnel directly from the field site to the laboratory (thereby ensuring careful handling), this step is recommended but may be omitted. However, this step is required when a courier or delivery service is transporting the samples.]
3. Place the samples tightly inside the double bag in the shipping container:
   - Use dividers or bubble wrap to separate all glass containers.
   - Seal large plastic bags with rubber bands or plastic tie.
   - Fill any empty space in the shipping cooler or box with packing material so that the jars are held securely.
4. Place the original completed chain-of-custody form in a sealed plastic bag and place it inside the shipping container. If using a cooler or ice chest, the form should be securely taped to the inside of lid.
5. If required to meet sample storage requirements, fill the ice chest with crushed or block ice, blue ice (refrigerated samples, 4°C) or dry ice (frozen samples). A temperature blank (provided by the laboratory) should be packed in each cooler.
6. Seal shipping container securely with packing or duct tape.
7. If the shipping container will be transported by anyone other than the person who completed and signed the chain-of-custody form, attach completed custody seals so that the shipping container cannot be opened without breaking the seal.
8. Attach a *This End Up* label to each side of the shipping container to ensure that jars are transported in an upright position. A *Fragile* label may also be attached to reduce rough handling of the samples.
9. Label the shipping container with all appropriate information (name of project, time and date, responsible person and company name, address and phone) to enable positive identification.

Sample Shipping

Packed containers may be delivered to the laboratory or storage facility by field personnel, courier, or common carrier (FedEx, UPS). However, any outside carrier or courier service must provide a delivery receipt. The carrier or courier must also ensure delivery time if holding time and storage conditions are critical. Unless

arranged in advance, shipping charges should be prepaid by sender to avoid confusion and possible rejection of the package by the laboratory.

The adequacy of handling and shipping procedures is reflected in the condition of the samples upon receipt by the laboratory:

- No jars are cracked or broken.
- There is no evidence of sample leakage.
- Measuring the temperature of the temperature black indicates that correct storage conditions have been maintained.

The sample custodian or other designated person is responsible for confirming that copies of all shipping documents, completed in full and correctly, are on file at Integral.

QUALITY CONTROL PROCEDURES

Field quality control (QC) samples that may be collected during sediment coring are the same as for any field sampling program. The types and frequency of field QC sample collection are project-specific. The most commonly collected field QC sample are described below (USGS 2000):

- **Field Blank**. A field blank is a sample of analyte-free water that is supplied by the laboratory. The field blank is generated by transferring the analyte-free water to another laboratory-supplied sample container while at the field sampling location. Field blank results are used to measure and document any possible onsite contamination.

- **Field Split Sample**. A field split sample consists of aliquots of the same composited surface water sample that are equally distributed in two sets of sample containers. These samples may be analyzed identically or analyzed by different laboratories to evaluate repeatability of sample handling and analytical procedures, sample heterogeneity, and analytical procedures.

- **Field Replicate**. A field replicate consists of a second sample that is collected using the same sampling methodology used to obtain the first sample. It is collected at the same sampling location and as soon after the original sample as possible. Analysis of the field replicate allows evaluation of the repeatability of field sampling methodologies, as well as the heterogeneity of the sample matrix. Statistical analysis of multiple replicates may also be used to calculate the likely range of an analyte concentration at a given sampling location.

REFERENCES

David, N., D. Bell, and J. Gold. 2001. Field Sampling Manual for the Regional Monitoring Program for Trace Substances. San Francisco Estuarine Institute, San Francisco, CA. (February 2001).

EPA. 1996. Method 1669. Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels. U.S. Environmental Protection Agency, Office of Water Engineering and Analysis Division (4303). Washington, DC. (July 1996).

USGS. 2000. Interagency Field Manual for the Collection of Water-Quality Data. Compiled by D.L. Lurry and C.M. Kolbe. U.S. Geological Survey, in cooperation with the U.S. Environmental Protection Agency. Open-File Report 00–213. Austin, TX.

Table 1-1. Equipment List for Surface Water Sampling Using a Persitaltic Pump System

Quantity	*Description*
1	Masterflex™ peristaltic pump
2	Pump speed controller boxes
2	Pump heads
2	Spare pump head screws
2	Spare pump fuses (3 amp)
2	Electrical power extension cords, 25 foot
	Flexframe™ fittings and clamps (2 small to hold tubing and 2 large for filter cartridges)
1	1/2-inch aluminum support rod and plastic-covered base
1 each	Plastic, duct, and electrical tape
1	Hand tool box: screwdriver, pliers, crescent wrench
3	Stainless steel adjustable (screw-tighten) hose clamps (to hold sample poles together)
20	4-meter (3/16 ID), 890 Teflon™ resin FEP intake tubing for shallow water intake tubing
3	25-meter (3/16 ID), 890 Teflon™ resin FEP intake tubing for deep water
23	Kit: 30-cm C-Flex™ tubing, 1-meter (3/16 ID), 890 Teflon™ resin FEP tubing, and a 10-cm C-Flex™ tubing
23	10-cm (1/4 ID), C-Flex™ tubing (Masterflex), 0.5-meter (3/16 ID), 890 Teflon™ resin FEP tubing, 30-cm (1/4 ID), C-Flex™ tubing (Masterflex) and 30-cm Teflon™
3	20-liter polycarbonate carboy
3	20-liter glass carboy
20	10-liter polycarbonate carboy
20	10-liter glass carboy
2	Stir-plates
46	5-inch Teflon™ coated stir-bars
1	Ziploc™ tool
as needed	Straps, bungee cords, nylon rope, cable ties
	Additional Field Gear
1	15- to 20-foot sampling pole (2 pieces; 1 hollow, 1 with a telescopic insert)
1	Plastic work box (PVC tubing covered with 6-mil clear polypropelene sheet)
1	YSI 556 MPS (Multi-Probe System)
1 each	Standard solutions for pH, conductivity, and oxidation reduction potential
1	Hand-held certified field thermometer (no mercury)

Table 1-1. Equipment List for Surface Water Sampling Using a Persitaltic Pump System

Quantity	*Description*
5	10-L container with ultrapure laboratory grade deionized water
5	500-mL plastic beaker
2	1000-mL plastic container for storage of calibration fluids waste
2	Sampling buckets
2	Plastic Chairs
30	10-µm pre-filter (Whatman Polycap 36HD)
30	0.45-µm filter cartridges (Whatman Polycap 36TC)
2	Coolers containing: 20 pounds wet ice/sampling day
1	Field log book
1	Field sampling plan
1	Health and safety plan with forms
	Tape: (2) plastic, (6) labeling
	Pens: (6) ballpoint, (6) Sharpies
1	Box of single edge razor blades
1	Box of trash bags (13 gal)
1	Box of trash bags (30 gal)
1 each	Ziploc™ bags (box each size; quart, gallon)
	Nylon gloves (4 pair, large; 2 pair, medium)
	Nitrile powderless gloves (3 boxes, large; 2 boxes, medium)
3 each	boxes of Kimwipes™ large and small
	Sun-protection lotion
	Spare batteries
	Bucket opener
	Foul weather gear

APPENDIX B-4

STANDARD OPERATING PROCEDURE

HIGH VOLUME SURFACE WATER SAMPLING WITH PR2900

STANDARD OPERATING PROCEDURE (SOP)

HIGH-VOLUME SURFACE WATER SAMPLING FOR ANALYSIS OF ORGANIC COMPOUNDS WITH LOW DETECTION LIMITS

Scope and Application

This Standard Operating Procedure (SOP) prepared by Gravity Marine Services (Gravity) describes the protocol for collecting high-volume (HV) water samples using a Gravity PR2900 pump system (Figure 1) coupled with XAD-2 cartridges, 0.5-micron (µm) glass flat fiber filter (GFF filter), and a vortex separator. This SOP is specific to HV techniques for the pre-design investigation (PDI) studies and is included as an attachment to the Surface Water Field Sampling Plan (FSP).

Large volumes of surface water are pumped through a filter system to quantify surface water concentrations of targeted organic chemicals at low-level concentrations. This method also allows for separate quantification of hydrophobic organic chemicals (HOCs) in the suspended particle and dissolved phases of the water column. HV surface water sampling techniques make it possible to obtain enough mass of HOC from the water column to allow quantitation of these compounds. In summary, a large volume of water (i.e., as much as 1,000 L) is pumped with a PR2900 (which has an internal flow-metered peristaltic pump) and is passed through a vortex separator and a glass flat fiber filter (0.5-µm pore size) and then through a cartridge containing XAD-2 resin that binds the dissolved forms of the compound in question. The compounds that bind to the adsorbent XAD-2 material are later extracted in the laboratory and measured on a gas chromatograph/mass spectrometer.

Figure 1: PR-2900

SOP Guidance

This SOP utilizes and augments the procedures outlined in the San Francisco Estuary Institute's Field Sampling Manual for the Regional Monitoring Program for Trace Substances (David et al. 2001), the Interagency Field Manual for the Collection of Water-Quality Data (United States Geological Survey [USGS] various dates), and United States Environmental Protection Agency (EPA) Method 1669, Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels (EPA 1996). A goal of this SOP is to ensure that the highest quality, most representative data are collected, and that these data are comparable to data collected by different programs that follow EPA guidelines.

This SOP details: 1) set-up of the sampling equipment, 2) sample handing, 3) collection methods for HOC surface water samples, and 4) measurement of water quality parameters *in situ*. An important component of sample handling for low-level organics and trace metals are clean hands, dirty hands sampling techniques per EPA 1996, as described in SOP for Surface Water Sampling [Integral Consulting (Integral) 2004a]) for handling of HV sampling equipment, filters, and samples. Using these techniques maximizes sample integrity and minimizes the potential for contamination during sample handling.

Summary of HV Method

Surface water samples to be analyzed for ultra-low concentrations of organic compounds will be collected using a high-volume PR2900 peristaltic pump with an extended Teflon™-lined polyethylene sampling tube lowered to the desired depths (see the Field Sampling Plan [FSP]). A 2-foot length of flexible tubing is spliced into the line to allow the pump head to move water through the sampling apparatus. Water pumped at a rate of up to 1.5 liters per minute (L/min) will be drawn through the Teflon™-lined tubing, passing sequentially through a vortex separator, a 0.5-µm GFF filter (142 millimeter [mm] diameter) and then through an XAD-2 cartridge. A work-flow diagram for the PR-2900 is shown in Figure 2.

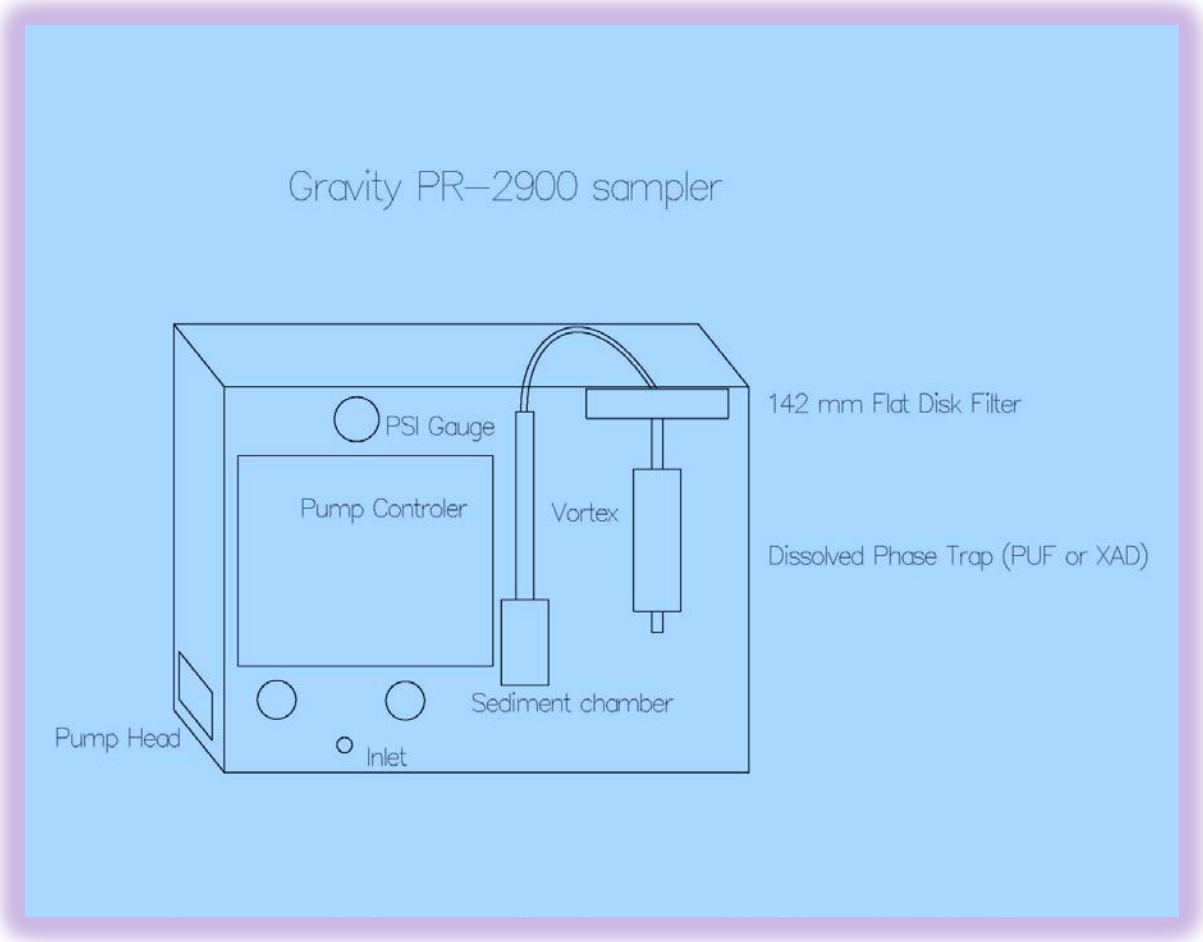


Figure 2: PR2900 Work-flow Diagram

At each station, the two lengths of Teflon™-lined tubing will be attached to a weight and the water quality meters (a YSI multiparameter sonde) with zip ties. Data from the YSI sonde will be monitored in real time on the vessel and data will be logged electronically. The tubing will be attached to the YSI sonde hanging approximately 6 inches lower than the sonde housing. While the boat is kept facing the current, the water sampler unit will be lowered to the appropriate depth with the help of a hydraulic or electric winch. Using a peristaltic pump, water will be directed into a high vortex separator. The high vortex separator will be able to separate suspended sediments by forcing the water in a centrifugal fashion before exiting towards the 0.5-µm GFF filter and then the XAD-2 cartridge (Figure 3). The XAD-2 cartridges contain solid phase extraction material (i.e., XAD-2 resin) that binds dissolved forms of the compounds in question (e.g., HOCs). A constant rate of water, up to 1.5 L/min, will be pumped through this system. The 1.5 L/min flow rate is optimum since the speed of the vortex separator is positively linked to the flow rate, and flow rates must be appropriately low to allow sorption of HOCs in the XAD-2 medium.

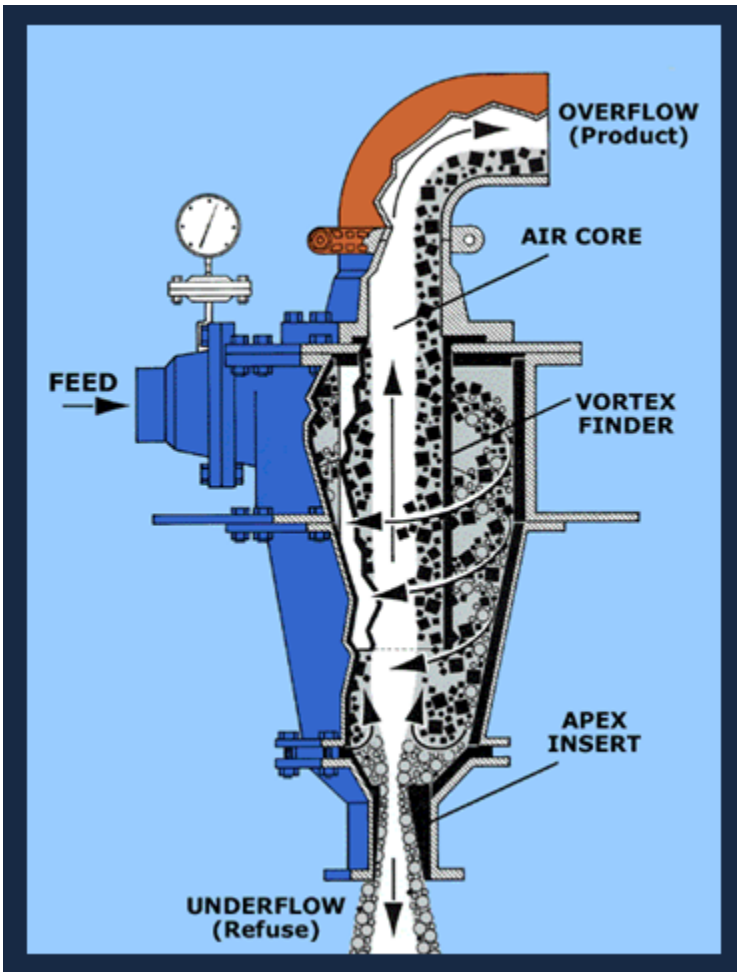


Figure 3: Vortex Separator

The design of the PR2900 includes an integrated flow meter to monitoring pumping rates. The flow meter will be calibrated in the field prior to collection of samples by pumping a known volume of water through the system into a graduated cylinder and then entering that volume into the control panel of the PR2900 as prompted by the system. The system then associates that volume with the numbers of revolutions of the pump it took to yield that volume. Every 15 minutes, the flow rate of water pumped will be confirmed manually to ensure that water is flowing at a constant desired rate. To check that the pump is accurately delivering water at the desired rate, the pump outflow must be checked with a 1L graduated plastic cylinder and a timer. The pump outflow will be checked from the discharge tubing. The tubing will not be disconnected before the vortex unit during testing of flow rates. If the pump is not delivering the correct flow rate, fine adjustment in the flow rate will be made until the desired flow rate is achieved.

After the desired volume has passed through the XAD-2 cartridge (see FSP), the HV peristaltic pump will be turned off and the XAD-2 cartridge and 0.5-µm GFF filter will be removed. Two stainless steel nuts that cap each end of the XAD-2 will be reattached. The cartridges will be labeled, taped, placed in resealable bags, and placed in a cooler with wet ice. As intermittent filter

changes may be required, more than one 0.5-µm GFF filter may be used. As total system pressure approaches 15 pounds per square inch (psi), the system should be shut down and the 0.5-µm GFF filter should be changed. Each 0.5-µm GFF filter that is used during the sampling will be added to the labeled 8-ounce (oz) jar. The volume from the vortex separator containing the suspended particles sample will be added to the labeled 8-oz jar together with the 0.5-µm GFF filter(s) before being placed in a cooler with ice. The solids in the vortex sampler will be removed by shutting the main line valve (located post vortex and pre-GFF filter) to the off position and opening the vortex outlet valve while running the pump for 10 seconds to purge captured solids into the sample jar.

Procedures for Collection of HV Samples

The sampling team should be comprised of three people. Two people are needed to conduct the sampling and a third person is required to keep track of sample logging and sample processing. In addition, the third person may be responsible for measuring the *in situ* surface water quality parameters.

To avoid potential cross-contamination, new tubing is used at each station and covered when moving between sub-stations on a transect to avoid contamination onboard the vessel. The PR2900 uses a peristaltic pump to avoid contact of the sample with pump components. The body of the filtration system is decontaminated between stations to avoid cross-contamination. Lastly, the intake tubing is placed below the sampling equipment by 6 inches and the additional distance between the tubing and the weight will prevent potential contamination from equipment.

Equipment Preparation

A sufficient amount of decontaminated sampling equipment will be brought to the field to minimize the amount of decontamination procedures that need to be performed between stations. Axys will be responsible for preparing equipment prior to the sampling event. This includes dedicated Teflon™-lined polyethylene and tubing, GFF filters, and XAD-2 cartridges. All precleaning will be done in the laboratory and the clean equipment transferred to Gravity or Geosyntec Consultants, Inc. (Geosyntec)/AECOM Technical Services (AECOM) under chain-of-custody. All GFF filters will be cleaned, pre-weighed, numbered at the laboratory, and individually packaged before being shipped to the site under chain-of-custody. The list of necessary equipment is provided as Attachment 1 to this SOP.

The following steps are taken to set up the surface water collection system in the field:

1. Assemble and secure the water inlet and tube to the YSI sonde line using cable ties. The end of the water inlet tube should be covered with aluminum foil or other protective cap until just prior to deployment.
2. Determine the correct position of the sampling station and have the captain anchor the vessel into the current at the sample site and switch off the engines. If anchoring is not possible and the engine must be on, care should be taken that the water intake tubing is always upstream of the engines.

3. Set up the sampling equipment on clean plastic sheeting, leaving an area sufficient for staging sampling bottles and other equipment necessary during sample collection.
4. Attach Teflon™-lined tubing (outflow end) to 30-centimeter tubing and a 1-meter Teflon™-lined tubing, sequentially, and then connect the end these interconnected pieces of tubing firmly into place inside the large peristaltic pump head. The outlet tubing should be directed outside of the boat gunnel. (The length of the Teflon™-lined tubing will vary depending on project-specific requirements and water depth at a given station.) Use tie wraps to hold tubing connections together if pressure causes tubing to leak, entrain air, or connections fail.
5. Insert a new pre-cleaned 0.5-µm GFF filter to the filter housing. Record the filter identification number (ID) (provided by the laboratory) on the log sheets. Each filter will be pre-cleaned and packaged separately, minimizing exposure of unused filters to ambient conditions.
6. Insert a new pre-cleaned XAD-2 cartridge as the primary sorbent of dissolved HOC. Record cartridge ID (provided by the laboratory) on the log sheets.
7. Attach the intake part of the Teflon™-lined tubing and YSI multi-parameter sonde from Step 1 to the weight. Sufficient weight should be added to allow near vertical deployment of the sampling tubing and sonde. The weight will be located approximately 3 feet below the instrument array. The intake tubing will extend 6 inches below the instrument array.
8. Secure the pump and pump speed controller and connect them to the vessel's GFCI-protected power source with an extension cord. If vessel power is not available, the pump can be operated by battery or a generator. If a generator is used, it must be run downwind from the sampling activities and should not be run while the XAD-2 cartridges are being transferred to or from the sampler, or while GFF filters are exposed or material is being transferred from the vortex separator.

Sample Collection

The following steps are taken to collect and process an HV surface water sample:

1. Remove the protective cap from the sampling tube and lower the sampler gently below the water surface.
2. Submerge the sample tubing inlet to the required sample depth using the shipboard fathometer to determine overall depth at the sampling location.
3. Switch the pump on and purge at least three volumes of river water through the tubing to ensure a representative sample is collected. Total volume pumped is logged by the PR2900. During purge, calibrate pump flow rate to 1.5 L/min (or other pre-determined flow rate based on desired sample volume) using a 1-L graduated cylinder and a stop watch. Record reading and adjustments in field log book.
4. Once purging is complete and flow rates are set, pump surface water through the sample tubing into the solids-separation devices and through the XAD-2 cartridges at target rate.

5. Every 15 minutes, record pump rate to ensure that the target rate of 1.5 L/min is maintained. If the pump rate falls +/- 5% outside this range (i.e., outside of the range of 1.425 L/min to 1.575 L/min), adjust the speed of the pump.
6. GFF filters may need to be replaced mid-sample. If system pressure reaches 15 psi prior to completion of sampling desired volume of water, shut down the system. The 0.5-µm GFF filter will be replaced. Release pressure by closing the valve above the GFF filter array and purging any water from the vortex separator into the 8-oz glass sample jar. Open the filter housing for the 0.5-µm GFF filter. Cover the filter paper with a new clean laboratory-weighed and numbered filter to sandwich the solids and absorb any perched water. Record the ID of the new filter paper. Fold the sandwiched filters in half, then in half again. Remove the GFF filters with stainless steel forceps by grasping the folded filters from the outside edge, taking care to ensure that all material retained on the filter is added to the jar. Place the GFF filters in the 8-oz glass sample jar and replace with a clean filter (record the filter ID on the log sheets). Reassemble the filter housing. Filter changes will be conducted as efficiently as possible, minimizing ambient exposure. Open the valve and resume pumping.
7. Use turbidity sensor to monitor ambient water quality while pumping.
8. Once the desired volume has been pumped through the system at each target location/depth, shut the pump system off, move to the next target location/depth, and repeat from Step 2.
9. Once the desired volume of surface water at each transect has been pumped through the XAD-2 cartridge, pump system dry and turn off the pump system.
10. Remove the XAD-2 cartridge, cap each end with stainless steel nuts and label the cartridges. Wrap XAD-2 cartridge in bubble wrap to cushion sharp edges and place in a labeled 1-gallon Ziploc® bag.
11. Remove the 0.5-µm GFF filter (using the same technique as above) and place in the 8-oz jar.
12. Add the volume from the vortex separator into the 8-oz jar that contains all the 0.5-µm GFF filters used during the sampling by shutting the main line valve to the off position and opening the vortex outlet valve while running the pump for 10 seconds to purge the vortex separator. If needed, rinse the inside of the vortex separator with a squirt bottle filled with deionized water.
13. Ensure that a sample label is attached to the 8-oz jar, the XAD-2 cartridges, and the Ziploc® bag containing the XAD-2 cartridges. The label must contain the date, time, project name or number, sample ID, type of analysis required, and sampler initials per the PDI Quality Assurance Project Plan (QAPP).
14. Once the Ziploc® bags containing the XAD-2 cartridges and the 8-oz solids jar are properly sealed and labeled, place them inside a cooler containing wet ice and store at approximately 4 degrees Celsius (°C). All samples are to be stored in coolers with ice onboard the vessel and transferred to the field facility no later than at the conclusion of the sampling day.

15. Quality assurance/control samples can be collected using the sampling techniques listed above. Field duplicates (as co-located samples) using the PR2900, if collected, should be collected in tandem with the site sample by using a second pump system on the vessel. The second pump system is a parallel system where the tubing intakes for the two systems are connected, thereby drawing water from the same location in the water column. It is critical that field duplicates be started and stopped at the same time as the site sample that is targeted for duplication. If filters are changed during sampling, both units should have exact same number and timing (L pumped per filter) of filter changes. Equipment blanks should follow the same sample process as a field sample with the following exceptions:
    - HOC-free deionized water from the laboratory should be used in place of river water; and
    - Sample volume should be adjusted to 100 L.

Sample Handling – Clean and Dirty Hand Techniques

Standard "clean and dirty hand" techniques will be observed on this project per Surface Water Sampling SOP (Integral 2004a) and EPA (1996). Clean hands are required for tubing assembly, filter installation and removal, handling the XAD-2 cartridges, sample collection, and sample handling, as described above. Field staff will wear appropriate non-contaminating, disposable, powderless nitrile gloves during the entire sampling operation. Gloves will be changed frequently, usually with each change in task (wearing multiple layers of gloves allows rapid glove changes).

Clean hands are required for all operations that involve equipment that comes into contact with the sample, including the following activities:

- Handling the XAD-2 cartridge(s), 0.5-µm GFF filter, and vortex separator vial;
- Handling the intake end of the sample tube or line;
- Setting up working space inside the processing chambers;
- Setting up the equipment (i.e., HV sampler and XAD-2 cartridges) inside the chambers;
- Handling the vortex separator; and
- Changing the chamber covers as needed.

Dirty hands take care of all operations that involve contact with potential sources of contamination, including the following activities:

- Working exclusively exterior to the processing and preservation chambers;
- Preparing a clean workspace (inside boat);
- Decontamination of equipment;
- Preparing and operating the sampling equipment, including the pumps and discrete samplers;
- Handling the generator or other power supply for samplers;
- Handling the tools, such as hammers, wrenches, keys, locks, and sample-flow manifolds;

- Setting up, handling, and checking the single or multi-parameter instruments for field measurements; and
- Measuring water depths and field measurements and recording field data.

All samples will be stored in coolers with ice at approximately 4°C onboard the vessel and transferred under chain-of-custody to cold storage at the field facility at the conclusion of the sampling day. Samples will be shipped under chain-of-custody and on ice to the analytical labs. The sampling team leader will be responsible for maintaining sample integrity throughout the sampling event.

Sample contamination will be avoided by handling the sample containers with clean gloves and transferring the samples into clean refrigerators (or clean coolers) immediately after samples have been brought back from the field. Sample bottles will always be handled by personnel wearing disposable, powderless nitrile gloves. This includes any and all sample handling that may occur during sample packing and shipping.

Decontamination

The following steps are taken to decontaminate the HV surface water sampling equipment between sample stations. Decontamination should be done at the field facility to minimize risk of carrying solvents and waste on the sampling vessel. The procedure specific to the HV sampling equipment is provided below.

1. Remove all silicone and Teflon™-lined tubing and discard.
2. Connect a new set of tubing to PR2900 system. A dedicated clean hands sampler with new disposable nitrile gloves handles all clean tubing and makes all tubing connections.
3. Open the GFF filter housing and brush inside of housing with a dedicated clean brush and deionized water. Reassemble the filter housing.
4. Open the vortex valve during the pumping of each of the decontamination liquids listed in Steps 5-11. Leave the valve open until three vortex volumes are rinsed through the vortex.
5. Pump 2 L of Liquinox solution through the PR2900 system. Liquinox solution consists of 1 capful of Liquinox per 20 L of deionized water.
6. Pump 1 L of deionized water through the PR2900 system.
7. Pump 1 L of methanol through the PR2900 system.
8. Inject 1 milliliter (ml) methanol through the injection port.
9. Pump 1 L of deionized water through the PR2900 system.
10. Pump 0.5 L of hexane through the PR2900 system.
11. Pump 1 L of deionized water through PR2900 system. If PR2900 is to be used immediately, cap all exposed inlets and outlets with aluminum foil and secure with tape until next sample is ready for collection. If system is to be used the next day, allow to air dry prior to capping.
12. Capture all decontamination solutions in a container designated for investigation-derived waste (IDW).

13. Recap the IDW container and store in a designated area.

References

David, N., D. Bell, and J. Gold. 2001. Field sampling manual for the Regional Monitoring Program for Trace Substances. San Francisco Estuarine Institute, San Francisco, California.

EPA (United States Environmental Protection Agency). 1996. Method 1669 – Sampling ambient water for trace metals at EPA water quality criteria levels. United States Environmental Protection Agency, Office of Water Engineering and Analysis Division (4303). Washington, D.C.

Integral (Integral Consulting). 2004a. Round 2A Field Sampling Plan – Surface Water. Appendix C – Surface Water Sampling SOP. Prepared by Integral Consulting Inc. for the LWG for submittal and approval by EPA Region 10. April 2.

Integral. 2004b. Round 2A Field Sampling Plan – Surface Water. Appendix E: Multi Probe YSI 556 SOP. Prepared by Integral Consulting Inc. for the LWG for submittal and approval by EPA Region 10. April 2.

USGS (United States Geologic Survey). Various dates. National field manual for the collection of water-quality data: United States Geological Survey techniques of water-resources investigations, Book 9, Chap. A1-A9. Available online at http://pubs.water.usgs.gov/twri9A. U.S. Geological Survey. Accessed February 5, 2008, at http://water.usgs.gov/owq/Field-Manual/index.html#Citation.

ATTACHMENT 1: HV SAMPLING FIELD EQUIPMENT LIST

- High volume peristaltic pump with vortex separator
- Surface water parameter multi-meter capable of measuring pH, reduction/oxidation (redox) potential, temperature, specific conductance, turbidity, and dissolved oxygen
- 6-mil plastic sheeting
- Teflon™-lined polyethylene sample tubing (length is site dependent)
- Platinum cured silicone tubing
- Plastic zip-ties
- Water Sampling Log forms
- Sample tags/labels and appropriate documentation (e.g., chain-of-custody forms)
- Insulated cooler(s), chain-of-custody seals, Ziploc® bags
- Sample containers (XAD-2 cartridges [numbered with ID at laboratory], 8-oz amber glass wide-mouth jars for filters and separated solids)
- Coolers
- Wet ice
- Nitrile gloves
- First aid kit
- Eye wash kit
- Duct tape
- Clear tape
- Packing tape dispenser
- Tool box
- Coated weights for water samplers
- Non-metallic wire for winch spool
- 2,000-watt power generator or inverter with GFCI protection
- Paper towels
- Dilute solution of Liquinox
- Deionized water
- Extension cord
- Power strip
- Resealable plastic bags (i.e., 1 gallon and 1 quart)
- Yuma Trimble
- HOC-free deionized water
- IDW containers
- Laboratory-grade methanol
- Laboratory-grade hexane
- Pre-cleaned, weighed and numbered 0.5-micron glass fiber flat filters

APPENDIX B-5

STANDARD OPERATING PROCEDURE

HORIZONTAL AND VERTICAL LOCATION CONTROL

(AUGUST 2018)

STANDARD OPERATING PROCEDURE
HORIZONTAL AND VERTICAL SURVEY CONTROL

Introduction

This Standard Operating Procedure (SOP) has been developed for the Pre-Remedial Design Sampling and Baseline Investigations (PDI) at the Portland Harbor Superfund Site located in Portland, Oregon to confirm accurate positioning of vessels and samples during sample collection activities. The survey control requirements described in this SOP are specifically for environmental sample collection and will generally comply with map-grade precision and accuracy in contrast to the geodetic-grade precision and accuracy performed for the Bathymetric Survey conducted by David Evans and Associates (DEA). However, the same survey control points and geodetic parameters will be used in both surveys for consistency, and a portion of the quality assurance/quality control (QA/QC) process will involve consultation with DEA Oregon Professional Land Surveyor (PLS) staff to review the map-grade data collected for the environmental sample collection.

The organization of this SOP is as follows:

- Methodology Overview
- Project Geodetic Parameters
- Survey Accuracy, Precision, and Control
- Primary Equipment
- Hand-Held GPS Operation
- Vessel Navigation and Equipment Operation
- Data Processing and QA/QC Procedures

Tables, figures, and attachments are presented at the end of the SOP.

Methodology Overview

Horizontal (Map) Data Collection

A combination of vessel-mounted and hand-held GPS receivers will be used to navigate to sampling locations and to collect map location coordinates (Northings, Eastings) for those sampling locations. The vessel-mounted GPS receivers will be the primary tool used for navigation to the pre-planned sampling locations in a GIS file, which will be pre-loaded into the vessel navigational system. The hand-held GPS devices will be used as a backup and confirmation of vessel position only if there are problems with the vessel GPS navigation system or if there is no specific vessel navigation system (i.e., smaller boats). Since the inception of field work, the vessel GPS coordinates have been consistently verified and deemed to be sufficient to meet position and accuracy requirements for the project. The hand-held GPS devices will primarily be used for studies involving small vessels. These devices will also have the pre-loaded basemap content depicting planned sampling locations.

The vessel GPS will operate in two modes, collecting both a separate continuous data stream of positional information (line file) and recording GPS soundings (target file) when a sample is specifically collected. The sample location target file will be recorded when the sampling device is in position for the grab (e.g., when sampler is on the river bottom). The specific Location ID associated with the sample will also be recorded in the GPS device log. Field personnel will be required to write that same Location ID on their field data collection forms at the same time. Both the continuous and episodic dataset will be timestamped to allow comparison of the two types of data. This data will be recorded and maintained on the vessel, and will also be exported from the vessel navigation system and archived to project servers on a daily basis.

The hand-held GPS devices will be operated independently of the vessel's systems and will be used to record a location sounding wherever a sample is collected only for studies unable to use the vessel GPS navigation system. The sample location sounding will be recorded approximately at the same time as when the vessel GPS measurement is collected (e.g., when sampler is in position). The specific Location ID associated with the sample will also be recorded on the GPS device. Field personnel will write this Location ID on the field forms only if the vessel measurement described earlier cannot be collected for some reason (e.g., equipment failure). These measurements will also be timestamped. The data from the hand-held GPS devices will be wirelessly synchronized to a "cloud" web service in near real-time; the data from the "cloud" will also downloaded and saved to project servers daily.

Vertical Data Collection

Vertical (elevation) data is also required for water levels, sample collection depth below surface water, and bottom (mudline) depth location for some types of sample locations. For increased precision and accuracy, it is proposed that bottom (mudline) depth locations (e.g., for sediment cores) be calculated from the 2018 bathymetric surface to be developed by the hydrographic survey performed by DEA (since the data will be collected within a few months of each other). The NAVD88 elevation will be calculated from the intersection of the surface map location coordinates collected as described earlier, projected vertically down to the bathymetric surface (United States Army Corps of Engineers [USACE], 2004). The elevation from the intersection of the bathymetric surface will be used as the final or "best" elevation for the sample.

In contrast, for depth measurements that require less precision (e.g., water levels, depth to samples below water surface), the onboard vessel sonar will be used to record depth and then subsequently calculate elevation. All depths will be recorded relative to the water surface and time tagged to correct with time tagged gauge data for obtaining riverbed elevations. The elevation will be calculated to NAVD88 datum (in feet). To correct elevations, gauge data from the Northwest River Forecast Center will be downloaded for gauge PRT03, which is representative of the former Morrison gauge which has been moved. This gauge does not report NAVD88 elevations but rather reports a value that is 0.3 feet above Columbia River Datum (CRD). Corrections from CRD to NAVD88 differ moving down the river from the gauge due to the fact that NAVD88 is a reference normal to gravity (water does not flow if the elevation is unchanging), and CRD is a gradient datum that follows the lower water surface. In Portland Harbor, the difference between CRD and NAVD88 (Geoid12b) ranges from 0.00 feet CRD = -5.16 feet NAVD88 (Geoid12b) at Willamette River river mile (RM) 2.0, to 0.00 feet CRD = -5.41

feet NAVD88 (Geoid12b) at Willamette River RM 12.8 (approximate location of PRT03 Gauge). Accordingly, a correction to the Willamette Gauge in Portland would be -5.41+0.3 or -5.11 feet at RM 12.8. An approximation would be to subtract 5 feet from the gauge reading for the full length of the study area, but precision will vary depending on tides and river gradient.

For sample locations requiring vertical information, depth will be recorded by field staff on their data collection forms relative to the water surface, and these values will be loaded to the project database as described in the Data Quality Management Plan (DQMP). Final calculated NAVD88 elevation data (feet) will also be entered into a separate data field in the project database after completion of spatial analysis, calculations, and QA/QC. DEA will provide support during the QA/QC process to verify proper calculation of NAVD88 elevation data.

Location Position Recording in Project Database

Discrete Samples

When discrete samples are collected, the Location ID and the location coordinates (Northing/Easting) will be recorded on the GPS device(s) and the field data collection form(s). The location coordinates will be based on the vessel GPS instantaneous target measurement. This target measurement will be the location coordinate pair loaded initially to the project database. After the field event is completed, the target measurement will be compared to the line file (vessel continuous GPS measurement) to confirm that the coordinate pair loaded to the project database is appropriate. If analysis reveals precision or accuracy issues, the loaded location coordinate pair in the project database may be updated and edited with a better value derived from the line file. In general, the hand-held GPS devices will be used as a backup and confirmation of vessel position only if there are problems with the vessel GPS navigation system or an independent navigation system is not available on the vessel. These coordinates will be loaded to the project database only if there is a significant problem with the vessel GPS (e.g., equipment failure) or if there is no vessel GPS.

Composite Samples

When composite samples are collected, location coordinates will also be recorded as both target measurements and continuous measurements using the vessel GPS. The continuous GPS measurements will be recorded during the entire compositing event, and instantaneous target measurements will be collected when the sampler is in position for each individual composite grab. At each compositing location, a target measurement will be recorded in the vessel GPS along with the Location ID with an “a,” “b,” or “c” suffix. These measurements will be recorded on the field forms in the same manner (e.g., there will be three sets of location coordinates, lithologic descriptions, etc.).

When the location data is loaded to the project database, a single set of location coordinates will be recorded in the project database with a Location ID that excludes the “a,” “b,” or “c” suffix. As a presumed middle time point, the “b” set of coordinates will be loaded with the primary Location ID to the project database. After the field event is completed, the target measurement associated with the “b” location composite will be compared to the line file (vessel continuous GPS measurement) to assess vessel position and the timeframe of the entire sampling event to confirm if the coordinate pair loaded to the project database is appropriate. The goal will be to finalize the location coordinate information in the project database based on the most representative position based on this analysis. Similar to

discrete sample collection, a hand-held GPS device and related data will only be loaded to the project database if there is a significant problem with operation of the vessel GPS or if the vessel does not have a GPS.

Finally, after field data are collected and surveys are completed, as defined in the DQMP, the location coordinate data will be joined with the tabular data collected by the field teams and loaded to the project database.

Project Geodetic Parameters

The geodetic parameters to be used for the PDI field studies will be as follows:

Horizontal Datum: North American Datum of 1983 (2011)
Projection: State Plane Coordinate System (SPCS) Oregon North Zone
Vertical Datum: North American Vertical Datum of 1988 (NAVD88) Geoid12b
Horizontal Units: International Feet
Vertical Units: Feet

Survey Accuracy, Precision, and Control

The anticipated horizontal accuracy of environmental sampling associated with vessel and hand-held GPS devices is a range of 1 to 5 meters (target 1 to 2 meters for the DGPS unit itself). This should be consistent with RI target accuracy (Integral 2002) and best practices (Puget Sound Estuary Protocols [PSEP] 1998 and US Environmental Protection Agency [EPA] 2008).

The anticipated vertical accuracy of final elevation calculations derived from vessel sonar systems is anticipated to be 1.0 meter.

Table 1 summarizes the survey control locations used in the DEA Bathymetric Survey, which will be used for the environment sample collection work described in this SOP. Figure 1 shows the PH2 piling at the Fred Devine boat dock, and Figure 2 shows the approximate locations of the survey control references for PH1 and PH2. Figure 3 shows approximate location of PH3 for survey control above the Willamette Falls. Attachment 1 contains detailed survey sheets of the following control points: Raindeer, PH1 and PH2, and PH3. Additional information regarding the DEMSI and 2100 control points is available upon request.

Primary Equipment

- Trimble® SPS 461 GPS with dual antennas (vessel GPS)
- A-frame assembly, sampling winch (vessel boom)
- Trimble® R1 (hand held GPS), tethered to Bluetooth® capable smartphone or tablet, ESRI Collector software with Trimble® GNSS Status middleware
- GPS owner's manual
- Writing tools (pencils, Sharpie®)

- Field logbook
- Spare batteries and/or battery charger
- Compass
- Tape measure

Hand-Held GPS Operations

For ease of use, the project team will utilize smartphones tethered to the Trimble® R1 GNSS Receiver via a Bluetooth® connection. The smartphone will be configured with Trimble's middleware software called GNSS Status to convert and stream NMEA satellite data to the smartphone for real-time correction and display to a simple electronic data collection form developed on the ESRI Collector platform. The form will contain a limited number of data fields, including location, study name and operator, date, and notes or comments. This form is not intended to duplicate the content and scope of the field data collection forms, but rather clearly link the GPS data to those forms via the unique Location ID. There are metadata fields available as well from these GPS records, such as estimated horizontal accuracy.

Collected data recorded onto the phone will be transmitted wirelessly via a synchronization process invoked when data is "saved" to the device. The data will be pushed to AECOM Online's Portal and ArcGIS Server for storage of "corrected" location coordinates, Location ID, and other information captured when the GPS sounding is recorded. The sampling event will be trackable in near-real-time as samples are collected on the ArcGIS Portal Interface. Either dedicated, experienced GPS-operators will be collecting the measurements on the smartphones, or, due to the very simple nature of the interface, field personnel will be trained to use the devices. Initial training sessions were already successfully conducted March 19-20, 2018 on use of the smartphone GPS interface. These handheld devices were successfully used for the first 2 weeks of field work. For some studies, such as the smallmouth bass tracking study, these handhelds may be used as the primary GPS due to smaller vessel configuration.

Vessel Navigation and Equipment Operation

Vessel positioning will be conducted through the marine navigation and hydrographic software package HYPACK. This software package allows the visualization of the vessel over navigable charts, the processing of satellite corrections, stored hardware, and vessel parameters, as well as the storing of physical target locations during sampling activities. HYPACK version 2017 will be used for this project.

Vessel position is measured using a Trimble SPS 461 GPS dual antenna receiver. The dual antennas provide precise vessel positioning via both satellite and differential radio corrections along with heading correction to 0.09 degree. GPS data is output through a serial connection into computer running the HYPACK software, for vessel positioning and target collection.

At each sampling location, depth to mudline will be measured using an onboard fathometer (with lead line as confirmation as needed) immediately prior to or during the sampling. Water depths are measured at each station using an Airmar ss510 survey sonar at the sampling point and confirmed daily with a lead line with reference to water surface. Vertical measurements will be recorded to the

nearest 0.1 foot. Water depths will be converted to elevations in NAVD88 based on the river stage at the time of sampling as recorded at the closest available tide gage.

Data Processing and QA/QC Procedures

All GPS devices will be subject to a position check to confirm the accuracy of the on-vessel GPS and hand-held GPS devices and to validate the positions derived from each GPS receiver. Correctors will be applied as needed, resulting in a position that is within specified positioning accuracy of the DEA published position for control monuments PH1, PH2, and PH3 (or future control point approved by EPA). At the start and end of each field day, the benchmark location will be visited to perform a position check.

At the piling serving as the PH2 control monument (accessible by boat), the on-vessel GPS calibrated to the top of A-frame assembly will be maneuvered as close to the benchmark piling as possible to record a point. The GPS-derived position of the sampling vessel is compared with the known horizontal location; results will be recorded in HYPACK to confirm that accuracy is within +/- 2 meters.

For handheld GPS, field staff will occupy the PH1 at the Swan Island boat launch parking lot or PH3 at the Willamette Park boat launch. Using the R1 and phone/tablet combination GPS setup, the field staff will hold the R1 above PH1 or PH3 and wait for a satellite "fix," and when ready, the staff will record the GPS location in Collector. This GPS location will be compared to the known coordinates to confirm the accuracy is within +/- 2 meters. The survey control monuments act as a known location to allow for corrected station location coordinates during post-processing of data as needed. If a need arises to locate another benchmark, there are several USGS control points near the project area and near the AECOM project warehouse. Experienced GPS operators on the project team will be involved in all aspects of field data collection events to troubleshoot devices and assist in daily review of extracted geospatial datasets. Additional details on QA/QC procedures can be found on the DQMP.

References

AECOM (AECOM Technical Services) and Geosyntec (Geosyntec Consultants, Inc.). 2018. Data Quality Management Plan Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling. Portland Harbor Superfund Site. 22 February.

Integral (Integral Consulting). 2002. Round 1 Field Sampling Plan. Prepared for the Lower Willamette Group (LWG) for submittal and approval by EPA Region 10. June 14.

EPA (United States Environmental Protection Agency). 2008. National Geospatial Data Policy. August 24.

PSEP. 1998. Recommended Guidelines for Station Positioning in Puget Sound. Prepared for United States EPA Region 10 and the Puget Sound Water Quality Action Team. September.

USACE (United States Army Corps of Engineers). 2004. Engineering and Design Hydrographic Surveying Manual, EM 1110-2-1003, U.S. Army Corps of Engineers, April 2004

Tables and Figures

Table 1. Benchmark Monument Coordinates and Description

Figure 1. Photograph of Piling PH2, at the end of the Fred Devine Boat Dock

Figure 2. Locations of control monuments PH1 and PH2 at Swan Island Boat Launch and Fred Devine Boat Dock, respectively

Figure 3. PK nail in the middle of Willamette Park Boat Launch parking is survey monument PH3

Attachments

Detailed survey sheets of PH Control Points of Portland Harbor (PH1, PH2, and PH3), and Raindeer survey monuments

Table 1. Benchmark Monument Coordinates and Description

Designation	Approx. Location	Description	NAD83 (2011), Oregon SPCS North (ft)		NAVD88 Elevation (ft)
			Northing	Easting	
DEMSI-BASE	Columbia River	Fixed antenna with height at antenna reference point	718172.70	7654431.05	73.58
DEMSI- CHECK	Columbia River	Fixed antenna with height at antenna reference point	718170.73	7654419.84	71.67
RAINDEER	RM 2	USACE Brass Cap	722443.24	7614886.64	35.44
Portland Harbor 1 (PH1)	Swan Island Boat Ramp	1/2" Iron Rod with red plastic cap stamped "DEA Control" Point is 0.3 feet south of the back of curb at the Swan Island Boat Ramp, 10.5 feet north of a cyclone fence, and 60 feet east of a light post	698702.46	7637426.37	33.38
Portland Harbor 2 (PH2)	Fred Devine Boat Dock	Reference point is 0.2 feet SE of the SE side of a 1-1/2-foot diameter steel pile. This is the furthest SE pile at the end of the Fred Devine Diving and Salvage Company dock in the Swan Island Lagoon.	700967.87	7634507.67	NA
Portland Harbor 3 (PH3)	Willamette Park Boat Launch (above the falls)	PK nail in trailer parking lot of boat launch ramp, near center of loop and approximately even with seventh parking space.	617123.76	7649701.80	72.42
2100	RM 13	5/8" bolt on SW corner of screen wall at DEA office 2100 SW River Parkway, Portland, OR	678400.01	7645190.81	159.51

General Notes:

1. The two DEMSI and the 2100 stations (indicated with green shading) are transceiver beacon stations in upland areas. These stations will not be used for daily location control checks by sampling team. More information regarding these stations is available upon request.
2. PH1 is located at the Swan Island boat ramp parking lot and accessible by foot.
3. PH2 is located at a piling at the boat dock where project-related vessels will be docked and is accessible by boat. This pile is to be used for daily position checks for sediment sampling operations. Pile is for position only and not elevation.
4. PH3 is located in the parking lot of the boat launch above the Willamette Falls and is accessible by foot.
5. Raindeer station is located adjacent to the river and accessible by foot (for the hand-held GPS).

Acronyms:
DEA = David Evans and Associates; ft = feet; NAD83 = North American Datum of 1983; NAVD88 = North American Vertical Datum of 1988; PH = Portland Harbor; RM = river mile; PK nail = survey marker; USACE = US Army Corps of Engineers; SPCS = State Plane Coordinate System

Figure 1. Photograph of Piling PH2, at the end of the Fred Devine Boat Dock. Piling was surveyed during and captured in DEA bathymetric survey. Photo is facing northwest.

PH2 is located on the SE corner of the Fred Devine Boat Dock, where Gravity's boats berth every night.

PH1 is located on the SW side of the Swan Island Boat Launch parking lot, where field crews park to meet the boats at the launch dock.

Figure 2. Locations of control monuments PH1 and PH2 at Swan Island Boat Launch and Fred Devine Boat Dock, respectively.

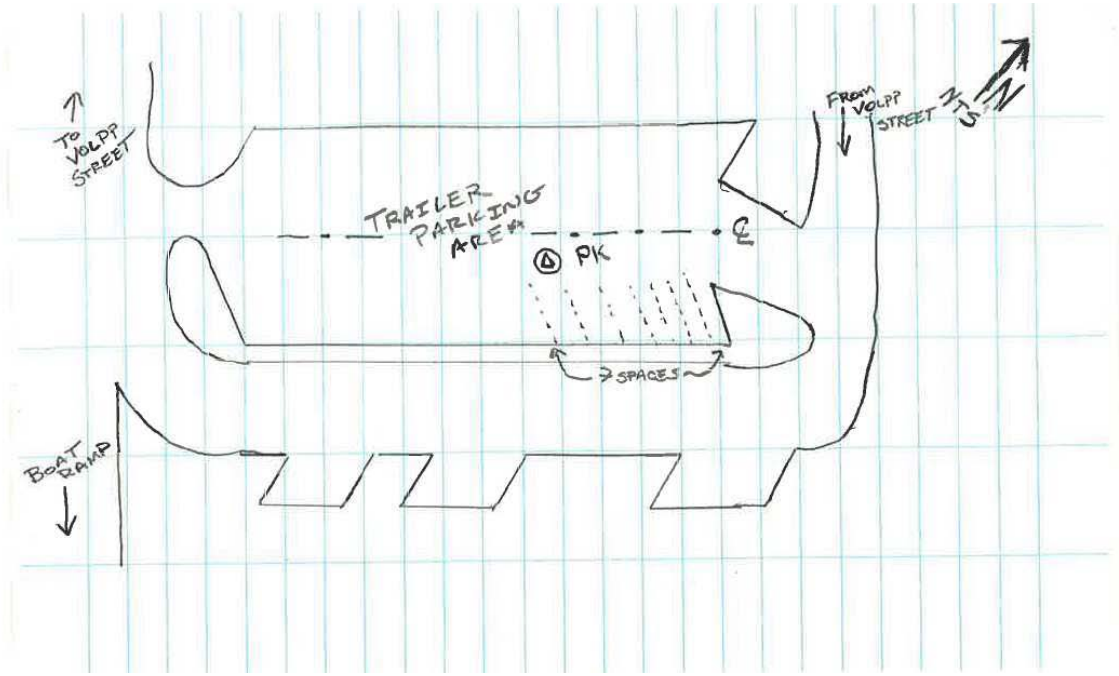


Figure 3. PK nail in the middle of Willamette Park Boat Launch parking marks survey monument PH3. It was land-surveyed by DEA and marked with pink survey tape. Photo shows survey equipment set-up over PH3.

NOTE: This form intended for field use. Unsolicited data submitted to NGS must be converted to bluebook format.

GPS STATION OBSERVATION LOG
April 16, 2003

Station Designation: (check applicable:__ FBN__ CBN__ PAC__ SAC __BM) Portland Harbor 1 (PH1)		Station PID, if any:	Date (UTC): 06-Mar-18
General Location: Swan Island Boat Launch	Airport ID, if any:	Station 4-Character ID:	Day of Year: 065
Project Name: Portland Harbor - AETR00000034	Project Number: GPS-	Station Serial # (SSN):	Session ID:(A,B,C etc)

NAD83 Latitude: o ' "
NAD83 Longitude: o ' "
NAD83 Ellipsoidal Height: meters
NAVD88 Orthometric Ht.: meters
GEOID99 Geoid Height: meters

Agency Full Name: David Evans and Associate, Inc.
Operator Full Name: David T. Moehl
Phone #: ( ) (360) 314-3200
e-mail address: dtm@deainc.com

Observation Session Times (UTC):
Sched. Start _____ Stop _____
Actual Start 19:30 Stop 21:32

Epoch Interval= 1 Seconds
Elevation Mask = 10 Degrees

Receiver Brand & Model: Trimble SPS985
P/N: 82500-60
S/N: 5616F59510
Firmware Version: 5.30
❒ CamCorder Battery, ❒ 12V DC, ❒ 110V AC, ✓ Other

Antenna Code*, Brand & Model: Trimble SPS985 Internal
P/N:
S/N:
Cable Length, meters: n/a
Vehicle is Parked 10 meters N (direction) from antenna.

Antenna plumb before session?	(✓ / N)	Circle
Antenna plumb after session?	(✓ / N)	Yes or No
Antenna oriented to true North?	(Y / N✓)	-If no,
Weather observed at antenna ht.	(Y / N✓)	explain
Antenna ground plane used?	(Y / N✓)	"
Antenna radome used?	(Y / N✓)	If yes,
Eccentric occupation (>0.5 mm)?	(Y / N✓)	describe.
Any obstructions above 10°?	(Y / N✓)	Use
Radio interference source nearby	(Y / N✓)	Vis. form

Tripod or Antenna Mount: Check one:
✓ Fixed-Leg Tripod, ❒ Collapsible-leg tripod ❒ Fixed Mount
Brand & Model: Seco fixed height
P/N:
S/N: 5115-00-FLY
Last Adjustment date: 2018-03-05

Psychrometer (if used) Brand & Model:
P/N:
S/N:
Last Calibration or check Date:

** ANTENNA HEIGHT **	Before Session Begins: Meters	Feet	After Session Ends: Meters	Feet
A= Datum point to Top of Tripod (Tripod Height)	2.000		2.000	
B=Additional offset to ARP if any (Tribrach/Spacer)	0.000		0.000	
H= Antenna Height = A + B = Datum Point to Antenna Reference Point (ARP)	2.000	6.56	2.000	6.56

Meters = Feet x (0.3048)
Height Entered Into Receiver = 2.000 meters.
Note &/or sketch **ANY** unusual conditions. Be **Very Explicit** as to where and how Measured!

Barometer (if used) Brand & Model:
S/N:

Weather Data	Weather Codes	Time (UTC)	Dry-Bulb Temp Fahrenheit	Dry-Bulb Temp Celsius	WetBulb Temp Fahrenheit	WetBulb Temp Celsius	Rel. % Humidity	Atm. Pressure inches Hg	Atm. Pressure millibar
Before	00000	19:30							
Middle									
After	00000	21:32							

Remarks, Comments on Problems, Sketches, Pencil Rubbing, etc:

Control point is a 1/2" iron rod with red plastic cap stamped "DEA CONTROL" set 0.1' below natural grade. Control point is 0.3' south of the back of curb, 10.5' north of a cyclone fence and 60' easterly of the 2nd light post east of the boat ramp. See detached sketch and photos.

Weather codes are required. Weather data are optional but encouraged. *Antenna code comes from ant_info file furnished by project coordinator.

Data File Name(s): 95100650.T02
(Standard NGS Format = aaaaddds.xxx)
where aaaa=4-Character ID, ddd=Day of Year, s=Session ID, xxx=file dependant extension

Updated Station Description: ❒ Attached ❒ Submitted earlier
Visibility Obstruction Form: ❒ Attached ❒ Submitted earlier
Photographs of Station: ✓ Attached ❒ Submitted earlier
Pencil Rubbing of Mark: ❒ Attached

LOG CHECKED BY: Jon Dasler

Table of Weather Codes

CODE	PROBLEM	VISIBILITY	TEMPERATURE	CLOUD COVER	WIND
0	did not occur	Good, over 15 miles	Normal, 32° F- 80° F	Clear, below 20%	Calm, under 5mph (8km/h)
1	did occur	Fair, 7-15 miles	Hot, over 80°F (27 C)	Cloudy, 20% to 70%	Moderate, 5 to 15 mph
2	- not used -	Poor, under 7 miles	Cold, below 32° F (0 C)	Overcast, over 70%	Strong, over15 mph (24km/h)

Examples: 00000 = No problem, good visibility, normal temp, clear, calm wind 12121 = Problems, poor visibility, hot, overcast, moderate wind

Sketch of Monument PH1

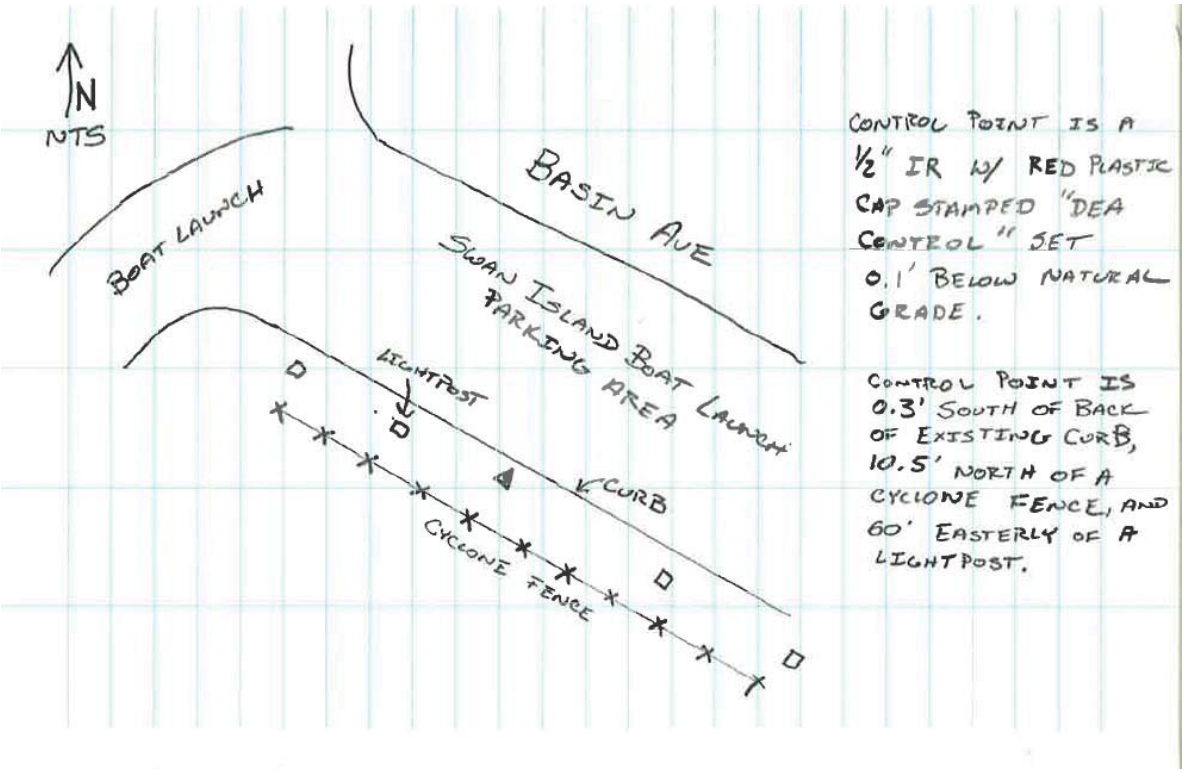


Photo of Monument PH1

GNSS Setup on PH1

NOTE: This form intended for field use. Unsolicited data submitted to NGS must be converted to bluebook format.

GPS STATION OBSERVATION LOG
April 16, 2003

Station Designation: (check applicable:__ FBN__ CBN__ PAC__ SAC __BM) Portland Harbor 2 (PH2)		Station PID, if any:	Date (UTC): 20-Apr-18
General Location: Fred Devine Boat Dock	Airport ID, if any:	Station 4-Character ID:	Day of Year: 111
Project Name: Portland Harbor - AETR00000034	Project Number: GPS-	Station Serial # (SSN):	Session ID:(A,B,C etc)

NAD83 Latitude o ' "	NAD83 Longitude o ' "	NAD83 Ellipsoidal Height meters	Agency Full Name: David Evans and Associate, Inc.
Observation Session Times (UTC): Sched. Start _____ Stop _____ Actual Start 19:45 Stop 19:49	Epoch Interval= 1 Seconds Elevation Mask = 10 Degrees	NAVD88 Orthometric Ht. meters GEOID99 Geoid Height meters	Operator Full Name: David T. Moehl Phone #: ( ) (360) 314-3200 e-mail address: dtm@deainc.com

Receiver Brand & Model: Trimble SPS985	Antenna Code*, Brand & Model: Trimble SPS985 Internal	Antenna plumb before session? (Y / N) ✓ Circle
P/N: 82500-60	P/N:	Antenna plumb after session? (Y / N) ✓ Yes or No
S/N: 5616F59510	S/N:	Antenna oriented to true North? (Y / N) ✓ -If no,
Firmware Version: 5.30	Cable Length, meters: n/a	Weather observed at antenna ht. (Y / N) ✓ explain
❒ CamCorder Battery, ❒ 12V DC, ❒ 110V AC, ✓ Other	Vehicle is Parked n/a meters ____(direction) from antenna.	Antenna ground plane used? (Y / N) ✓ "
		Antenna radome used? (Y / N) ✓ If yes,
		Eccentric occupation (>0.5 mm)? (Y / N) ✓ describe.
		Any obstructions above 10°? (Y / N) ✓ Use
		Radio interference source nearby (Y / N) ✓ Vis. form

Tripod or Antenna Mount: Check one:
✓ Fixed-Leg Tripod, ❒ Collapsible-leg tripod ❒ Fixed Mount
Brand & Model: Seco fixed height
P/N:
S/N: 5115-00-FLY
Last Adjustment date: 2018-03-05

Psychrometer (if used) Brand & Model:
P/N:
S/N:
Last Calibration or check Date:

** ANTENNA HEIGHT **	Before Session Begins: Meters	Feet	After Session Ends: Meters	Feet
A= Datum point to Top of Tripod (Tripod Height)	2.000		2.000	
B=Additional offset to ARP if any (Tribrach/Spacer)	0.000		0.000	
H= Antenna Height = A + B = Datum Point to Antenna Reference Point (ARP)	2.000	6.56	2.000	6.56

Meters = Feet x (0.3048)
Height Entered Into Receiver = 2.000 meters.
Note &/or sketch **ANY** unusual conditions. Be **Very Explicit** as to where and how Measured!

Barometer (if used) Brand & Model:
S/N:

Weather Data	Weather Codes	Time (UTC)	Dry-Bulb Temp Fahrenheit	Dry-Bulb Temp Celsius	WetBulb Temp Fahrenheit	WetBulb Temp Celsius	Rel. % Humidity	Atm. Pressure inches Hg	Atm. Pressure millibar
Before	00010	19:45							
Middle									
After	00010	19:49							

Remarks, Comments on Problems, Sketches, Pencil Rubbing, etc:

Reference point is 0.2 feet SE of the SE side of a 1-1/2 foot steel pile. This is the furthest SE pile at the end of the Fred Devine Diving and Salvage Company dock in the Swan Island Lagoon. This pile is to be used for daily position checks for sediment sampling operations. Pile is for position only and not elevation.
NAD83(2011) Oregon North Zone International Feet Coordinates
North 700967.9 East 7634507.7

Weather codes are required. Weather data are optional but encouraged. *Antenna code comes from ant_info file furnished by project coordinator.

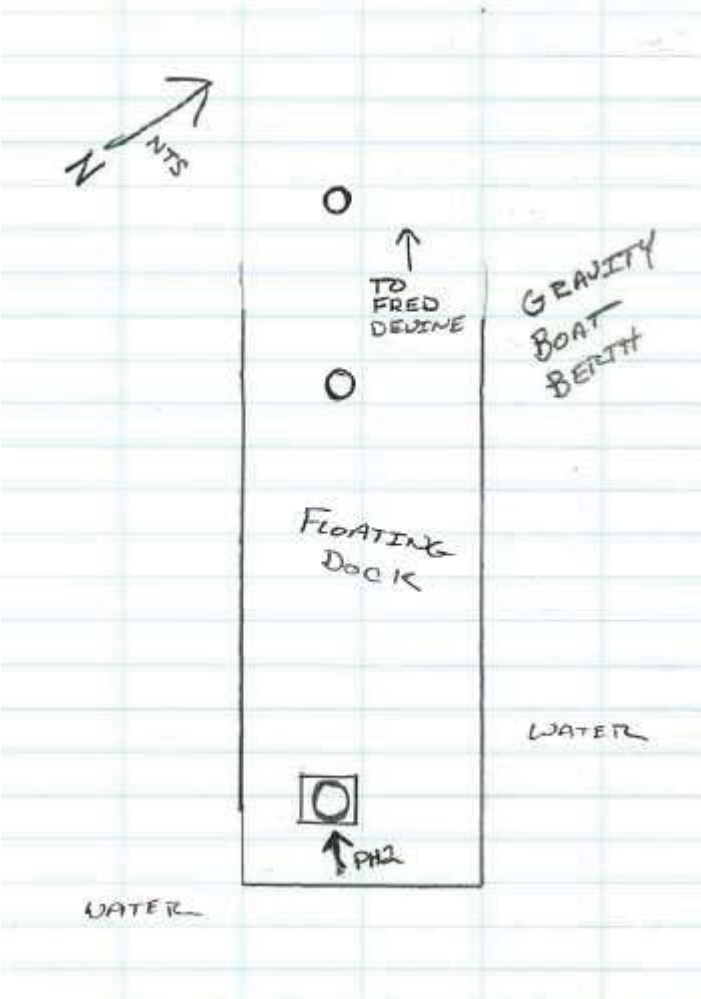
Data File Name(s):
(Standard NGS Format = aaaaddds.xxx)
where aaaa=4-Character ID, ddd=Day of Year, s=Session ID, xxx=file dependant extension

Updated Station Description: ❒ Attached ❒ Submitted earlier
Visibility Obstruction Form: ❒ Attached ❒ Submitted earlier
Photographs of Station: ✓ Attached ❒ Submitted earlier
Pencil Rubbing of Mark: ❒ Attached

LOG CHECKED BY: Jon Dasler

Table of Weather Codes	CODE	PROBLEM	VISIBILITY	TEMPERATURE	CLOUD COVER	WIND
	0	did not occur	Good, over 15 miles	Normal, 32° F- 80° F	Clear, below 20%	Calm, under 5mph (8km/h)
	1	did occur	Fair, 7-15 miles	Hot, over 80°F (27 C)	Cloudy, 20% to 70%	Moderate, 5 to 15 mph
	2	- not used -	Poor, under 7 miles	Cold, below 32° F (0 C)	Overcast, over 70%	Strong, over15 mph (24km/h)
Examples:	00000 = No problem, good visibility, normal temp, clear, calm wind				12121 = Problems, poor visibility, hot, overcast, moderate wind	

Sketch and Fieldnotes



200 CHK PH1

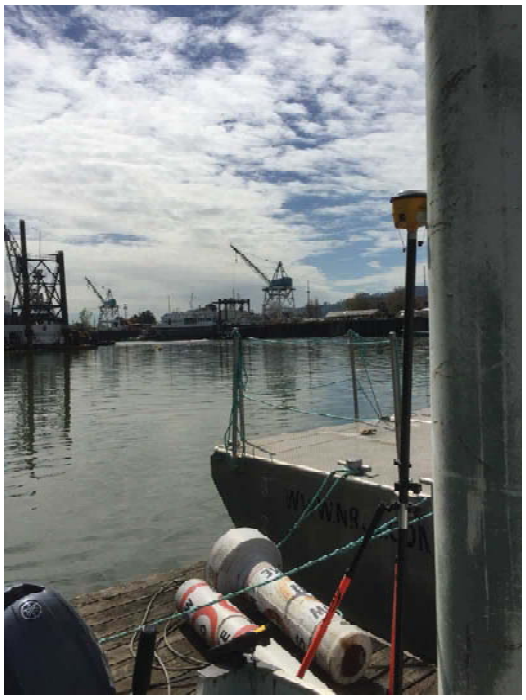
	KNOWN COORDS	OBS	Δ (FT)
	N = 698702.46	N = 698702.45	0.01
	E = 7637426.37	E = 7637426.39	0.02
	Z = 33.38	Z = 33.37	0.01

201 SE FACE OF PILE
3-MIN OBS
N = 700967.87
E = 7634507.64
Z = N/A

202 SW FACE TOPO
203 NW FACE TOPO
204 NE FACE TOPO

Overview of PH2 Pile

GNSS Setup on PH2 Pile



View facing south

View facing northwest

NOTE: This form intended for field use. Unsolicited data submitted to NGS must be converted to bluebook format.

GPS STATION OBSERVATION LOG
April 16, 2003

Station Designation: (check applicable:__ FBN__ CBN__ PAC__ SAC __BM)		Station PID, if any:	Date (UTC):
General Location:	Airport ID, if any:	Station 4-Character ID:	Day of Year:
Project Name:	Project Number: **GPS-**	Station Serial # (SSN):	Session ID:(A,B,C etc)

NAD83 Latitude o ' "	NAD83 Longitude o ' "	NAD83 Ellipsoidal Height meters NAVD88 Orthometric Ht. meters GEOID99 Geoid Height meters	Agency Full Name: Operator Full Name: Phone #: ( ) e-mail address:
Observation Session Times (UTC): Sched. Start _____ Stop _____ Actual Start _____ Stop _____	Epoch Interval=____ Seconds Elevation Mask = _____ Degrees		

Receiver Brand & Model:

P/N:
S/N:
Firmware Version:

❒ CamCorder Battery, ❒ 12V DC, ❒ 110V AC, ❒ Other

Antenna Code*, Brand & Model:

P/N:
S/N:
Cable Length, meters:

Vehicle is Parked _____ meters ____(direction) from antenna.

Antenna plumb before session?	(Y / N)	Circle Yes or No -If no, explain "
Antenna plumb after session?	(Y / N)	
Antenna oriented to true North?	(Y / N)	
Weather observed at antenna ht.	(Y / N)	
Antenna ground plane used?	(Y / N)	
Antenna radome used?	(Y / N)	If yes, describe. Use Vis. form
Eccentric occupation (>0.5 mm)?	(Y / N)	
Any obstructions above 10°?	(Y / N)	
Radio interference source nearby	(Y / N)	

Tripod or Antenna Mount: Check one:
❒ Fixed-Leg Tripod, ❒ Collapsible-leg tripod ❒ Fixed Mount
Brand & Model:
P/N:
S/N:
Last Adjustment date:

Psychrometer (if used) Brand & Model:

P/N:
S/N:
Last Calibration or check Date:

** ANTENNA HEIGHT **	Before Session Begins: Meters	Before Session Begins: Feet	After Session Ends: Meters	After Session Ends: Feet
A= Datum point to Top of Tripod (Tripod Height)				
B=Additional offset to ARP if any (Tribrach/Spacer)				
H= Antenna Height = A + B = Datum Point to Antenna Reference Point (ARP)	2.003	6.57	2.003	6.57

Meters = Feet x (0.3048)
Height Entered Into Receiver = _____ meters.
Note &/or sketch **ANY** unusual conditions. Be **Very Explicit** as to where and how Measured!

Barometer (if used) Brand & Model:

S/N:

Weather Data	Weather Codes	Time (UTC)	Dry-Bulb Temp Fahrenheit	Dry-Bulb Temp Celsius	WetBulb Temp Fahrenheit	WetBulb Temp Celsius	Rel. % Humidity	Atm. Pressure inches Hg	Atm. Pressure millibar
Before									
Middle									
After									

Remarks, Comments on Problems, Sketches, Pencil Rubbing, etc:

Weather codes are required. Weather data are optional but encouraged. *Antenna code comes from ant_info file furnished by project coordinator.

Data File Name(s):

(Standard NGS Format = aaaaddds.xxx)
where aaaa=4-Character ID, ddd=Day of Year, s=Session ID, xxx=file dependant extension

Updated Station Description: ❒ Attached ❒ Submitted earlier
Visibility Obstruction Form: ❒ Attached ❒ Submitted earlier
Photographs of Station: ❒ Attached ❒ Submitted earlier
Pencil Rubbing of Mark: ❒ Attached

LOG CHECKED BY:

Table of Weather Codes

CODE	PROBLEM	VISIBILITY	TEMPERATURE	CLOUD COVER	WIND
0	did not occur	Good, over 15 miles	Normal, 32° F- 80° F	Clear, below 20%	Calm, under 5mph (8km/h)
1	did occur	Fair, 7-15 miles	Hot, over 80°F (27 C)	Cloudy, 20% to 70%	Moderate, 5 to 15 mph
2	- not used -	Poor, under 7 miles	Cold, below 32° F (0 C)	Overcast, over 70%	Strong, over15 mph (24km/h)

Examples: 00000 = No problem, good visibility, normal temp, clear, calm wind 12121 = Problems, poor visibility, hot, overcast, moderate wind

Sketch of Monument PH3

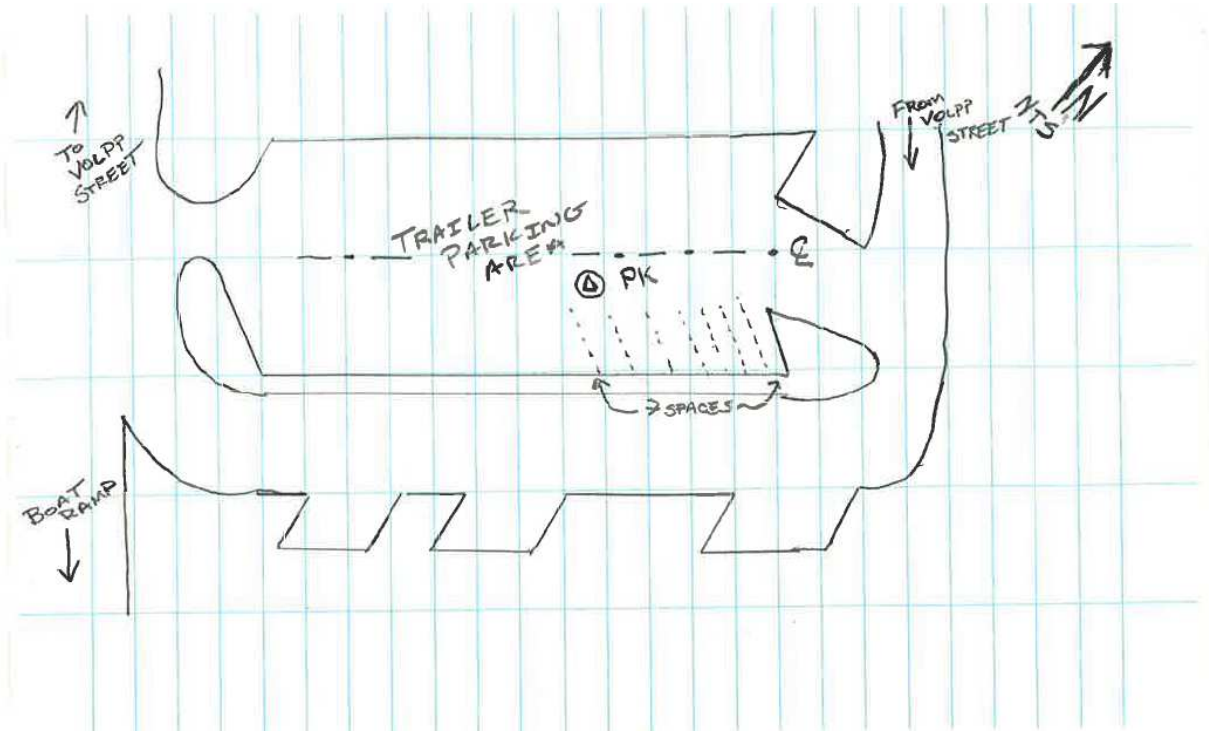


Photo of Monument PH3

GNSS Setup on PH3

NOTE: This form intended for field use. Unsolicited data submitted to NGS must be converted to bluebook format.

GPS STATION OBSERVATION LOG
April 16, 2003

Station Designation: (check applicable:__ FBN__ CBN__ PAC__ SAC __BM) Raindeer		Station PID, if any:	Date (UTC): 06-Mar-18
General Location: Sauvie Island, Willamette River	Airport ID, if any:	Station 4-Character ID:	Day of Year: 065
Project Name: Portland Harbor - AETR00000034	Project Number: GPS-	Station Serial # (SSN):	Session ID:(A,B,C etc)

NAD83 Latitude ° ' "	NAD83 Longitude ° ' "	NAD83 Ellipsoidal Height meters	Agency Full Name: David Evans and Associates, Inc.
Observation Session Times (UTC): Sched. Start _____ Stop _____ Actual Start 17:38 Stop 23:45	Epoch Interval= 1 Seconds Elevation Mask = 10 Degrees	NAVD88 Orthometric Ht. meters GEOID99 Geoid Height meters	Operator Full Name: David T. Moehl Phone #: ( ) (360) 314-3200 e-mail address: dtm@deainc.com

Receiver Brand & Model: Trimble SPS855	Antenna Code*, Brand & Model: Trimble Zephyr 3 Base	Antenna plumb before session? (✓Y / N) Circle
P/N: 69855-60	P/N: 115000-00	Antenna plumb after session? (✓Y / N) Yes or No
S/N: 5506R0074	S/N: 1551129193	Antenna oriented to true North? (✓Y / N) -If no,
Firmware Version: 5.30	Cable Length, meters: 10	Weather observed at antenna ht. (Y / N✓) explain
❒ CamCorder Battery, ✓❒ 12V DC, ❒ 110V AC, ❒ Other	Vehicle is Parked n/a meters ____(direction) from antenna.	Antenna ground plane used? (Y / N✓) "
		Antenna radome used? (Y / N✓) If yes,
		Eccentric occupation (>0.5 mm)? (Y / N✓) describe.
		Any obstructions above 10°? (Y / N✓) Use
		Radio interference source nearby (Y / N✓) Vis. form

Tripod or Antenna Mount: Check one:
✓❒ Fixed-Leg Tripod, ❒ Collapsible-leg tripod ❒ Fixed Mount
Brand & Model: Seco fixed height
P/N:
S/N: 5115-00-FLY
Last Adjustment date: 2018-03-05

Psychrometer (if used) Brand & Model:
P/N:
S/N:
Last Calibration or check Date:

** ANTENNA HEIGHT **	Before Session Begins: Meters	Feet	After Session Ends: Meters	Feet
A= Datum point to Top of Tripod (Tripod Height)	2.000		2.000	
B=Additional offset to ARP if any (Tribrach/Spacer)	-0.003		-0.003	
H= Antenna Height = A + B = Datum Point to Antenna Reference Point (ARP)	1.997	6.55	1.997	6.55

Meters = Feet x (0.3048)
Height Entered Into Receiver = 2.000 meters.
Note &/or sketch **ANY** unusual conditions. Be **Very Explicit** as to where and how Measured!

Barometer (if used) Brand & Model:
S/N:

Weather Data	Weather Codes	Time (UTC)	Dry-Bulb Temp Fahrenheit	Dry-Bulb Temp Celsius	WetBulb Temp Fahrenheit	WetBulb Temp Celsius	Rel. % Humidity	Atm. Pressure inches Hg	Atm. Pressure millibar
Before	00000	17:38							
Middle									
After	00000	23:45							

Remarks, Comments on Problems, Sketches, Pencil Rubbing, etc:

Weather codes are required. Weather data are optional but encouraged. *Antenna code comes from ant_info file furnished by project coordinator.

Data File Name(s): 00740650.T02
(Standard NGS Format = aaaaddds.xxx)
where aaaa=4-Character ID, ddd=Day of Year, s=Session ID, xxx=file dependant extension

Updated Station Description: ❒ Attached ❒ Submitted earlier
Visibility Obstruction Form: ❒ Attached ❒ Submitted earlier
Photographs of Station: ✓Attached ❒ Submitted earlier
Pencil Rubbing of Mark: ❒ Attached

LOG CHECKED BY: Jon Dasler

Table of Weather Codes	CODE	PROBLEM	VISIBILITY	TEMPERATURE	CLOUD COVER	WIND
	0	did not occur	Good, over 15 miles	Normal, 32° F- 80° F	Clear, below 20%	Calm, under 5mph (8km/h)
	1	did occur	Fair, 7-15 miles	Hot, over 80°F (27 C)	Cloudy, 20% to 70%	Moderate, 5 to 15 mph
	2	- not used -	Poor, under 7 miles	Cold, below 32° F (0 C)	Overcast, over 70%	Strong, over15 mph (24km/h)
Examples:	00000 = No problem, good visibility, normal temp, clear, calm wind			12121 = Problems, poor visibility, hot, overcast, moderate wind		

Photo of Monument RAINDEER

Photo of Monument RAINDEER

GNSS Setup on RAINDEER

APPENDIX B-6

EXCERPTS FROM SEDIMENT TRAP FSP

(Integral 2006c)

reviewed. The bottle wash certificate documentation will be archived in the LWG project file. Field personnel will not obstruct these stickers with sample labels.

Sample containers will be clearly labeled at the time of sampling. Labels will include the project name, sample location and number, sampler's initials, analysis to be performed, date, and time. The scheme used for designating field sample identification numbers is described in Section 3.8.

3.5 EQUIPMENT DECONTAMINATION PROCEDURES

The containers for collecting suspended sediment will be glass tubes with one end open. Sample processing equipment will be stainless steel utensils and mixing bowls. Glass tubes will be decontaminated prior to initial deployment and before each successive quarterly re-deployment. Sediment handling equipment that comes in direct contact with the samples will be decontaminated prior to use at each station and between field replicates. The equipment will be decontaminated in the following manner

- Rinse with site water.
- Wash with brush and Liquinox™ or other phosphate-free detergent.
- Double rinse with distilled water.
- Rinse with 0.1 N nitric acid.
- Rinse with deionized water.

Sample handling equipment also will be wrapped in aluminum foil following the methanol rinse.. To minimize the potential for sample contamination, gloves will be replaced or thoroughly washed using Liquinox™ or another phosphate-free detergent and rinsed with distilled water before and after handling each sample, as appropriate. Rinse waters will be diluted with site water and discarded into the river.

3.6 SEDIMENT TRAP DEPLOYMENT AND RECOVERY PROCEDURES

Collecting suspended sediment samples will require four deployment and four recovery operations. The following subsections describe the procedures for performing these operations.

3.6.1 Sediment Trap Design

Figure 3-1 shows schematics of the sediment trap construction and deployment. Each sediment trap will consist of an assembly of four glass tubes, each placed inside a

protective PVC sleeve. The sleeves will be fastened together and will include hardware for mounting and securing on a rebar post driven into the river bottom.

The glass tubes will be approximately 10 cm in diameter and 55 cm long. The tubes will contain a dense salt and sodium azide or formalin preservative if these substances pose no risk to the integrity of sample analyses. Dye may be added to the preservative so visual examination of the recovered trap can determine whether traps have been spilled or flushed.

3.6.2 Sediment Trap Deployment

The sediment traps will be installed and retrieved by commercial divers. The divers will drive a rebar support rod vertically into the sediment bed a sufficient distance to ensure the bar will remain in place. A lead line (line on the bottom) 100 feet long will be tied to the rebar, extended downstream of the rebar, and terminated in an anchor to keep the line taut. The lead line will assist divers in locating the sediment trap locations for re-sampling during the project.

The glass tubes will be decontaminated prior to insertion into the protective PVC sleeves and subsequent deployment of the sediment trap assembly. The sediment trap assembly will be lowered using the vessel's winch. The diver will descend with the trap assembly and control its movement. The diver will affix the trap assembly to the rebar so that the open tops of the cylinders are 3 feet above the mudline elevation. Prior to departing, the diver will inspect the installation for stability and tight connections. In addition, the location of a given sediment trap will be confirmed and recorded in the vessel's navigation computer.

3.6.3 Sediment Trap Recovery

The vessel will occupy the location of a given sediment trap, and one member of the dive team will enter the water. If the diver does not locate the trap immediately, the diver will then move downstream of the location and use a hook or hand to locate the lead line that lies on the bottom downstream of the trap location. The diver will follow the line to the trap.

After locating the sediment trap, the diver will place foil over the top of each glass tube and secure it in place with a rubber band. Sediment traps will be retrieved by loosening the connections that secure the assembly to the rebar and slowly lifting the assembly off the rebar support. The vessel's winch will be used to slowly hoist the trap assembly to the surface and onto the deck. The diver will guide the trap to the surface to keep the trap vertical as much as possible.

APPENDIX B-7

STANDARD OPERATING PROCEDURE

INVESTIGATION-DERIVED WASTE

STANDARD OPERATING PROCEDURE
MANAGEMENT OF INVESTIGATION-DERIVED WASTE

Introduction

Investigation derived wastes (IDW) generated during the Pre-Remedial Design Investigations at the Portland Harbor Superfund Site may include:

- Soils/sediments
- Surface water
- Other materials:
    - Personal protective equipment
    - Disposable sampling equipment
    - Spent decontamination liquids
    - Plastic sheeting, containers, etc.

The management of these wastes will be conducted to limit exposure of Site personnel to hazardous materials, and to prevent introduction of contaminated materials to uncontaminated environmental media at the Site (soils, sediment). The following Standard Operating Procedures (SOPs) establish protocols for testing, storage, and disposal of these materials.

Disposal of laboratory test equipment and supplies will be handled in accordance with the laboratory Quality Assurance Project Plan (QAPP).

General

IDW management will follow guidance described in the Office of Solid Waste and Emergency Response (OSWER) document, Guide to Management of Investigation-Derived Wastes (United States Environmental Protection Agency [EPA] 1992). This guidance discusses factors to consider as part of an IDW management program. These factors include protectiveness of human health and the environment, compliance with applicable and relevant or appropriate requirement (ARAR)-based cleanup levels, land disposal restrictions, storage requirements, recordkeeping and manifesting, and handling of non- Resource Conservation and Recovery Act (RCRA) hazardous wastes. The IDW management program described in this section incorporates these factors in the program.

All IDW identified as potentially contaminated with hazardous materials will be stored in a designated and clearly marked IDW management area located at the AECOM Technical Services (AECOM) Field Laboratory. All vessels will also be clearly labeled to indicate the source of the IDW. The IDW storage area will be inspected daily to ensure that storage procedures (as outlined below) are being followed. Any violations of these procedures will be

documented and remedied as quickly as possible. Potentially contaminated IDW will be identified based on its origin, olfactory evidence, and visual evidence. Laboratory testing will be required to determine the proper disposition of these IDW.

Media Specific IDW Management

Sediment/Soils

Waste soils and sediments will be generated as excess sample material. The required testing and handling of this IDW will depend on its origin and characteristics. Olfactory and visual observations will be used to determine if the soils contain potentially elevated levels of hazardous materials. The amount of sediment generated will be minimized to the volume necessary for sampling and analysis, if possible. During field operations, leftover sediment material will be returned to the location it was generated from unless a significant sheen or non-aqueous phase liquid (NAPL) is observed. If significant sheen or NAPL is observed, sediment on the vessel or laboratory processing area will be temporally stored in 5-gallon buckets with lids, then transferred to 55-gallon drums. Each drum will be labeled using a grease pencil or paint pen to indicate the date sealed, location, and contents. Each of the sealed drums will then be staged at a designated solid waste management unit location for later disposal characterization.

Surface Water

Sampling activities may result in the creation of surface water sheens. Sorbent booms will be deployed if significant sheen is encountered on the water surface during coring/grab sampling. A small support boat may be used to manage the boom so the sampling vessel can operate without interruption. AECOM will coordinate with the Office of Spill Prevention Section on additional mitigation measures and agency notifications for releases. Surface water generated during sediment collection will be returned to the lake unless a significant sheen is observed. If a sheen is observed, water will be contained in 55-gallon drums or plastic containers and managed accordingly.

Personal Protective Equipment (PPE)

Investigation-derived PPE consists of gloves, chemically protective clothing, respirator canisters, and other one-time use equipment used during the field investigation. All used PPE will be containerized in plastic garbage bags and disposed of on-site for subsequent transport to the municipal landfill.

Decontamination Fluids

Decontamination fluids will be drummed up in either 55-gallon drums or disposed of in sanitary sewers if no significant sheen is observed. Alconox used on the boat will be discarded overboard if no significant sheen is observed. The decontamination containers will be kept on-site until the water has been analyzed for hazardous materials, at which time the water will be discarded appropriately.

Chemical Liquid Wastes

Chemical liquid wastes will include the spent solvents and acids and other residual chemicals generated during the decontamination process.

Waste acids and solvents will be collected in (dedicated) satellite containers as follows:

- Waste acids (e.g., hydrogen chloride, nitric acid) will be collected in a plastic storage carboy (20-L) SEPARATE FROM WASTE SOLVENTS, labeled with a Class 8 Corrosive Liquid label and containing a tag that indicates acid name, concentration, and volume along with users' initials and date/time.
- Waste solvents (e.g., acetone, methanol, and hexane) will be collected in Type I or II UL-approved galvanized steel disposal can, SEPARATE FROM WASTE ACIDS, labeled with a Class 3 Flammable Liquid label and containing a tag that indicates solvent name, concentration, and volume along with users' initials and date/time.

Solvent Waste (Acetone, Methanol, Hexane)

- Assign a unique identification number to the Type I or II UL-approved steel disposal can (clearly marked on the top and sides).
- Prepare a log for the drum, listing the volume and concentration of each solvent transferred to the drum along with date/time.
- Place a label indicating that the drum contains IDW pending characterization and a Class 3 Flammable Liquid label on the drum.
- Close the drum after each transfer.
- Store the drum in a secure area at the field facility until pickup by an authorized waste handler at the end of the field phase. Drums containing hazardous waste will be removed from the facility within the time mandated for the governing hazardous waste generator status (large quantity generator, small quantity generator, or conditionally except generator).

Other Materials

All plastic sheeting, sampling containers, and other disposable equipment that is free from hazardous materials will be containerized in plastic garbage bags and disposed of on-site for subsequent transport to the municipal landfill. Materials that have visible NAPL will also be drummed and shipped off-site for disposal at an approved facility. Non-disposable or bulky materials may be decontaminated and re-used or disposed as solid waste (see SOP for decontamination). Other disposable materials used on-site (tarps covering non-contaminated soils, caution tape, potable water containers) that have not contacted contaminated media will be disposed as solid waste.

Testing and Disposal

All drummed materials will be tested to determine the proper disposal method. Composite samples will be collected from each drum for analysis. Composite samples will be collected such that reasonable likelihood exists that the entire volume of material in a drum is represented in the sample.

Composite samples will be tested for the parameters identified in the QAPP. Modifications of this analyte list may be made based on specific knowledge of the origin and likely contaminants in the materials.

Soils contaminated above hazardous waste criteria will be shipped to a licensed disposal facility following any further required waste characterization or stabilization.

References

United States Environmental Protection Agency (EPA). 1992. Guide to Management of Investigation-Derived Wastes. Office of Solid Waste and Emergency Response. 9345-03FS.

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FINAL

Acoustic Fish Tracking Study Field Sampling Plan

Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling

Portland Harbor Superfund Site

AECOM Project Number: 60554349
Geosyntec Project Number: PNG0767A

March 30, 2018

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CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

March 30, 2018

Kenneth M. Tyrrell
PDI Project Coordinator
AECOM Technical Services

Date

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Appendix A. Standard Operating Procedures
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ACRONYMS AND ABBREVIATIONS

AECOM	AECOM Technical Services
ASAOC	Administrative Settlement Agreement and Order on Consent
Ballard	Ballard Marine Services
BHHRA	baseline human health risk assessment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	contaminant of concern
CSM	Conceptual Site Model
DGPS	differential global positioning system
DO	dissolved oxygen
DQMP	Data Quality Management Plan
DQO	data quality objective
DSL	[Oregon] Department of State Lands
DUO	data use objective
EPA	United States Environmental Protection Agency
FC	Field Coordinator
FS	feasibility study
FSP	Field Sampling Plan
g	gram
Geosyntec	Geosyntec Consultants, Inc.
Gravity	Gravity Marine Services,
ID	identification number
kHz	kilohertz
km	kilometer
LWG	Lower Willamette Group
m	meter
NMFS	National Marine Fisheries Service
ODFW	Oregon Department of Fish and Wildlife
PDI	pre-remedial design investigation
PHSS	Portland Harbor Superfund Site

Pre-RD AOC Group	Pre-Remedial Design Agreement and Order on Consent Investigation Group
QA	quality assurance
QAPP	quality assurance project plan
QC	quality control
RI	remedial investigation
RM	river mile
ROD	Record of Decision
Site	Portland Harbor Superfund Site
SMB	smallmouth bass
SOW	Statement of Work
USACE	U.S. Army Corps of Engineers

1. INTRODUCTION

The Record of Decision (ROD) described a post-ROD sampling effort for the Portland Harbor Superfund Site (Site or PHSS; Figure 1) located in Portland, Oregon, to delineate and better refine the sediment management area footprints, refine the Conceptual Site Model (CSM), determine baseline conditions, and support remedial design (United States Environmental Protection Agency [EPA] 2017a). Geosyntec Consultants, Inc. (Geosyntec), and AECOM Technical Services (AECOM) submitted a Work Plan for Pre-Remedial Design Investigations (PDI) on behalf of a group of industrial parties called the Pre-Remedial Design Agreement and Order on Consent Investigation Group (Pre-RD AOC Group). On December 19, 2017, EPA entered into an Administrative Settlement Agreement and Order on Consent (ASAOC) with the Pre-RD AOC Group to conduct the PDI studies at the Site (EPA 2017b). The ASAOC includes the Statement of Work (SOW) and the PDI Work Plan (an attachment to the SOW), which generally describe the field investigation activities, data analyses, schedule, and deliverables for the PDI.

These PDI studies are a focused and foundational step in what will be a multi-phase effort to update current conditions from the collection of data during the remedial investigation (RI)/ feasibility study (FS). The RI/FS was initiated by a group of potentially responsible parties known as the Lower Willamette Group (LWG) and completed by EPA in 2016 (EPA 2016a, 2016b). The RI consisted of three rounds of data collection, including surface and subsurface sediment, bank soils, surface water, sediment traps, porewater, fish tissue, and other media from 2001 through 2007.

This Field Sampling Plan (FSP) was prepared to support the acoustic fish tracking study outlined in the PDI Work Plan (Geosyntec 2017) and the project Quality Assurance Project Plan (QAPP) (AECOM and Geosyntec 2018a).

1.1 Project Setting

The PHSS is located in Portland, Oregon, on the lower Willamette River immediately downstream of the urban downtown. The Site extends from river mile (RM) 1.9 upstream to RM 11.8 and covers 2,190 acres (Figure 1). There are two reaches located immediately upstream of the Site. The Downtown Reach, which includes the urbanized area of downtown Portland, is defined by EPA as extending from RM 11.8 to RM 16.6. EPA defines the Upriver Reach as extending from RM 16.6 to RM 28.4.

1.2 Project Overview

The RI included preparation of a baseline human health risk assessment (BHHRA), baseline ecological risk assessment, and food web model (Kennedy/Jenks 2013a; Windward Environmental 2013, 2015). The BHHRA identified several persistent lipophilic compounds, including polychlorinated biphenyls, as contaminants of concern (COC) based on their bioaccumulation into fish.

The PDI studies are designed to update the RI/FS dataset and characterize current conditions, refine the CSM for all pathways consistent with the ROD, and refine delineation of active remedial areas. In addition to updating sediment, surface water, and tissue chemistry data sets, the PDI scope of work includes a year-long acoustic fish tracking program to capture fine-scale temporal and spatial movement of Smallmouth Bass (*Micropterus dolomieu*; SMB) at the PHSS.

1.3 Study Objectives and Data Uses

The overall goal of the fish tracking study is to improve understanding of fish residency and exposure areas that affect the sediment-fish tissue relationship. The study focuses on SMB (versus other resident species) because of their abundance, more limited home range, extensive historical chemistry database, and importance in the BHHRA. The specific data quality objectives (DQOs) include the following:

- Monitor resident fish movement in the lower Willamette River over an approximately 1-year period to understand seasonal movement, habitat use/preference, and home range.
- Provide a monitoring network sufficient to characterize river mile and fine-scale movement of SMB and whether tagged fish leave the PHSS.
- Generate a dataset that supports reliable estimates of home range area and bank travel distance of SMB in the PHSS.

The results of the study will be used to support the analyses identified in the PDI Work Plan. Additionally, information collected during the fish tracking study may be used to inform the 2018 fish tissue sampling program. For example, insights gained during the fish collection portion of the tracking study may be used to inform the subsequent SMB sampling (e.g., targeting certain areas within sediment decision units/targeting certain times of day/tides/flow regimes/etc.). The 3-month data download is anticipated to be available before the fish tissue sampling commences. These data will be reviewed and considered when targeting locations for capture of SMB.

2. SAMPLING DESIGN AND APPROACH

The overall sampling design, rationale for approach, DQOs, and data use objectives (DUOs) are described in the PDI Work Plan. This FSP provides the additional details necessary to ensure that execution of the study will achieve the project-specific DQOs and DUOs set out in Section 1.3 of this FSP and Section 3.2 of the QAPP (AECOM and Geosyntec 2018a). The sampling design and approach are based on the current understanding of the river system and the target fish species; the specifications and capabilities of the acoustic telemetry equipment, which have been informed by a June 2017 pilot study; and the project-specific DQOs and DUOs. This section of the FSP presents the basis of the study design, including the location and array of receivers and the targeted number of tagged fish. A sample size of 40 tagged fish has been selected for the PDI study. This number is sufficient to generate a robust dataset, even if some fish are lost over the

course of the study. A summary of prior fish tracking studies in the PHSS is presented first for context, followed by details on the proposed 2018 fish tagging study.

2.1 Previous Studies

Two prior studies have been conducted in the PHSS that provide information useful for the design of the acoustic fish tracking study. A study conducted by Oregon Department of Fish and Wildlife (ODFW) in the lower Willamette River in early 2000s used radio tracking technology to track fish movement. In 2017, a pilot study evaluated the performance of acoustic telemetry systems in the river (AECOM 2017a). Radio tracking provides "opportunistic" measurements of fish location (e.g., weekly, bi-weekly) that are not highly refined. Acoustic tracking provides a more refined understanding of fish movement in time and space.

2.1.1 2000-2003 ODFW Radio Tracking Study

From 2000 to 2003, ODFW performed a radio tracking survey of four predator species in the lower Willamette River from RM 0 to ~RM 26 (Pribyl et al. 2004). A total of 73 fish were implanted with Lotek tags (battery life ranging from 238 to 439 days), including 8 walleye, 37 northern pikeminnow, 23 SMB, and 5 largemouth bass. Radio tracking was conducted by boat on an irregular basis, about 1 to 10 days per month from May 2000 to July 2003. A total of 53 of the 73 tagged fish were relocated during radio tracking at least once (i.e., location of tagged fish was recorded by the radio receiver), including 96% of the SMB. A total of 264 relocations were recorded over the survey period. Anglers captured four radio-tagged fish. Most tagged fish were relocated offshore (defined as greater than 10% of the measured channel width to either bank), often adjacent to a structure, such as pilings or floating structures. The distribution of radio-tagged fish across the river channel indicated a preference for areas within 20% of either shoreline. For SMB, the median total distance traveled (upstream and downstream movement) was 4.3 kilometers (km) (2.7 miles), and the 25th and 75th percentiles were 0.8 km (0.5 mile) and 8.0 km (5 miles).

2.1.2 2017 Acoustic Tracking Pilot Study

In June of 2017, an acoustic fish tracking pilot study was conducted to test the technical feasibility of acoustic tracking in the lower Willamette River environment and perform a side-by-side comparison of two different acoustic telemetry systems (HTI-Vemco and Lotek Wireless) (AECOM 2017a). The pilot study assessed and confirmed the technical feasibility of acoustic tracking in the lower Willamette River system. The experimental design involved deployment of a receiver array and fixed tags at two sites (Willamette Cove and RM 11.5 East [E]) where resident SMB had previously been caught. Each site has unique acoustic properties based on bathymetry, bottom sediment composition, anthropogenic alteration, and noise; Willamette Cove was a more quiescent location and RM 11.5E a more active location with regard to boat traffic. The pilot study design was developed with the input and assistance of Karl Gustavson of EPA's Office of Superfund Research and Technology Innovation.

Each array consisted of five autonomous receivers deployed in a pattern designed to optimize detection and two-dimensional positioning of acoustic transmissions (quadrilateral with a central node). The distances of the quadrilateral nodes were within the detection specifications of each vendor's equipment (≤ 150 meters [m]). A receiver from each vendor was installed on the same mount that was securely moored such that the receiver was located about 1 m above the river bottom. Lotek tested their model WHS 4250 datalogger/receiver, which is a 416.7 kilohertz (kHz) system. HTI-Vemco tested their model VR2 receiver, which is a 180 kHz system. Three transmitters representing "tagged fish" were also deployed in stationary positions in optimal, less optimal, and sub-optimal locations relative to the receiver array. Lotek tested their JCART model 14-12 tag (combined acoustic and radio) and HTI-Vemco tested their V9 acoustic tag. All tags were set to a transmission interval of 3 seconds. The fixed receivers and transmitters were deployed for 1 week and then recovered. Tag transmission distance and positioning from the receiver array were also tested using mobile transmitters towed behind a vessel. Based on the transmission detections recorded during the pilot study, the detection efficiency and position efficiency and accuracy of each system was determined.

Overall, the detection efficiency and position efficiency and accuracy of the HTI-Vemco system was higher (AECOM 2017b).[1] Tag detection was recorded by the HTI-Vemco system at distances up to 400 m in Willamette Cove and 250 m in the noisier RM 11.5E area. Based on the pilot study, arrays with HTI-Vemco receivers spaced between 150 to 250 m (or more, depending on the site characteristics) are expected to provide reliable detection capability for fine-scale positioning of SMB. For detection only of tagged fish passing through a gate, receiver spacing of at least 200 m is expected to provide very high levels of detectability and trackability.

2.2 Rationale for Array Locations/Layout

The positioning of individual receivers is based on the physical configuration of the lower Willamette River, water depth (Figure 2), historical knowledge of contaminated areas at the Site, and the project objectives (Section 1.2). Lessons learned from the June 2017 pilot study also contributed to the design of the receiver array (AECOM 2017b). A total of 34 HTI-Vemco VR2 acoustic receivers will be installed in the river as part of this study. The layout of the acoustic receiver array will be a combination of "gates" (designed to track fish presence/absence) and more closely spaced receiver positions designed to track fine-scale fish movement in specific areas of interest.

A series of gates consisting of transects of two to three receivers will be installed at each river mile between RM 5 and RM 9 (Figure 3). These gates will track fish movement on a river mile scale in a section of the river that is representative of conditions and SMB habitat across the PHSS. Focusing on the four mile stretch in the central part of the Site also minimizes potential for tagged fish to leave the study area especially early on in the study. Based on the 2000-2003 radio-tracking study conducted in the lower Willamette River by the Oregon Department of Fish

[1] An equipment malfunction (SD card failure) in the Lotek receiver located in the central node of the Willamette Cove array compromised the detection capability of the Lotek system in this location.

and Wildlife, the travel distance of SMB is estimated to be a few miles on average. By focusing on the central part of the Site and collecting fish when they are spawning, the potential for a tagged fish to exit the study area is minimized as it would require the tagged fish to travel 3 miles upstream or downstream to exit the study area.

Gates will also be installed at the PHSS boundaries (RM 1.9, RM 11.8, and the mouth of Multnomah Channel) to track fish that enter or leave the study area. Three receivers will be deployed along each transect, except at RM 7, RM 8, and Multnomah Channel, where two receivers are expected to be sufficient due to the smaller river width, for a total of 21 receivers at the eight transects of gates. Based on the pilot study, the receivers within each transect will be spaced approximately 200 to 250 m apart.

To capture fine-scale fish movement, receiver arrays will also be installed in three areas of interest: Willamette Cove (RM 6.8 [four receivers]), Swan Island Lagoon (RM 8 [five receivers]), and near the Cargill/Glacier terminals (RM 11.5E [four receivers]). These three focused locations provide a range of SMB habitat and acoustic environments within the PHSS and represent areas of elevated COCs in sediment and SMB. The receiver layouts at the focused locations are shown on Figure 4 (Willamette Cove), Figure 5 (Swan Island Lagoon), and Figure 6 (RM 11.5E). Based on the pilot study, the receivers within each fine-scale array will be spaced approximately 150 to 200 m apart. The proposed receiver location coordinates are presented in Table 1 (final positioning will change based on the specific locations where receivers are deployed).

The key principle of the study design is that each receiver gate will not allow a tagged fish to transit past the gate without being detected. Based on the pilot study findings, the distance between receivers along a transect provides a high degree of certainty that a passing tagged fish will be detected. After a tagged fish is released, its location will be determined via transponding. The receiver technology allows for acoustic querying to determine which tagged fish have been detected and how many detections have been received. If a tagged fish then moves out of the detection range of one gate, it cannot pass the next gate either upstream or downstream without being detected. The sequence of detections then defines the location and direction of the tagged fish to the area between the upstream and downstream gates surrounding the last gate where the tagged fish was detected. Over time, the sequence of detections at the gates and arrays will inform the fish's movement within and across the 1-mile zones. At the study area end points, it is unlikely for a tagged fish to exit the study area without being detected, and it would be obvious which direction a fish is traveling if it is detected by the end gates. Likewise, it would not be possible for a tagged fish to re-enter the study area without being detected and its direction of movement logged.

For the fine-scale positioning arrays, the detection ranges of all receivers will be at least as great as the greatest dimension of the given fine-scale array. Therefore, upon approach, a tagged fish will be detected by one or more receivers long before it enters the bounds of the positioning array. Positioning a tagged fish can occur outside the bounds of the positioning array, although positioning error increases with increasing distance away from the array.

The combination of RM and fine-scale acoustic tracking of SMB over the year-long study duration (discussed in Section 2.6) is expected to provide a robust and representative dataset for characterizing the seasonal movement and home range of SMB throughout the PHSS.

Prior to deployment, AECOM will confirm station placement with the U.S. Army Corps of Engineers (USACE) Portland District to see if there is any potential for dredging in the monitoring locations over the course of the study. If there is potential dredging activity scheduled, these locations will be adjusted accordingly, and EPA will be notified of any changes.

2.3 Tagged Fish

The SMB has been selected as the species of interest for this study, as it is a prevalent, resident species with a smaller home range than other species included in the BHHRA (Kennedy/Jenks 2013a; Windward 2015). Further, a robust historical dataset on this species exists, making the SMB a good target for tissue monitoring (Section 2.1.1). A sample size of 40 tagged fish was selected for the PDI study. This number is sufficient to generate a robust dataset, even if some fish are lost over the course of the study. Consistent with the PDI SMB tissue study, SMB that are greater than 228 millimeters in total length (approximately 9 inches) will be targeted, with a preference for larger specimens. To the extent practicable, the weight of the tag (in air) will be in the range of 2-5% of the total fish body weight, but not exceed 10% of the total body weight (Adams, et al 1998; Brown, et al, 1999). The HTI-Vemco model V9 tag, with a weight of 3.7 grams, will be used. Achieving a tag-fish weight ratio of less than 10% is not expected to pose a challenge based on the weight of SMB specimens caught during several prior sampling programs in the Study Area, as summarized in the table below.

Study		SMB Body Weight		
	Sample Size	Minimum (g)	Maximum (g)	Mean (g)
2012 SMB Study	92	85	660	350
2011 SMB Study	68	140	790	377
2007 RI Sampling for SMB	136	134	1035	344

2.4 Targeted Fishing Locations

Collection of fish for the study will be targeted within the high resolution array areas (Willamette Cove, Swan Island Lagoon, and RM 11.5E), supplemented with fish collection in RM 5 – RM 9 as needed. Maps from historical fish sampling efforts as well as institutional knowledge of the Oregon Bass and Panfish Club will help guide sampling efforts. Angling efforts will be focused on locations that were productive in prior sampling events, as shown in Figure 7 (Integral 2008; GSI 2012; Kennedy/Jenks 2013b). It is anticipated that the fish collected for this effort will be representative of the resident population in the PHSS.

2.5 Sample Nomenclature

Both the acoustic receivers and the tagged fish will have a unique identifying sample identification number (ID) that includes the following, as described in the project-specific QAPP:

- Project phase (PDI)
- Sample matrix (AR [acoustic receiver] and AT [acoustic tagged fish])
- Sample type (A [acoustic receiver] and SMBT [tagged smallmouth bass]
- Unique, sequential station number (001 to ### per sample)

For example, acoustic receiver #32 would have the sample ID PDI-AR-A032, and the SMB implanted with tag #40 would have the sample ID PDI-AT-SMBT040.

2.6 Schedule

The fish tracking study is scheduled to begin in late April 2018 with deployment of receivers followed by fish tagging in early May over a period of approximately 2 to 3 weeks. Receivers will be checked monthly for operational status using a topside transponder. Data downloads are scheduled for 3 months, 6 months, and at the conclusion of the study in late March/early April of 2019. It is anticipated that the results of the 3-month data download (July 2018) will be used to inform the SMB sampling program scheduled for August/September 2018. Telemetry equipment retrieval will take place at the conclusion of the study in spring 2019.

3. PROJECT ORGANIZATION/FIELD TEAM

3.1 Team Organization and Responsibilities

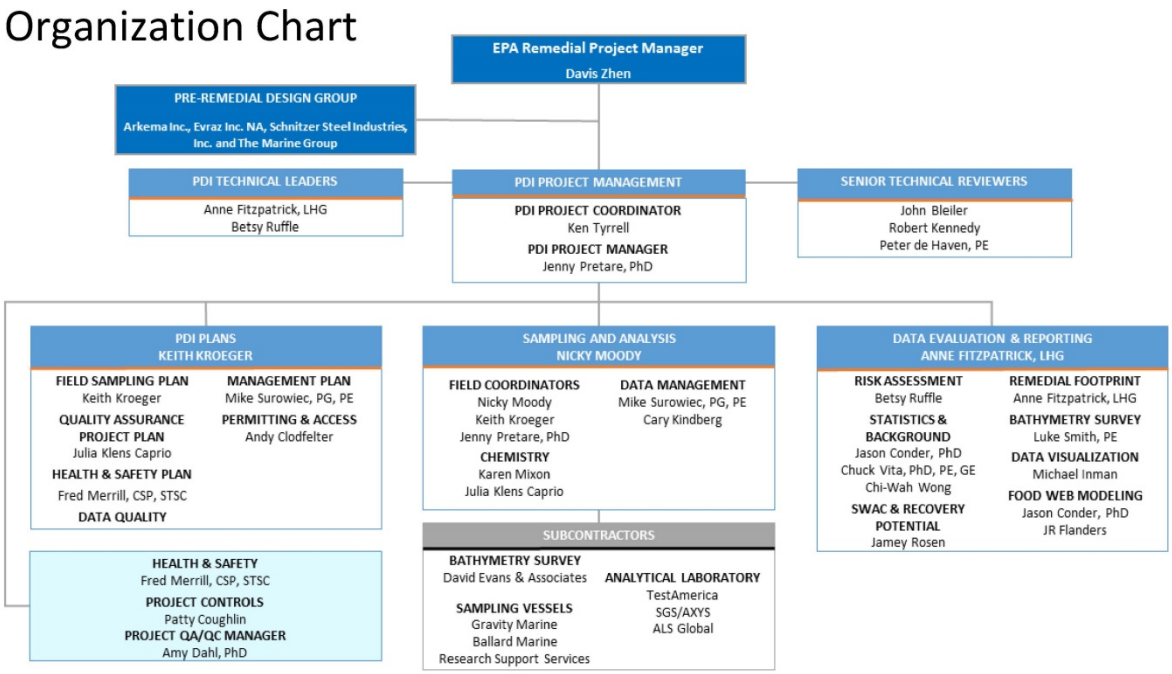
EPA is the lead agency overseeing the work. The EPA Project Manager is Mr. Davis Zhen. EPA will be assisted in the review of technical documents by an oversight contractor.

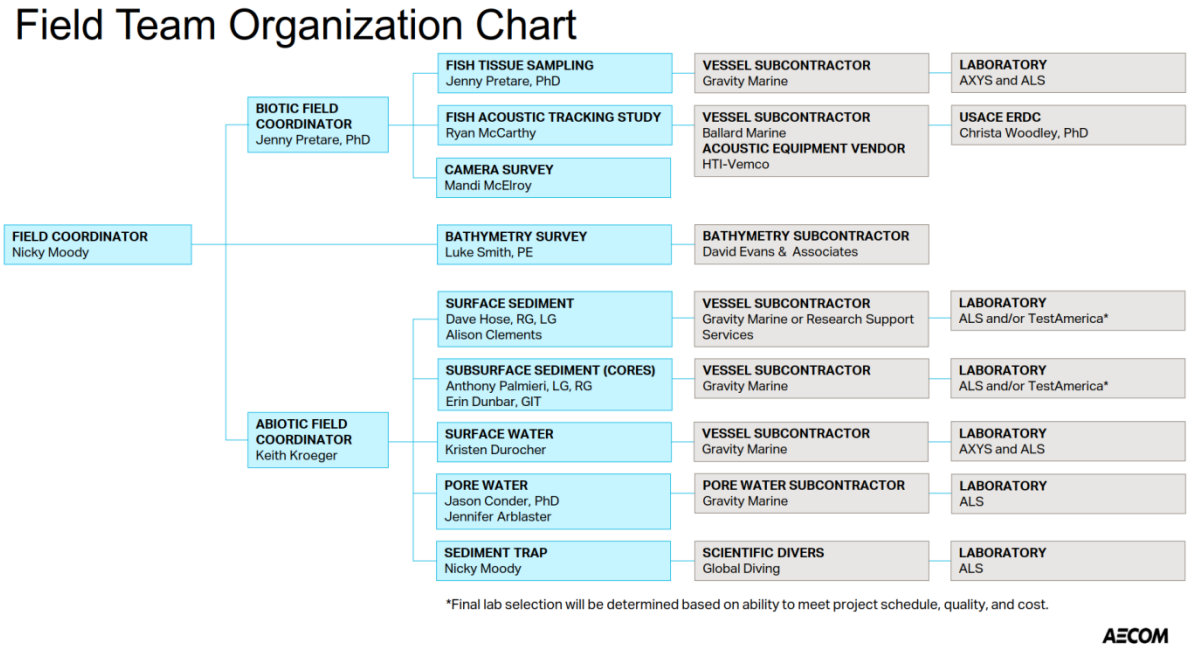
Team organization is presented in detail in the PDI Work Plan and in Section 2 of the QAPP. Project organizational charts are presented below. As it relates to this FSP, AECOM is coordinating activities, including management of all subcontractors, field sampling, analysis, and reporting scoping tasks.

The PDI Project Coordinator, Mr. Ken Tyrrell, and PDI Project Manager, Dr. Jennifer Pretare, Ph.D. (AECOM), will be responsible for overall project coordination and providing oversight on planning and coordination, work plans, all project deliverables, and performance of the administrative tasks needed to ensure timely and successful completion of the project. Ms. Betsy Ruffle (AECOM) will serve as the senior technical lead for this study.

Ms. Nicky Moody (AECOM) and Mr. Keith Kroeger (Geosyntec) will be the Project Field Coordinators (FCs) and will be responsible for managing field activities and general field quality assurance/quality control (QA/QC) oversight. The fish tracking task will be led by Mr. Ryan McCarthy (AECOM), who led the pilot study, with support from Mr. Steve Pagliughi, an AECOM senior fishery biologist with extensive experience with SMB and fish telemetry studies.

Ballard Marine Services (Ballard), of Washougal, Washington, will provide vessel support during the deployment of the acoustic moorings and monthly field checks, with Mr. Robert Stanton acting as the point of contact. Gravity Marine Services (Gravity), of Fall City, Washington, will provide vessel support during fish collection and tag implant, with Mr. Shawn Hinz acting as the point of contact. HTI-Vemco of Seattle, Washington, will provide telemetry support, including provision of telemetry equipment, supporting receiver deployment and tag implantation, and performing preliminary post-processing and data analysis. Mr. Sam Johnston will serve as the HTI-Vemco point of contact. Both Ballard and HTI-Vemco participated in the pilot study. Dr. Christa Woodley, Senior Aquatic Biologist with the USACE Engineer Research and Development Center, who also participated in the pilot study, will provide expert assistance and review.





3.2 Communication/Information Flow

The communication strategy is outlined in Section 2 of the QAPP. The FC will be the point of contact for field staff during the implementation of this FSP. Deviations from this FSP or the project-specific QAPP will be reported to the PDI Project Coordinator for consultation. Significant deviations from the FSP/QAPP will be further reported to representatives of the Pre-RD AOC Group and EPA.

3.3 Coordination with EPA

The PDI Project Coordinator will notify the EPA Project Manager 1 week prior to beginning any field activities so that EPA can schedule any oversight activities required. The PDI Project Coordinator will also notify the EPA Project Manager once field activities have been completed.

4. FIELD WORK TASKS AND PROCEDURES

The following sections describe the procedures and methods that will be used during the acoustic fish tracking study. These procedures include receiver/mooring deployment, fish collection, tag implantation, data downloading, and mooring recovery activities, as well as recordkeeping and field quality control procedures. It is currently anticipated that this work will commence in April 2018 and will be 1 year in duration. All field work will be conducted in accordance with the project-specific Health and Safety Plan (AECOM and Geosyntec 2018b). Standard Operating Procedures (SOPs) associated with the fish tracking program are provided in Appendix A.

4.1 Sampling Vessels and Equipment

Fish collection activities will be performed on vessels provided by a subcontractor (Gravity Marine, supported by the Oregon Bass and Panfish Club). These boats will be equipped with aerated livewells in order to store/transport fish between the collection site and the landside surgery station, which will be located in Swan Island Lagoon at Fred Devine Diving and Salvage facility (6211 North Ensign Street, Portland).

Receiver mooring deployment, data download, and recovery activities will be performed on research work vessels provided by Ballard. The vessels will provide a wide, stable platform and be equipped with a davit arm suitable for safely lifting and deploying heavy loads (e.g., 100 pounds). Monthly routine monitoring may be performed using smaller vessels, depending on availability and river conditions.

4.2 Permits/Notifications

The study will involve the collection of approximately 40 SMB using hook-and-line methods, surgical implant of an acoustic tag, and subsequent release back to the river following a recovery period. All non-target sized SMB or other fish incidentally captured will be immediately and safely returned back to the river.

The lower Willamette River supports five federally threatened salmonid species that could be incidentally captured during hook-and-line fishing. Section 4(d) of the Endangered Species Act directs the National Marine Fisheries Service (NMFS) to issue authorizations for scientific research projects that may result in incidental take (harm or harassment) of federally threatened species. The ODFW also requires a scientific taking permit to collect fish from the waters of the state for scientific purposes. However, Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) 121(e)(1) and the National Contingency Plan (40 CFR

300.400(e)(1)) exempt the requirement for federal, state, or local permits for on-site response actions conducted pursuant to CERCLA.

The Pre-RD AOC Group submitted a letter to EPA describing the program-wide approach to permit equivalencies on February 16, 2018. The AECOM PDI Project Coordinator and/or PDI Project Manager will continue to work with EPA on refining and implementing this approach. As described in the permit equivalencies letter, an Oregon Department of State Lands (DSL) General Authorization for Minimal Disturbance and a DSL Access Agreement will be obtained, along with an ODFW Scientific Taking Permit. The project team is coordinating with NMFS regarding Endangered Species Act listed resources in the study area.

4.3 Station Positioning/Navigation

The Ballard research vessel will navigate to each proposed mooring location using a differential global positioning system (DGPS) unit with an accuracy of 1 to 2 m (SOP-05, Recording Sample Collection Locations). The DGPS accuracy will be confirmed each morning and evening to a known land-based survey point. Confirmed deployment locations will be recorded to the nearest whole international foot in North American Datum 1983 (NAD83), National Spatial Reference System (NSRS) 2007. Once the vessel has navigated to the proposed deployment location, the field team will visually confirm the location and surroundings against the proposed receiver array maps (Figures 3 through 6) prior to deployment. The locations depicted on the figures are approximate, as actual deployment locations will be dictated by conditions encountered in the field.

4.4 Acoustic System Components

The major components of the acoustic system are the HTI-Vemco Model HR2 receiver and the Model V9 tag (180 kHz). The internal clocks in receivers will all be synchronized to an external GPS receiver prior to deployment. The HTI-Vemco HR2 receivers are expected to have sub-meter positional accuracy.

The acoustic receivers will be mounted to fixed moorings placed on the bottom of the lower Willamette River (Figure 8). The bottom mounts will be fabricated prior to the commencement of the study. The mooring platforms will consist of a purpose-built metal frame that has been designed for easy deployment and retrieval of the system (Figure 9). A ground line will be attached as a backup in the event that an acoustic release fails or is damaged. If determined to be practical, the ten bottom mounts that were used for the 2017 Pilot Study may be reused for this study. These moorings will be outfitted with an acoustic release for periodic downloading and maintenance.

According to the tag manufacturer (HTI-Vemco), fine suspended particulates do not significantly affect detection ranges at 180 kHz until the concentration is very high, and/or the particles are

relatively large (similar to sand grains).[2] During the course of the study, the signal strength of transmissions between receivers at each detection gate and at the positioning arrays will be measured every 30 seconds. If there is significant reduction of detection range due to attenuation caused by increased turbidity, it can be quantified and time periods when detection ranges are reduced can be characterized. There may be times of reduced detectability when special events occur (e.g., a large tug passing nearby); however, it is expected that these times will be limited in duration.

In the three focus areas (Willamette Cove, Swan Island Lagoon, and RM 11.5E), the receivers in each array will be anchored to the bottom and have a tethered cable to shore, given the proximity to shore and assuming property access agreements are obtained. The final locations of the cabled receivers will be confirmed after a Site visit and final approval(s) of property access.

4.5 Mooring/Receiver Deployment

Receivers will be attached directly to the moorings and configured to have the receiver submerged approximately 1 m above the river bottom such that it will not be damaged by vessel traffic or impede navigation. Each mooring will have a submerged float, which will aid in retrieval. The on-deck davit on the research vessel will be used to hoist the mooring and gently place it on the river bottom. The receiver mount system was successfully used in the 2017 pilot study and was effective in terms of performance, security, and safe deployment/retrieval.

The Vemco HR2 180 kHz receivers planned for this study transmit a unique ID code every 25-35 seconds. It is anticipated that at least one receiver will be in close enough proximity for the receivers to detect each other's regular transmissions. During deployment and set-up of the stationary receiver array, transponding will be performed using a boat-mounted VR100 receiver to determine which receiver(s) are within range and how many detections have been stored for each one. Within the fine-scale positioning arrays, each receiver's transmissions will be used with the other receivers in each array to position each receiver in two dimensions. Tag drags will be conducted to verify maximum detection ranges and coverage. A fixed "beacon" or sentinel tag may be added at locations where transponding or tag drags indicate that receiver reception is challenged (e.g., higher noise areas) to provide a continuous time series of positioning error measurement and assess any change in receiver detectability over the course of the study. Additionally, the receiver moorings will be checked for tilt, to ensure that they are sitting flat on the river bottom and have not been deployed on a slope or fallen over. Receiver locations will be modified as needed in order to achieve the desired coverage and to optimize detection resolution in specific areas.

The location of each receiver will be surveyed using a DGPS when deployed. These station positions will be recorded on the pre-deployment checklist (included in Appendix B). Each time

[2] For over 18 years, HTI has used 307 kHz acoustic tag tracking systems (which should be much more susceptible to changes in absorption due to turbidity than 180 kHz) with no reduction in detectability throughout the highest flow periods (spring and early summer) on the Columbia, Sacramento, and other rivers.

a receiver is recovered for download or replaced, the field team will resurvey the receiver's location.

4.5.1 Monthly Field Checks

Acoustic receivers will be checked for presence, maintenance, and functionality approximately once every month. A Ballard vessel will be used for this task. The receiver's internal transponder allows for remote monitoring of tilt, temperature, battery level, available storage space, and noise levels, reducing the number of times the receiver needs to be hauled to the surface for operational checks and redeployed with new GPS coordinates. A surface communication deck box will be used for remote communications with the deployed receivers.

4.5.2 Data Downloading

Acoustic receivers will be manually retrieved, and acoustic data from the receiver will be downloaded directly via USB cable to a field computer. The receivers will be evaluated for functionality and cleared of any biofouling growth. Acoustic receivers will also be visually examined for any obvious defects or necessary repairs, and batteries will be replaced. Data downloading will be performed at 3 months, 6 months, and at the conclusion of the study (12 months). Upon re-deployment, a new GPS station position will be recorded. Once the maintenance check has been performed and the data have been downloaded, the field team will proceed to the next acoustic receiver until all receivers have been visited. Once data has been retrieved, it will be managed according to the project Data Quality Management Plan (DQMP; AECOM and Geosyntec 2018c).

4.5.3 Mooring/Receiver Recovery

At the conclusion of the study, all receiver/moorings will be collected from the river bottom. It is not anticipated that any equipment will be left behind. If the acoustic releases do not actuate, a grapple hook will attempt to snag the ground/back-up line attached to the receiver mooring.

4.5.4 Receiver Contingency Plan

Regular transponding efforts will verify that receivers are functioning properly and detecting tagged fish and other receivers. If during the course of the study, a receiver is observed to be damaged or non-functional, all practical attempts will be made to promptly retrieve it, recover the data, and restore receiver function. If the receiver is determined to be missing or irreparable, it may be replaced dependent on discussions with the Pre-RD AOC Group and EPA. Factors to consider for replacement may include the following:

1) How much time is left in the proposed study period?

2) Has this array been productive from a data perspective (i.e., many observations of SMB)?

3) Is it likely that this receiver may be damaged/vandalized again if deployed at the same location?

4) Would there be significant impacts to overall DQOs?

The Seattle, Washington, office of HTI-Vemco has a pool of Vemco HR2 180 kHz receivers that could be deployed to the Site within a few days should it be necessary to replace a receiver.

4.6 Fish Collection and Tagging

4.6.1 Fish Collection

Fish for acoustic tagging will be collected by hook-and-line angling techniques using artificial lures (SOP-04, Fish Collection). Contract anglers from the Oregon Bass and Panfish Club will be employed to capture SMB. Each subcontracted angler vessel will be outfitted with a GPS to record capture locations and an onboard or side-mounted tank or "livewell" for transporting/holding caught SMB. A maximum of four SMB will permitted to be held in livewells at any given time. Each livewell will be filled with river water that is kept aerated, cleared of all potential snags, and cooled (if necessary). This will keep the fish alive after capture so the fish can be safely transported to the surgery station. Fish will be carefully handled and cared for prior to and after surgeries.

A fish collection datasheet will be filled out immediately after a candidate specimen is captured (sheets are presented in Appendix B). A GPS coordinate will be electronically collected (SOP-05, Recording Sample Collection Locations). Each fish will be given a unique sample ID on the fish collection datasheet, and this number will be used to name the capture location point file. Sample identification nomenclature will follow the guidelines detailed in Section 2.5 of this FSP and the SOPs in Appendix A (SOP-03, Field Documentation; SOP-06, Sample Labeling). After a fish is surgically implanted with an acoustic tag at the surgery station (Section 4.6.2), the tag code and sample ID will be recorded on the fish collection datasheet in order to link the tag code to the collection location. Therefore, it will be necessary to be able to identify each captured individual between the time of capture and the time of acoustic tag implantation. Maximum total length, fork length, (in millimeters) and weight (in pounds [0.00]) will also be recorded on the fish collection datasheets immediately after capture to identify individuals. This approach will allow identification of individuals and eliminate having to mark or attach a numbered culling buoy to each individual, thus avoiding potential marking injuries that may affect post-release survival and behavior. Pre- and post-surgery livewells will also have unique IDs so the fish can be accurately tracked through the surgery and eventual release.

Landing nets will not be used to land fish in order to avoid potential injuries to captured fish and maintain tagging candidates in the best possible condition. Captured SMB having hooking or other injuries and/or displaying obvious abnormal behavior (e.g., sluggishness, erratic swimming) will not be implanted with an acoustic tag. Abnormal behavior will be determined by the best professional judgement of the on-site fisheries biologists. If at any point abnormal behavior is observed, the fish will be sacrificed and the fish will be retained for potential chemical analysis (Section 4.6.4 below).

4.6.2 Acoustic Tag Implantation

Surgical implantation will be performed by HTI-Vemco field biologists experienced in acoustic fish tag implantation procedures with assistance from AECOM biologists in accordance with SOP-07 (Appendix A). A secure, sterile, land-based surgical station will be established prior to the commencement of the study and will be assembled and disassembled each day (SOP-01, Decontamination). The surgery station will be located at the moorage location at Fred Devine Diving and Salvage facility at 6211 North Ensign Street, which has ready access to the river. Holding pens/livewells will be on-site to retain fish prior to surgery, during recovery, and before release.

A portable electronarcosis system will be utilized by HTI-Vemco field biologists to anesthetize SMB during surgical implantation procedures. The electronarcosis system consists of a modified 153 liter marine cooler, fish cradle, and a variable power generation system. The electronarcosis system is based on designs described in Hudson et al. 2011. Prior to being placed in the electronarcosis system, each SMB will be photographed (SOP-02, Digital Camera Use and Documentation Procedures) and have scales removed for age dating. Scales will be removed from the area posterior to the pectoral fin and slightly below the lateral line (DeVries and Frie 1996); scale samples will be placed in wax paper, and placed in a coin envelope with the sample date and associated sample identification number clearly written on the outside of the envelope.

Each SMB will be placed ventral side up in the cradle within the electronarcosis system with the anterior end of the fish pointed towards the anode. SMB will be submerged deep enough in the water to cover the gills. Multiple aquarium bubblers will provide and maintain adequate dissolved oxygen (DO) levels during surgery. An on-site fisheries biologist will monitor DO levels in the livewells and will record this information on the datasheets. Maintaining the oxygen level near saturation in the surgery station livewell potentially results in higher blood oxygen levels during anesthesia, which aids in post-surgery recovery (Itazawa and Takeda 1982). Using a DC power supply, voltage will be slowly increased until induction (surgical anesthesia) is achieved (Coyle et al. 2004; Hudson et al. 2011).

Prior to and after each surgery, acoustic tags, hemostats, sutures, and scalpels will be disinfected. Following a small incision in the midline area, a pre-programmed HTI-Vemco Model V9 acoustic tag will be activated and inserted through the incision and into the abdominal cavity. Each acoustic tag will be programmed with a unique code/number in order to identify the individual fish, and the acoustic tag code/number will be recorded on the fish collection datasheet. After tag insertion, the incision will be closed with two simple interrupted sutures. A small external tag (T-bar tag or equivalent) will be attached to the SMB just behind the dorsal fin, and the SMB will be removed from the electronarcosis system, placed in a well oxygenated recovery livewell, and carefully observed for post-surgery behavior. SMB should fully recover within 2 minutes after being removed from the electronarcosis system; each surgical procedure will take approximately 30 minutes.

4.6.3 Fish Recovery/Release

Tagged fish will be placed in an aerated recovery tank for at least 2 hours and up to 1 day prior to release to ensure that there are not any post-surgery complications or mortalities. Tagged fish that regain equilibrium and exhibit controlled movement will be released. To the extent practicable, fish will be released back into the river in the vicinity of where they were originally caught. The coordinates of the release location for each fish will be recorded on the field data sheet.

4.6.4 Fish Mortality

To the extent practicable, every attempt will be made to prevent any inadvertent mortalities of SMB captured and/or tagged during the study. However in the event that a mortality does occur, the fish may be considered for tissue chemistry analysis as part of the baseline fish tissue sampling described in the Fish Tissue FSP (AECOM and Geosyntec 2018d). In this case, the individual fish will be wrapped in aluminum foil, labeled, and placed in a gallon-sized, zip top bag. Fish collected in this manner will be submitted to the project selected analytical laboratory for cold storage (+/- 4°C) until a decision can be made regarding analysis. The data necessary for including the fish as a future tissue chemistry sample (e.g., location captured, size, age, etc. per the Fish Tissue FSP) will be recorded in order to ensure that DQOs are met.

4.6.5 Contingency Fish Tagging Event

The sample size of 40 tagged fish was selected assuming that some loss, due to mortality or leaving the study area, would occur over the year-long study duration. As few as 20 to 30 tagged fish are expected to provide the data needed to characterize SMB movement and home range.[3] The data from the June and July monthly monitoring and the 3-month data download in early August will be evaluated to determine the total number of tagged fish residing in the 10-mile study area and the number of detections of each tagged fish. A second tagging event will be performed in conjunction with the late August/early September 2018 SMB tissue sampling if the total number of tagged fish that have been detected at least monthly falls below 20. A minimum of 10 and up to 20 additional SMB will be tagged and tracked for the remainder of the study period. Consistent with the initial tagging event, the additional SMB will be targeted within the high resolution array areas, supplemented with fish collection in RM 5 to RM 9 as needed.

4.7 Decontamination

The physical environment implantation surgeries are performed in is an important consideration that determines the quality and success of the procedure. The surgical environment will be maintained in a sterile condition throughout all procedures. The surgical station will be intermittently cleaned and wiped down with a solution of disinfectant; reusable surgical instruments will be placed in a disinfectant bath before and after surgical procedures. Surgical

[3] A total of 23 SMB were tagged during the 2000-2003 radio-tracking study of the lower Willamette River from RM 0 to Willamette Falls (Pribyl et al. 2004). A total of 11 SMB were tagged in 2000, nine were tagged in 2002, and three were tagged in 2003. The results of this study were used by EPA to determine the 1-mile exposure areas for SMB in the Portland Harbor RI/FS.

instruments will be transferred to a freshwater rinse bath before surgery. All equipment used for capture, holding, anesthesia, surgery, recovery, and movement of fish during the project will be thoroughly cleaned and disinfected to minimize the potential for any biological interferences.

4.8 Management of Investigation-Derived Waste

Fish collected but not retained for surgery will be returned to the lower Willamette River area from which they were collected or sacrificed and retained for potential chemical analysis. Water used for decontaminating the sample processing equipment will be collected and then returned to the lower Willamette River. Only biodegradable, phosphate free detergents will be used for decontamination (e.g., Liquinox®). Other consumables such as disposable sampling equipment, fish surgical tools, and gloves will be bagged for disposal and managed as a solid waste and discarded as general municipal waste. A disposable sharps container will be on-site for safe collection/disposal of any sharps waste.

5. DATA MANAGEMENT AND REPORTING

All data management will be performed according to the QAPP and DQMP.

5.1 Field Documentation and Reporting

A bound field logbook will be assigned to and maintained by AECOM field team members to provide daily records of significant events, observations, and measurements during the field effort. Each page will be numbered, signed, and dated. These logbooks will be kept as permanent records. Complete field record keeping details can be found in the project QAPP (AECOM and Geosyntec 2018a).

A brief activity log will be filed with the FC at the completion of each working day. This log will summarize the work activities undertaken/completed each day, progress, personnel on-site, hours worked, health and safety concerns, and any technical issues encountered. Field logbooks and field data sheets completed during fish collection and implantation activities will be scanned and emailed to the Technical Lead at the conclusion of each working day (or as soon as practically possible).

5.2 Data Processing

The fish tracking data collected from the acoustic receivers during the study will be provided in raw and data-processed formats. The data will be compiled and processed using HTI's software (Acoustic Tag Software Suite and MarkTags) in order to identify valid tag returns within the raw data. The valid detections will then be compiled into a single detection history for each fish. This detection history will be further processed to identify false/erroneous events to remove spurious data points. Once the data are processed and proofed, the data will be used to create fish tracks/positions (where possible). The gated portion of the system can only provide a presence/absence data point and indicate whether a fish was within the receiver detection range.

The post-processed data sets from the high-resolution and gated receivers will be combined and imported into a Microsoft Access database.

5.3 Quality Review

A series of QA/QC steps will be implemented to ensure data integrity. Monthly checks of the receiver network will be performed to ensure system functionality and proper data collection. The data will be processed on HTI's software (Acoustic Tag Software Suite and MarkTags) to evaluate the data for accuracy/usability. If problems with the systems are detected/identified during the monthly checks, they will be corrected using remote access to the collection equipment, or field crews will be dispatched as soon as possible to visit the site and correct the problems.

The monthly transponding will allow for determining data collection continuity for each receiver, as well as the number of detections received for each tagged fish. These data will be compiled and reviewed monthly to assess overall system performance, including receiver performance. The 3-month and 6-month data downloads will also be evaluated to assess the detection range and efficiency and any changes over time. If a tagged fish is not detected by any receiver for some time, the VR100 transponder may be used as a mobile receiver to locate tagged fish in areas not near the detection gates or the fine-scale positioning arrays. The need to conduct any mobile transponding to locate "missing" tagged fish over the course of the study would be discussed with EPA.

5.4 Reporting Frequency

Brief field summary reports will be provided to EPA following the 3-, 6-, and 12-month data downloads. Equipment specifications including system and tag operating parameters, calibrations, and results of pre-installation testing will be included in the summary reports. Methods, analyses, and results for all testing procedures including establishing range and efficiency calculations will be documented and presented in standard scientific reporting format.

The overall results of the study will be discussed and presented in a final report that will specifically address the key questions identified in the study objectives in Section 1.2, identify plan deviations, and summarize field collection activities.

5.5 Plan Deviations

Deviations to this FSP potentially include the monitoring of alternate stations or scope reductions/enhancements related to site conditions or real-time information. Safety will be given the highest priority in all aspects, and the Field Coordinator will be responsible for documenting all plan deviations and contacting the Project Technical Lead or PDI Project Manager to discuss these at the earliest convenience, preferably before deviations are undertaken, if possible.

5.6 Data Management and Retention

All related documentation is to be maintained in the project file either in electronic or hardcopy form. All hardcopy records will be maintained in the project file; all electronic records will be maintained in project-specific directories within AECOM's network and a final Electronic Data Deliverable will be provided to EPA at the conclusion of the PDI study.

6. REFERENCES

Adams, N. S., D. W. Rondorf, S. D. Evans, J. E. Kelly, and R. W. Perry. 1998. Effects of surgically and gastrically implanted radio transmitters on swimming performance and predator avoidance of juvenile Chinook salmon (Oncorhynchus tshawytscha). Canadian Journal of Fisheries and Aquatic Sciences 55:781–787.

AECOM (AECOM Technical Services). 2017a. Lower Willamette River – Acoustic Fish Tracking Pilot Study Work Plan. Portland Harbor Superfund Site, Portland, Oregon. May 2017. Prepared by AECOM for ExxonMobil. Submitted to EPA Region 10.

AECOM. 2017b. Summary of Fish Tracking Pilot Study – Lower Willamette River. Technical Memorandum. September 12, 2017. Prepared by AECOM for ExxonMobil. Submitted to EPA Region 10.

AECOM and Geosyntec (Geosyntec Consultants, Inc.). 2018a. Quality Assurance Project Plan, Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling. Portland Harbor Superfund Site. March.

AECOM and Geosyntec. 2018b. Programmatic HAZWOPER Health and Safety Plan. Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling. Portland Harbor Superfund Site. February.

AECOM and Geosyntec. 2018c. Data Quality Management Plan, Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling, Portland Harbor Superfund Site. February.

AECOM and Geosyntec. 2018d. Fish Tissue Field Sampling Plan, Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling, Portland Harbor Superfund Site. March.

Brown, R. S., S. J. Cooke, W. G. Anderson, and R. S. McKinley. 1999. Evidence to Challenge the “2% Rule” for Biotelemetry. North American Journal of Fisheries Management 19:867-871.

Coyle, S. D., R. M. Duborow, and J. H. Tidwell. 2004. Anesthetics in Aquaculture. U.S. Department of Agriculture, Southern Regional Aquaculture Center, Publication No. 3900.

DeVries, D. R., and R. V. Frie. 1996. Determination of Age and Growth. Pages 483-512 *in* B. R. Murphy and D. W. Willis, editors. Fisheries Techniques, second edition. American Fisheries Society, Bethesda, Maryland. 732 pp.

EPA (United States Environmental Protection Agency). 2016a. Portland Harbor RI/FS, Final Remedial Investigation Report, Portland Oregon. United States Environmental Protection Agency Region 10, Seattle, Washington. 8 February.

EPA. 2016b. Portland Harbor RI/FS, Final Feasibility Study, Portland Oregon. United States Environmental Protection Agency Region 10, Seattle, Washington. June.

EPA. 2017a. Record of Decision Portland Harbor Superfund Site, Portland Oregon. United States Environmental Protection Agency Region 10, Seattle, Washington. January.

EPA. 2017b. ASAOC between US EPA and the Pre-RD AOC Group for Pre-Remedial Design Investigation Studies, Portland Harbor Superfund Site, Portland Oregon. United States Environmental Protection Agency Region 10, Seattle, Washington. 19 December.

Geosyntec. 2017. Pre-Remedial Design Investigation Work Plan. Portland Harbor Superfund Site. Prepared for the Portland Harbor Pre-Remedial Design Group. December 19.

GSI. 2012. Portland Harbor 2011 Baseline Smallmouth Bass Tissue Study. Field Sampling Report. Prepared for U.S. EPA, U.S. Army Corps of Engineers, and City of Portland. June.

Hudson, J. M., J. R. Johnson, and B. Kynard. 2011. A Portable Electronarcosis System for Anesthetizing Salmonids and Other Fish. North American Journal of Fisheries Management 31:335-339.

Integral. 2008. Round 3B Fish and Invertebrate Tissue and Collocated Surface Sediment Data Report. Portland Harbor RI/FS, Portland Oregon. Prepared for U.S. Environmental Protection Agency and Lower Willamette Group. 8 August.

Itzawa, Y., and T. Takeda. 1982. Respiration of Carp under Anesthesia Induced by Mixed Bubbling of Carbon Dioxide and Oxygen. Bulletin of the Japanese Society of Science and Fisheries 48(4):489-493.

Kennedy/Jenks. 2013a. Final Baseline Human Health Risk Assessment. Portland Harbor RI/FS. Prepared for Lower Willamette Group and U.S Environmental Protection Agency. March 28, 2013.

Kennedy/Jenks. 2013b. Portland Harbor RI/FS, 2012 Smallmouth Bass Tissue Study, Data Report. Draft. Prepared for Lower Willamette Group. March 13, 2013.

Pribyl, A.L., J.S. Vile, and T.A. Friesen. 2004. Population Structure, Movement, Habitat Use, and Diet of Resident Piscivorous Fishes in the Lower Willamette River, 2005. In: Biology, Behavior, and Resources Resident and Anadromous Fish in the Lower Willamette River. Final Report of Research, 2000-2004. Edited by Thomas A. Friesen. March 2005.

Windward Environmental. 2013. Final Baseline Ecological Risk Assessment. Prepared for Lower Willamette Group. Appendix G of the Portland Harbor RI/FS. Submitted to U.S. Environmental Protection Agency. December 16, 2013.

Windward Environmental. 2015. Bioaccumulation Modeling Report. Revised Draft. Prepared for Lower Willamette Group. Submitted to U.S. Environmental Protection Agency. June 19, 2015.

TABLES

Table 1. Coordinates of Proposed Receiver Locations

	Proposed Location Coordinates (NAD 1983, Intl Feet) [a]	
Receiver ID	**Easting**	**Northing**
PDI-AR-A01	7617785	725573
PDI-AR-A02	7617159	725997
PDI-AR-A03	7616627	726410
PDI-AR-A04	7613373	720491
PDI-AR-A05	7613329	720241
PDI-AR-A06	7620316	711291
PDI-AR-A07	7619786	710986
PDI-AR-A08	7619351	710760
PDI-AR-A09	7623346	707348
PDI-AR-A10	7622976	706944
PDI-AR-A11	7622675	706598
PDI-AR-A12	7626823	705692
PDI-AR-A13	7626771	705455
PDI-AR-A14	7627349	705607
PDI-AR-A15	7627114	705360
PDI-AR-A16	7627510	704330
PDI-AR-A17	7627033	703825
PDI-AR-A18	7631922	701400
PDI-AR-A19	7631107	700551
PDI-AR-A20	7630513	699906
PDI-AR-A21	7632710	701760
PDI-AR-A22	7633412	701735
PDI-AR-A23	7633178	701324
PDI-AR-A24	7633956	701070
PDI-AR-A25	7635076	697378
PDI-AR-A26	7634788	696950
PDI-AR-A27	7634459	696383
PDI-AR-A28	7644382	688077
PDI-AR-A29	7644821	688359
PDI-AR-A30	7645142	687911
PDI-AR-A31	7644791	687638
PDI-AR-A32	7645511	687193
PDI-AR-A33	7645322	687027
PDI-AR-A34	7645129	686858

Notes:

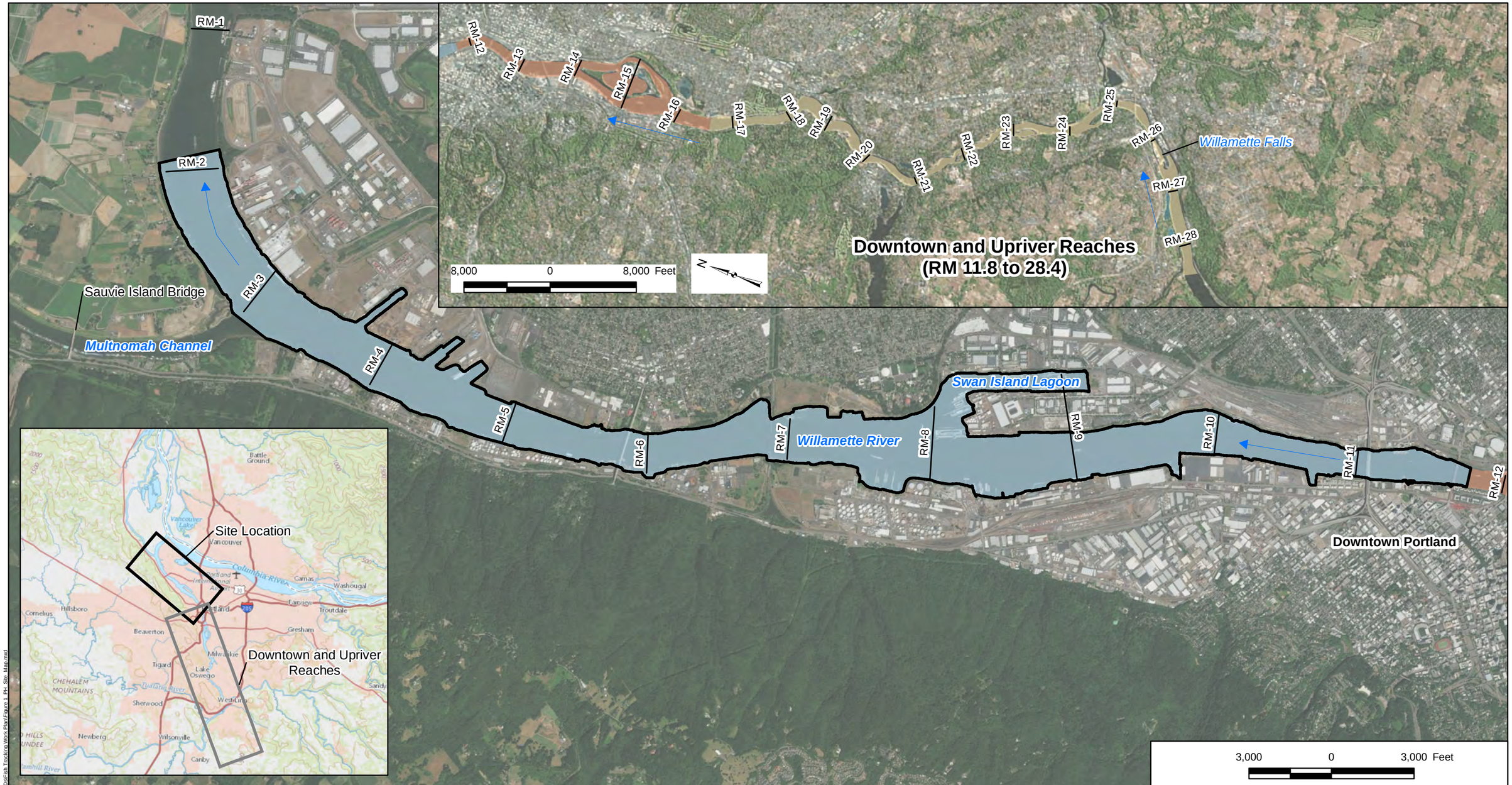
a) Horizontal Projection: NAD 1983 Oregon State Plane North (Intl Feet)

Acronyms:

ID = identification number

NAD = North American Datum

FIGURES



Legend

- Flow Direction
- River Mile Marker
- Superfund Site Boundary (RM 1.9 to 11.8)

Study Area

- Site Area (RM 1.9 to 11.8)
- Downtown Reach (RM 11.8 to 16.6)
- Upriver Reach (RM 16.6 to 28.4)

Note:
1. Aerial Imagery provided by ESRI Basemaps 2016

Portland Harbor Site Map

Portland Harbor Superfund Site
PDI Fish Tracking FSP

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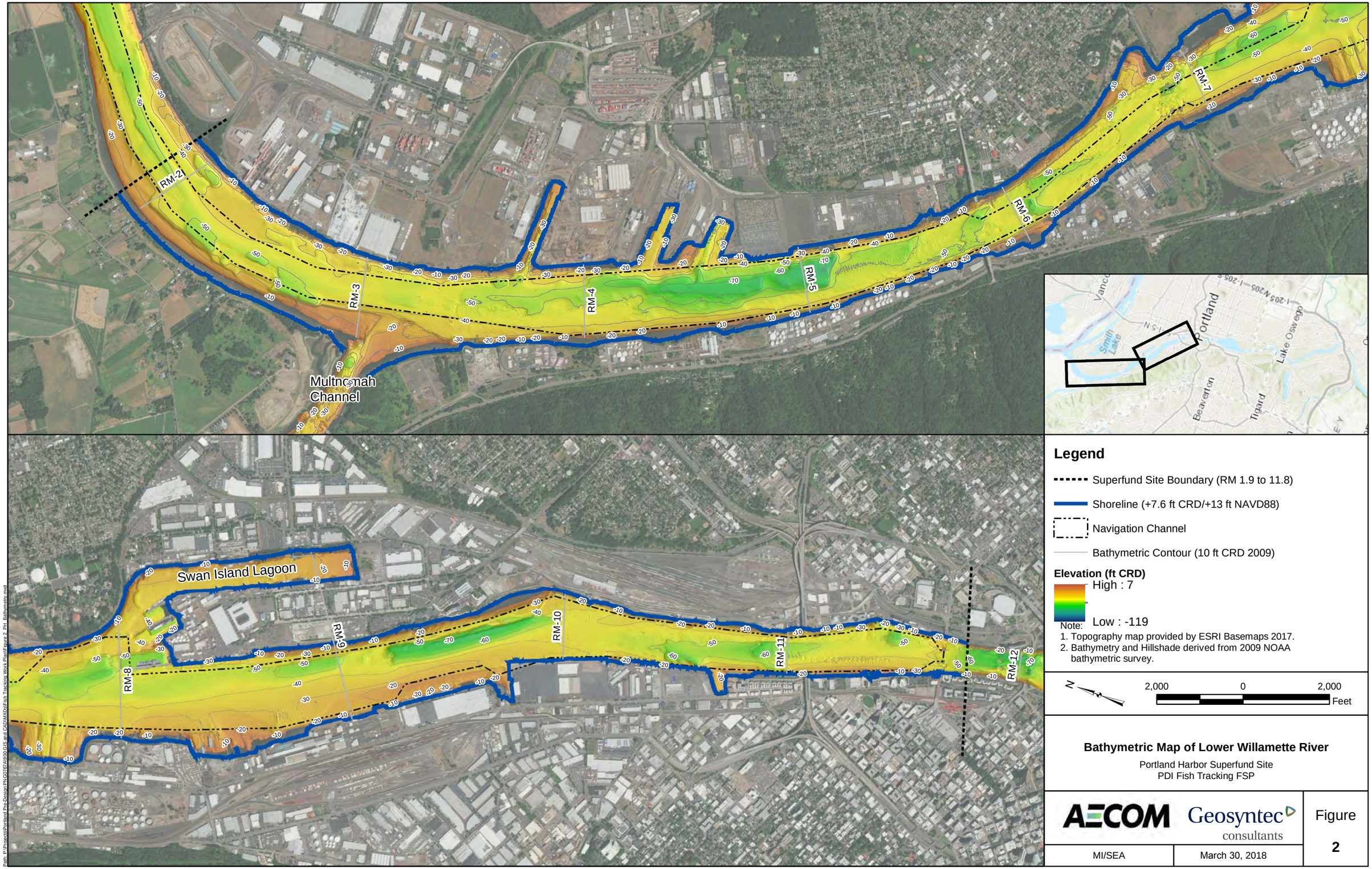
Figure 1

MI/SEA | March 30, 2018

Path: P:\Projects\Portland Pre-Design PNG0767A\900 GIS and CAD\MXDs\Fish Tracking Work Plan\Figure 1_PH_Site_Map.mxd



Bathymetric Map of Lower Willamette River

Portland Harbor Superfund Site
PDI Fish Tracking FSP

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MI/SEA	March 30, 2018	Figure 2

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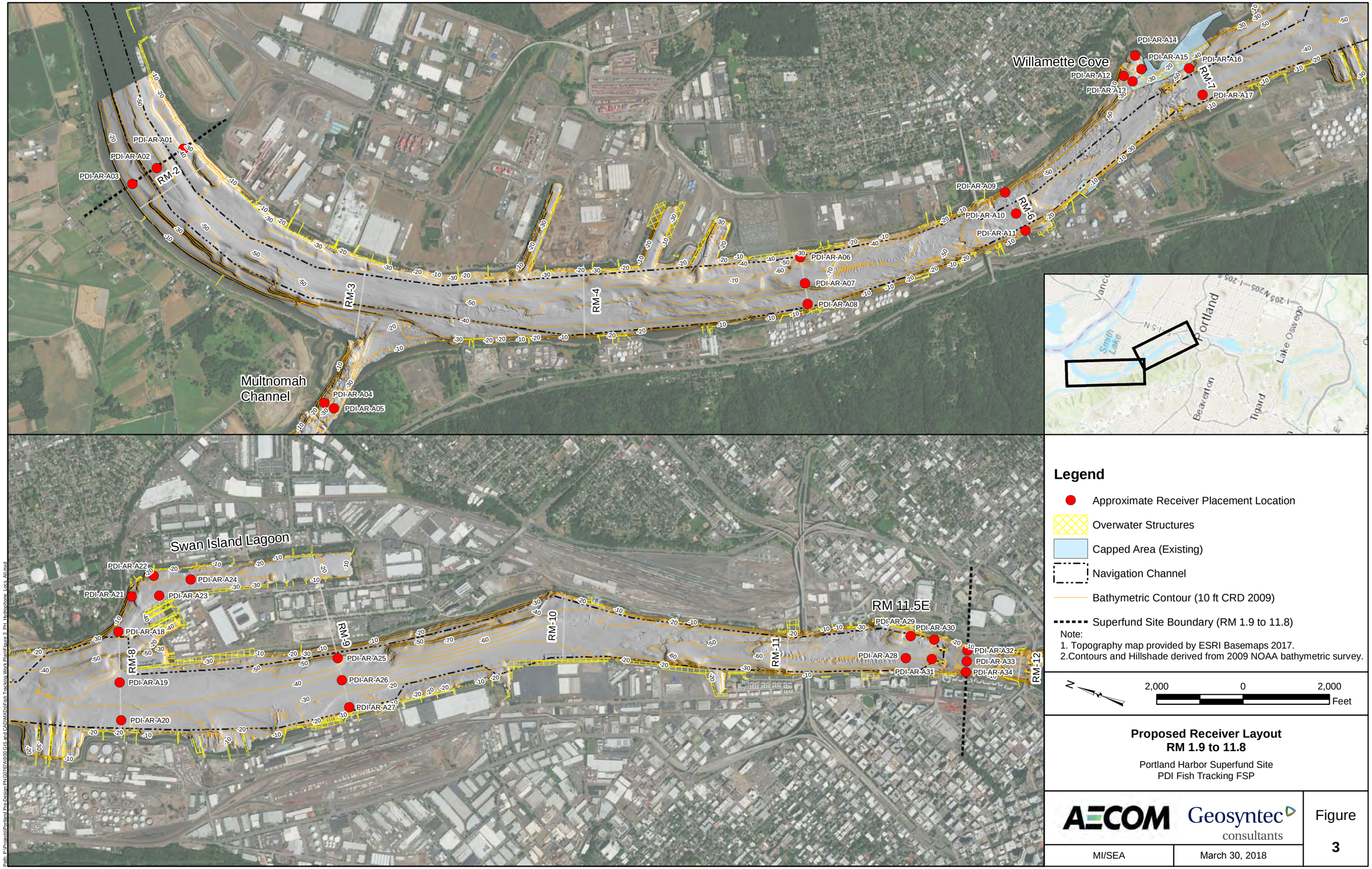

Legend

- Approximate Receiver Placement Location
- Overwater Structures
- Capped Area (Existing)
- Navigation Channel
- Bathymetric Contour (10 ft CRD 2009)
- Superfund Site Boundary (RM 1.9 to 11.8)

Note:
1. Topography map provided by ESRI Basemaps 2017.
2.Contours and Hillshade derived from 2009 NOAA bathymetric survey.

N

2,000 0 2,000 Feet

Proposed Receiver Layout
RM 1.9 to 11.8

Portland Harbor Superfund Site
PDI Fish Tracking FSP

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MI/SEA	March 30, 2018	Figure 3

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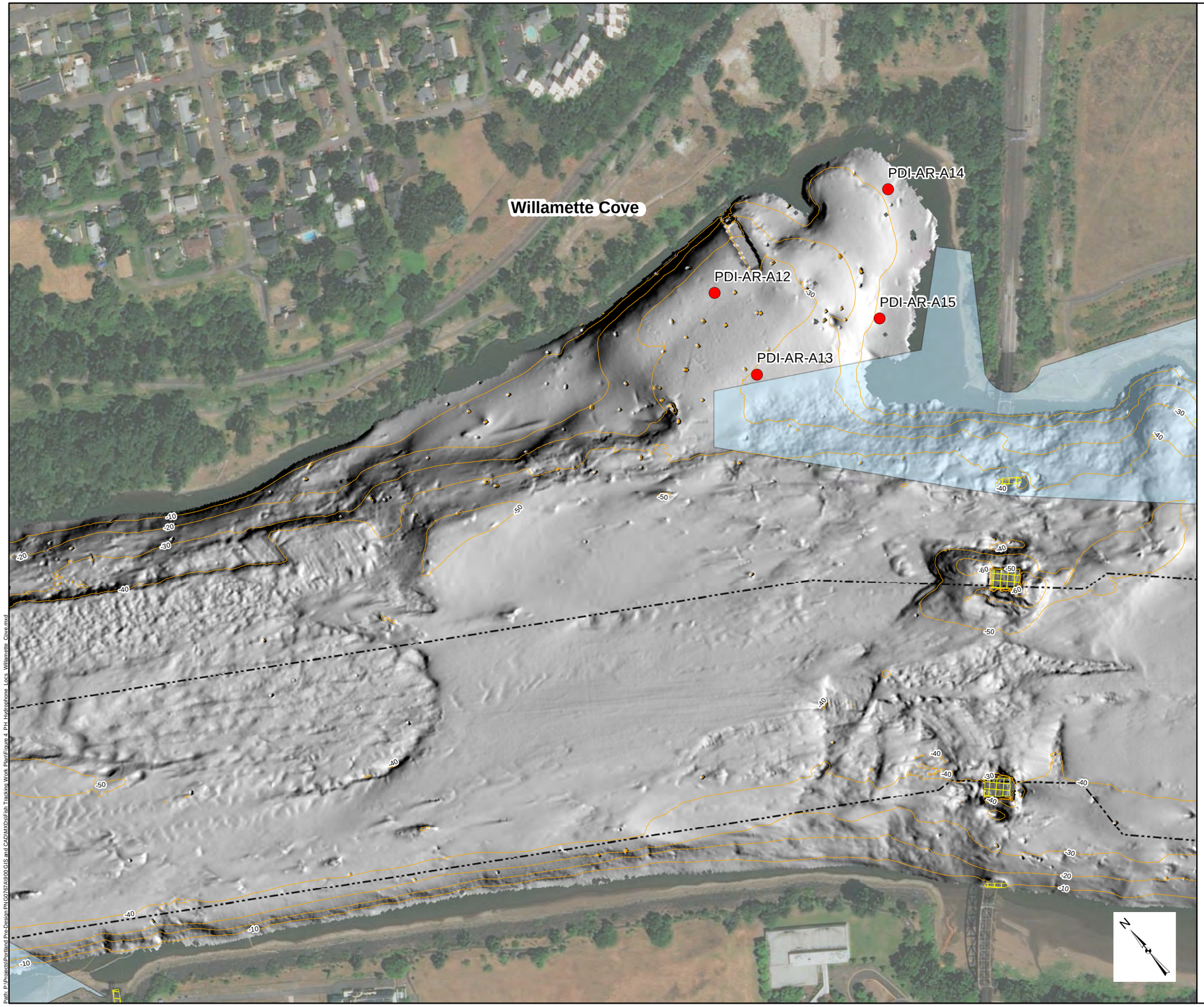

Legend

- Approximate Receiver Placement Location
- Overwater Structures
- Capped Area (Existing)
- Navigation Channel
- Bathymetric Contour (10 ft CRD 2009)

Note:
1. Topography map provided by ESRI Basemaps 2017.
2. Contours and Hillshade derived from 2009 NOAA bathymetric survey.

200 0 200 Feet

Proposed Receiver Array Layout
Willamette Cove

Portland Harbor Superfund Site
PDI Fish Tracking FSP

AECOM Geosyntec consultants

MI/SEA	March 30, 2018	Figure 4

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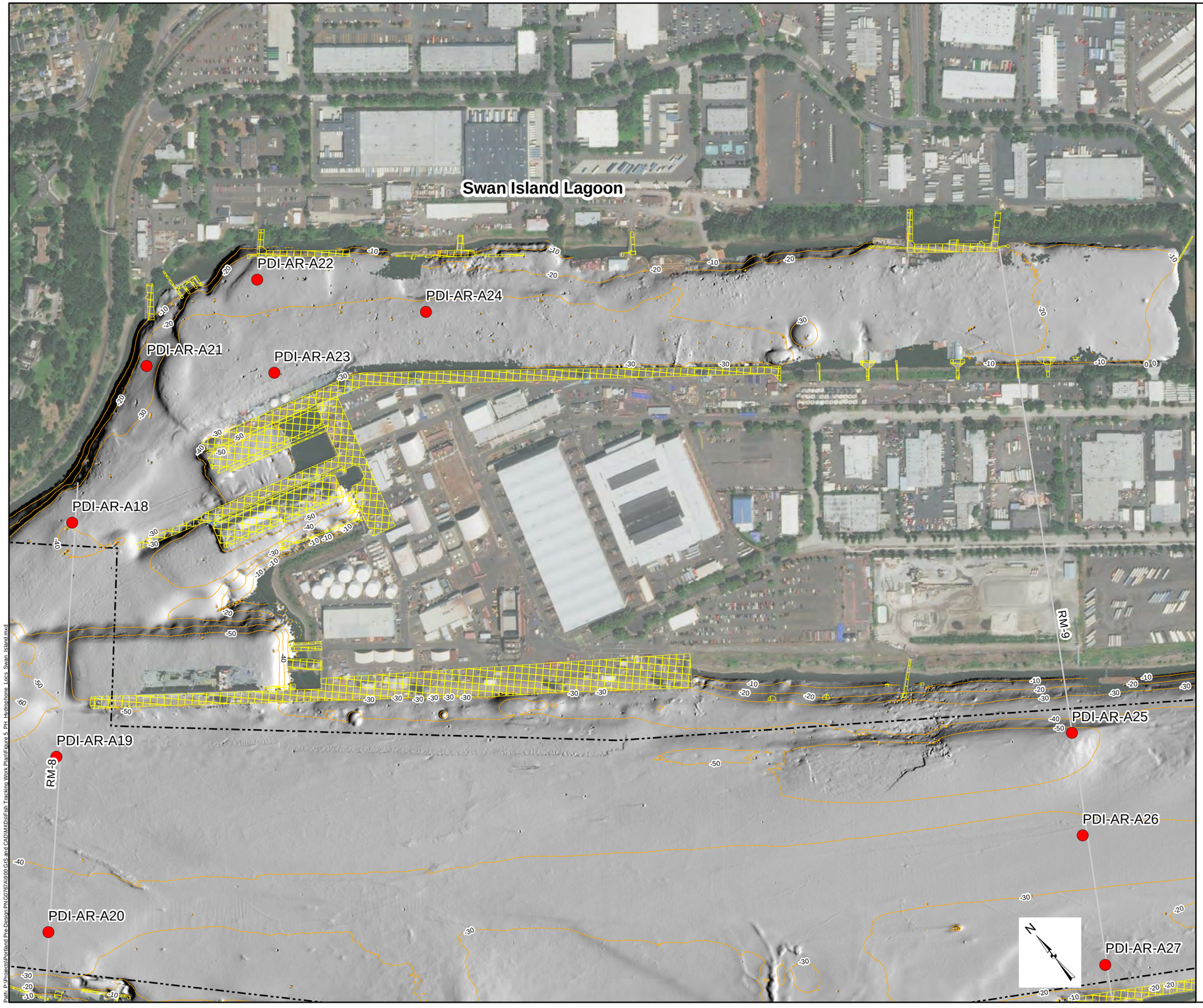

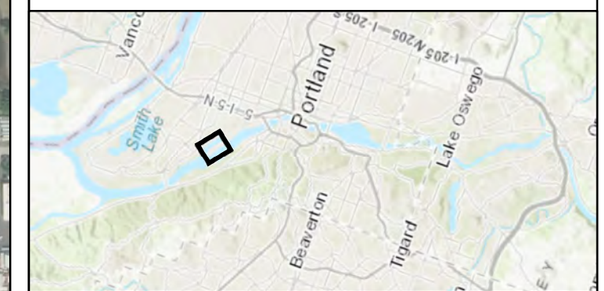

Legend

- Approximate Receiver Placement Location
- Overwater Structures
- Navigation Channel
- Bathymetric Contour (10 ft CRD 2009)

Note:
1. Topography map provided by ESRI Basemaps 2017.
2. Contours and Hillshade derived from 2009 NOAA bathymetric survey.

200 0 200
Feet

Proposed Receiver Array Layout
Swan Island Lagoon

Portland Harbor Superfund Site
PDI Fish Tracking FSP

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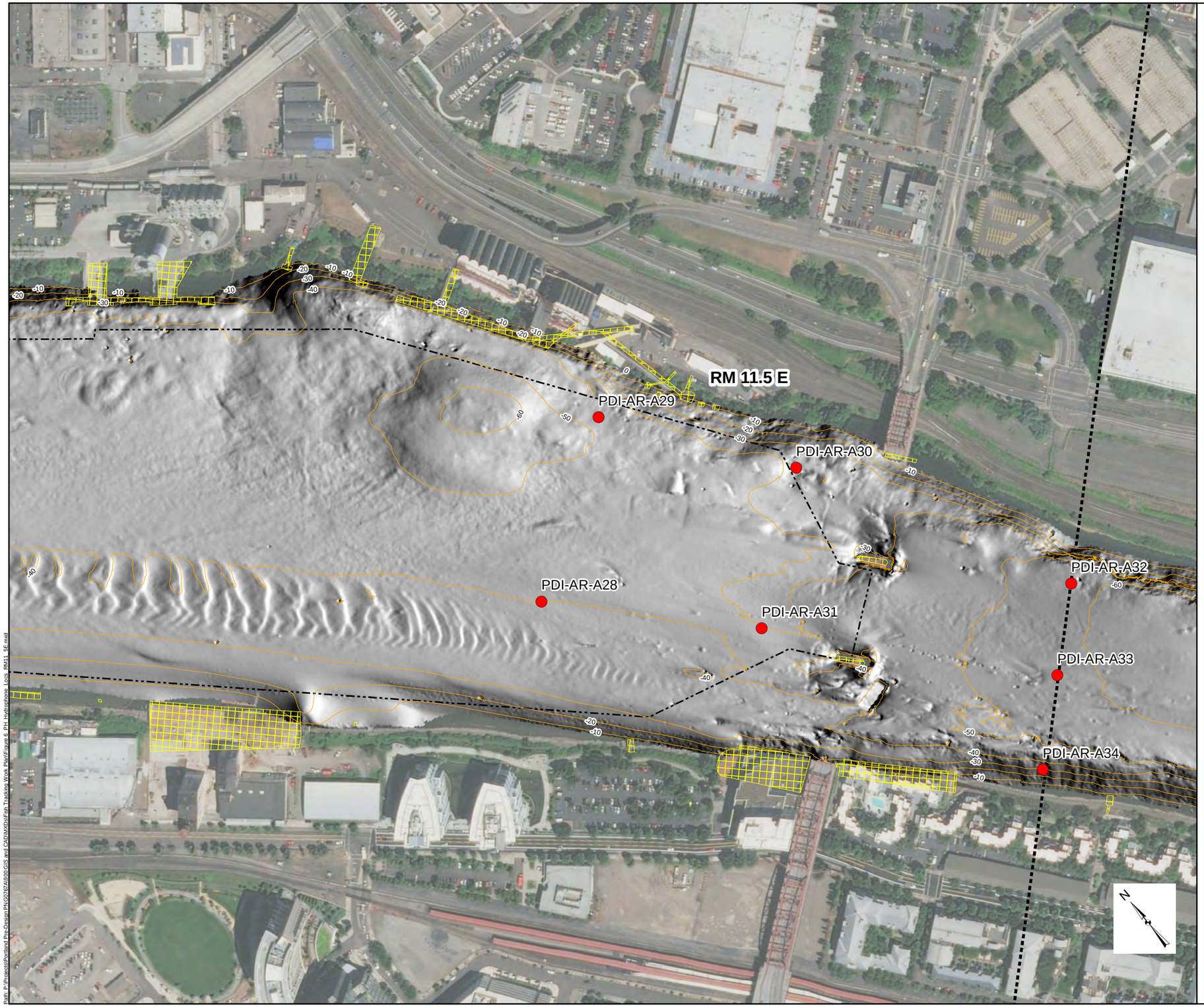
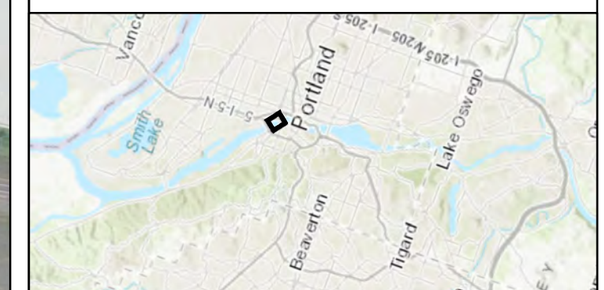
Figure 5

MI/SEA | March 30, 2018





Legend

- Approximate Receiver Placement Location
- Overwater Structures
- Navigation Channel
- Bathymetric Contour (10 ft CRD 2009)
- Superfund Site Boundary (RM 1.9 to 11.8)

Note:
1. Topography map provided by ESRI Basemaps 2017.
2. Contours and Hillshade derived from 2009 NOAA bathymetric survey.

200 0 200
Feet

Proposed Receiver Array Layout
RM 11.5E

Portland Harbor Superfund Site
PDI Fish Tracking FSP

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Figure 6

MI/SEA | March 30, 2018

2,000 0 2,000 Feet

N

Legend

- 2012 Fish Tissue Sampling Location
- 2011 Fish Tissue Sampling Location
- 2007 Fish Tissue Sampling Location
- Superfund Site Boundary (RM 1.9 to 11.8)
- Alternative F Mod SMA Footprint

Note:
1. Aerial Imagery provided by ESRI Basemaps 2017
2. n - sample count, RM - River Mile, SMA - Sediment Management Area
3. Site defined as RM 1.9 to 11.8
4. The Downtown Reach is defined by EPA as extending from RM 11.8 to RM 16.6 and Upriver Reach is defined by EPA as extending from RM 16.6 to RM 28.4
5. The 2007 locations represent a central point for the individual specimens included in each composite

Smallmouth Bass Catch Locations from Prior Sampling Events (RM 1.9 to 20)

Portland Harbor Superfund Site
PDI Fish Tracking FSP

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Figure 7

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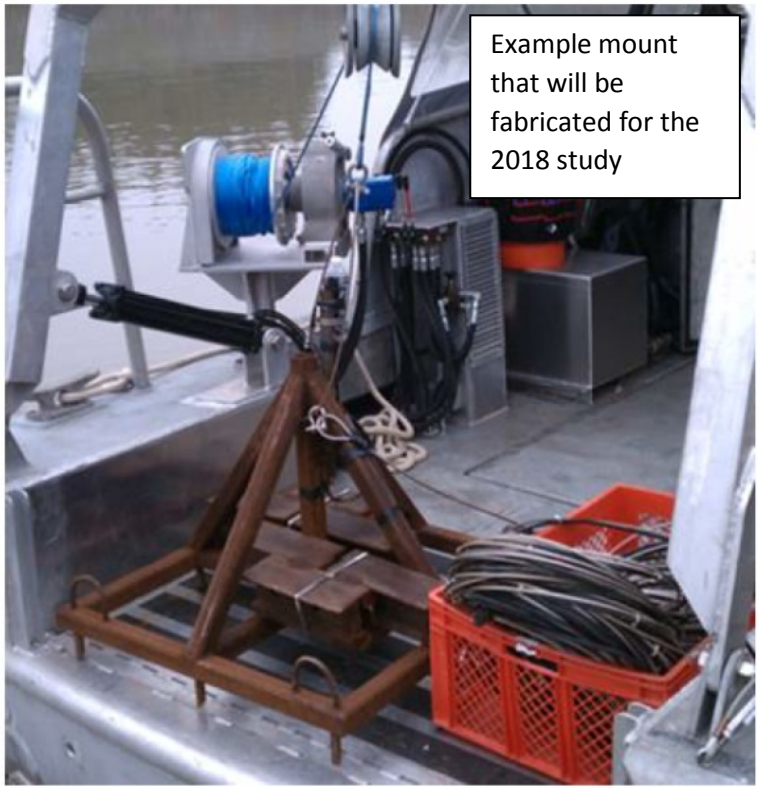

Figure 8. Acoustic Equipment Mount

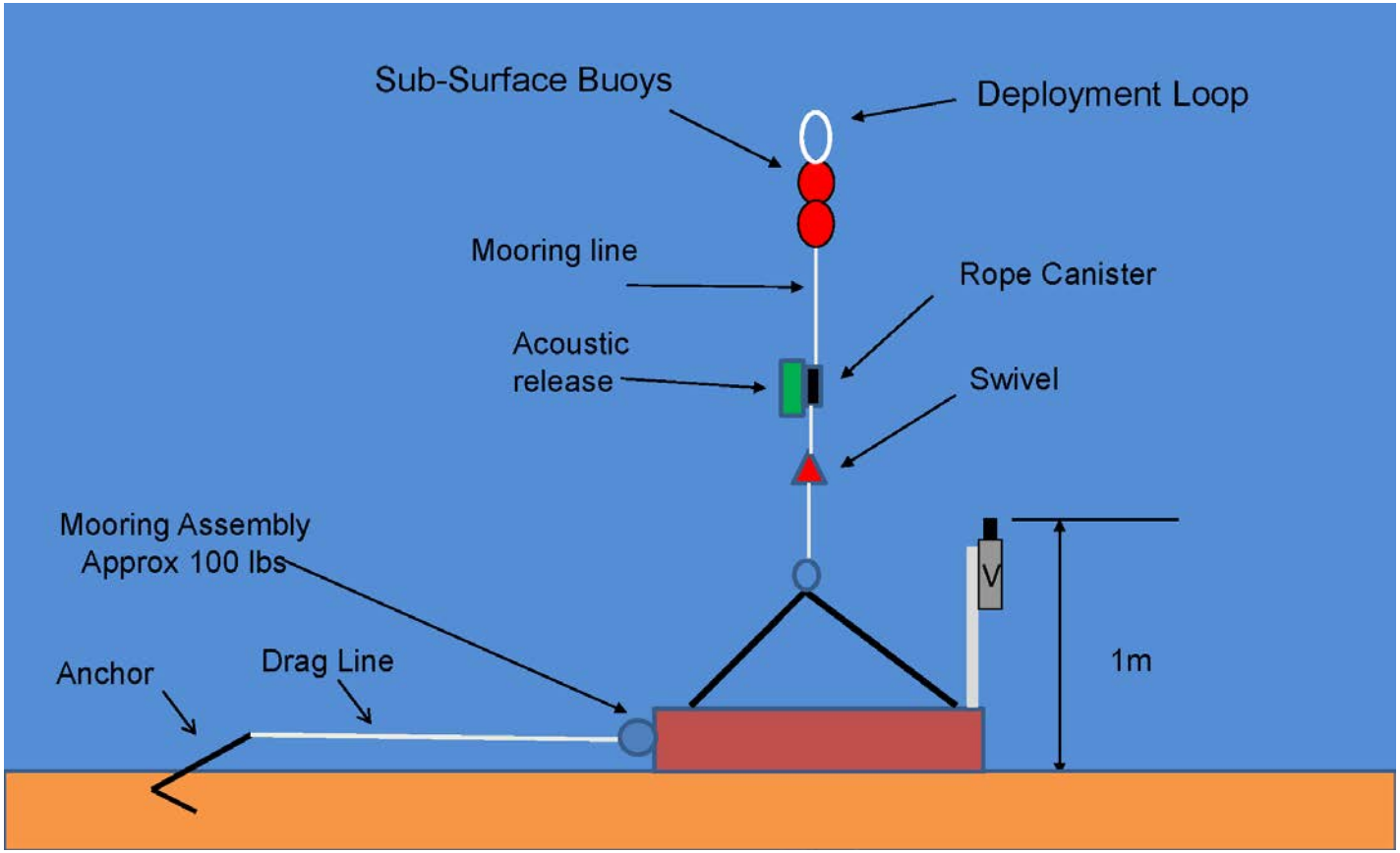

Figure 9. Acoustic Equipment Schematic

APPENDIX A

Standard Operating Procedures

- Decontamination
- Digital Camera Use and Documentation Procedures
- Field Documentation
- Fish Collection
- Recording Sample Collection Locations
- Sample Labeling
- Surgical Implantation of Acoustic Tags

STANDARD OPERATING PROCEDURE SOP-01

DECONTAMINATION

Scope and Applicability

This standard operating procedure (SOP) describes procedures for decontaminating sampling and processing equipment contaminated by inorganic and organic materials. To prevent potential cross-contamination of samples, all reusable sampling and processing equipment will be decontaminated before each use. Decontaminated equipment will be stored away from areas that may cause recontamination. When handling decontamination chemicals, field personnel will follow all relevant procedures and will wear protective clothing as stipulated in the project health and safety plan (HASP).

Equipment and Materials

Equipment and materials for this task include the following:

- Plastic bucket(s) (e.g., 5-gallon bucket)
- Properly labeled squirt bottles (or large spray bottles if needed)
- Long-handled, hard-bristle brushes
- Plastic sheeting, garbage bags, and aluminum foil
- Tap water or river water
- Personal protective equipment, as specified in the HASP

Decontamination Procedures

When necessary, reusable sampling equipment should be decontaminated before and after the sampling effort, between sampling stations, and at any other times specified by the field sampling plan (FSP). The specific procedures for decontaminating reusable sampling equipment are as follows:

1. Rinse the equipment thoroughly with tap or river water to remove any visible sediment or debris.
2. Pour a small amount of concentrated laboratory detergent (e.g., Alconox) into a bucket (e.g., about 1/2 tablespoon per 5-gallon bucket) and fill it halfway with tap or river water. If the detergent is in crystal form, all crystals should be completely dissolved prior to use.
3. Scrub the equipment in the detergent solution using a long-handled brush with rigid bristles, using a back-and-forth motion. Be sure to clean the outside of samplers,

bowls, and other tools that may be covered with sediment or tissue. Remove all particulate matter and surface films.

4. Rinse with tap or river water. Equipment does not need to be dried before use.
5. If the decontaminated sampling equipment is not to be used immediately, wrap small items in aluminum foil (dull side facing the cleaned area).
6. If the sample collection or processing equipment is cleaned at the field laboratory and transported to the sampling site, then the decontaminated equipment will be wrapped in aluminum foil (dull side facing the cleaned area) and stored and transported in a clean plastic bag (e.g., a trash bag) until ready for use, unless the FSP lists special handling procedures.

STANDARD OPERATING PROCEDURE SOP-02

DIGITAL CAMERA USE AND DOCUMENTATION PROCEDURES

Purpose

The purpose of this standard operating procedure (SOP) is to describe the use of digital cameras and procedures for digital camera data management.

Scope and Applicability

This SOP is applicable to taking digital photographs and placing the digital data in a database. Digital photographs may be taken to document field activities, site conditions and features, and sampling locations.

Equipment and Materials

Equipment and materials for taking digital photographs include the following:

- Digital camera
- Spare batteries
- Digital camera-carrying case and manual
- Photo log form
- Dry-erase board
- Dry-erase marker
- Personal computer
- Black waterproof pen

Typical Camera Features

- Save photographs (in standard mode) directly to a memory stick or comparable device
- Auto focus; manual focus available if required
- Zoom
- Brightness control
- Playback of photographs on camera screen
- Display of photograph number, date, and time
- Flash
- Timer

- Display showing time remaining on battery and remaining disk capacity
- Ability to protect and delete images that have been taken

Camera Use

Digital cameras will be used by the field team to document field activities. Each field team will be directly responsible for the camera to ensure that it is not exposed to excessive heat, cold, or moisture. The field team leader will be responsible for digital photograph documentation or for assigning documentation duties to a team member.

Digital photographs will be taken to document field activities and locations. Examples of field activities for which photo documentation will be useful include 1) individual samples; 2) sampling location; and 3) field sampling techniques used, such as equipment use and operation.

Each individual sample and each sample location will be photographed. A minimum of three photographs of each field sampling technique will also be photographed.

Digital photographs will be collected at a high-pixel setting such that enlargements can be made with minimal degradation in picture quality.

Photograph Documentation

Field Team Responsibilities

Each field team will keep a daily hard copy log of all photographs. The following digital photograph data will be collected:

- Date and time—as provided by the camera display.
- Team members—list each team member.
- Camera identifier (type, model, equipment number).
- Sample Location ID, if applicable. This information is obtained from the field team leader and/or Data Quality Management Plan (DQMP). This ID should be written onto a dry erase board and included in the photo frame.
- Sample ID, if applicable. This ID should be written onto a dry erase board and included in the photo frame.
- Photograph ID—record the number of the photograph and the photograph file name (as coded below).
- Description—the target of the photograph.

Digital Photograph File Name

At the end of each field day, the member of the field team who is responsible for the camera will transfer the electronic data from the camera to the field operations computer. The folder structure will be as follows (or as specified in the DQMP):

\\DATA\PHOTOS\YYYYMMDD\SAMPLE AREA\file\[1, 2, 3, ...N]

The notation YYYYMMDD represents the year, month, and day. The sample area is the sampling area name (e.g., Willamette River). The individual files for the day (e.g., file 1, file 2, file N) will be placed within this folder using the default file identifier provided by the camera.

Transfer of Information and Archive

After the photograph disks have been uploaded, the original hard copy of the photograph log will be initialed and dated by the team member who downloaded the photographs, then archived by the field team leader.

Sample Processing Coordinator Responsibilities

The field team leader will be responsible for 1) reviewing electronic photographs and the logs as they are made available to ensure consistency and completeness of annotations; 2) collecting and archiving the hard copies of the photograph logs; 3) reviewing electronic photographs and the logs as they are made available to ensure consistency and completeness of annotations; and 4) notifying the sampling team leader of apparent inconsistencies and making recommendations for corrective action.

Key Checks and Items

Important checks for digital camera management include the following:

- Make sure the camera's battery is fully charged on a daily basis.
- Keep extra memory sticks available.
- To save battery life, use flash only when necessary.
- Make sure the camera quality level is set at "best" or equivalent (high pixel).
- Review photograph records periodically to ensure that the electronic photographs, dry erase board information, and the Specimen Tally and Location Form agree.
- Leave enough time at the end of the field day to transfer the data.

STANDARD OPERATING PROCEDURE SOP-03

FIELD DOCUMENTATION

Scope and Applicability

This standard operating procedure (SOP) presents the general information that will be documented for all sampling activities conducted by field personnel. Proper record keeping will be implemented in the field to allow samples to be traced from collection to final disposition. All information pertaining to field operations during sample collection must be properly documented to ensure transparency and reproducibility of methods and procedures. Several types of field documents will be used for this purpose by field personnel.

Equipment and Materials

Equipment and materials used for this SOP include the following:

- Field logbook, preferably Rite-in-the-Rain 8.5 x 11 inch spiral-side notebook
- Field forms
- Black-ink waterproof pen
- Digital camera

Field Logbooks

During field sampling events, field logbooks and field forms are used to record all daily field activities. The purpose of the field logbook is to thoroughly document the sampling event to ensure transparency and reproducibility. The field logbook will contain sampling-related information supplemental to the field forms. Any deviations from the project-specific field sampling plan (FSP) that occur during sampling (e.g., personnel, responsibilities, sample station locations) and the reasons for these changes will be documented in the field logbook. Other types of information, as applicable, that should be documented in the field logbook include the following:

- Project sampling name and type
- Name of person making entries and other field staff
- On-site visitors, if any
- Observations made during sample collection, including collection complications and other details not entered onto the field form
- A record of health and safety meetings, updates, and related monitoring
- Presence of vessel traffic, construction and maintenance activities, or man-made features that may influence sampling

- Specific measured characteristics of collected samples

The field supervisor will maintain the field logbook and is responsible for ensuring that the field logbook and all field data forms are correct. Requirements for logbook entries will include the following:

- Entries will be made legibly with black (or dark) waterproof ink.
- Unbiased, accurate language will be used.
- Entries will be made while activities are in progress or as soon afterward as possible (the date and time that the notation is made should be documented, as well as the time of the observation itself).
- Each consecutive day's first entry will be made on a new, blank page.
- The field supervisor must sign and date the last page of each daily entry in the field logbook.
- Logbooks will be photographed daily and copied or scanned weekly, and backups of data will be generated as specified in the Data Quality Management Plan.
- When field activity is complete, the logbook will be scanned into the project file, and originals will be retained by the Project Manager.

All logbook entries must be completed at the time any observations are made. Logbook corrections will be made by drawing a single line through the original entry, allowing the original entry to be read. The corrected entry will be written alongside the original. Corrections will be initialed and dated and may require a footnote for explanation.

Upon completion of the field sampling event, the field supervisor will be responsible for submitting all field logbooks to be copied. A discussion of copy distribution is provided below.

Field Forms

Field data forms will be used to record the relevant sample information collected during a sampling event. These forms will be filled out completely by the sampling team during sampling.

The Fishing Effort and Tally Form will be used to record data on all fish caught and shall include the following:

- Sampling date (YYYY-MM-DD)
- Sampling location
- Angler initials
- Fishing start and stop times (24-hour Pacific Standard Time)
- Total duration of fishing effort; this will used to calculate catch per unit effort

- Catch time (24-hour Pacific Standard Time)
- Catch species, Abbreviations: BB= brown bullhead, BC= black crappie, BG= bluegill, CC= common carp, LS= largescale sucker, LMB= largemouth bass, NP= northern pikeminnow, PS= pumpkinseed, SC= sculpin, SMB= smallmouth bass, WC= white crappie, YP= yellow perch; for ESA species: CHK=Chinook salmon, CM= chum salmon, CO= coho salmon, STH= steelhead
- Health examination will include general condition, injuries, survivability after release.
    - Good: Rapid swimming away on release, usually with a vigorous splash.
    - Fair: Slow but strong swimming away on release.
    - Poor: Short recovery time (up to 30 seconds) required; once recovered, slow but sometimes atypical swimming away on release.
    - Very poor: Long recovery time (more than 30 seconds); once recovery, limited or no swimming observed on release but respiration functional.
    - Dead: Dead on removal from gear or does not recover following removal from gear.

For any SMB that are caught, the Smallmouth Bass Specimen Tally and Location Form will be used and data to be recorded shall include:

- Collection date and time (YYYY-MM-DD and 24-hour Pacific Standard Time)
- Sample ID
- Fork and total length in millimeters
- Weight in grams
- Health examination, including gill condition, fin condition, visible parasites, and presence/absence of lesions
- Retained for analysis or tagging?
- Sample location depth to mudline in feet
- Sample location coordinates

Upon completion of the field sampling event, the field supervisor will be responsible for submitting all field data forms to be copied. A discussion of copy distribution is provided below.

Photographs

Reference SOP-02 of the FSP for procedures regarding digital photographs.

Distribution of Copies

Electronic scans of the field logbooks and field data forms will be made after completion of the field sampling event and stored electronically in the project files for use by project staff. The original field logbooks and forms will be placed in a locked file cabinet at the Project Manager's location.

Set-up of Locking File Cabinet

Each field event will have its own dedicated section in a locking file cabinet. The section label will include the project name and work order number. The following documents may be included in this cabinet for each field event:

- Original field logbook(s)
- Original field data forms
- Original signed chain-of-custody forms

STANDARD OPERATING PROCEDURE SOP-04

FISH COLLECTION

Scope and Applicability

This standard operating procedure (SOP) describes the procedures for fish collection associated with the acoustic tracking study at the Portland Harbor Superfund Site were previously described in the U.S. Environmental Protection Agency-approved Portland Harbor Fish Tissue Sampling SOP (SEA et al. 2002), incorporated here by reference. This SOP focuses on smallmouth bass (*Micropterus dolomieu*) collection using angling (hook and line).

Equipment and Materials

Equipment and materials for this task include the following:

- Personal protective equipment as specified in the project Health and Safety Plan (HASP)
- HASP and scientific collection permits (as needed)
- Field location maps
- Bait-casting or spinning rod, with medium action and rated for an 8- to 12-pound line and 1/4- to 3/4-ounce lure or similar.
- Monofilament line (6-12 pound line)
- Lures: plastic worms, crankbaits (diving plugs), spinnerbaits, jigs, top-water lures, swimbaits
- Decontamination supplies
- Resealable plastic bags, black permanent markers, waterproof labels, and aluminum foil
- Appropriately sized fish measuring board
- Hanging fish scale/ lab balance
- Plastic bucket(s) (e.g., 5-gallon bucket)
- Sample containers/coolers and ice
- Rite-in-the-rain field notebooks
- White board and dry erase markers
- Boat-mounted GPS or handheld GPS device

Target Species, Species Length, and Number of Specimens

The target species for this SOP is smallmouth bass. The target size is approximately 9 inches (228 millimeters) in total length, with a preference for larger specimens. Specimens that do not meet the target range will be released. The targeted number of specimens for acoustic tagging is 40.

Fish Sampling Techniques

Fish collection will be exclusively by angling. Bass fishing techniques tend to be based on the type of lure utilized. As described in previous sampling plans, smallmouth bass can be caught with a variety of lures, depending on the desired sampling depth. Lead-weighted hooks with attached green-rubber tube jigs can be used to fish the bottom, while plastic crank baits resembling small fish or crayfish can be used to fish the shallower surface waters (zero to 20 feet). Landing nets will not be used to land fish in order to avoid potential injuries to captured fish and maintain tagging candidates in the best possible condition. Electric trolling motors will be used to more accurately access specific smallmouth angling locations and enable the complete coverage of selected areas. Angling for smallmouth bass will be conducted primarily from 7:00 a.m. to 7:00 p.m.

Fish Processing and Identification

Qualified biologists will be a part of each team to oversee fish collection efforts. All buckets, measuring boards, handheld scales, and coolers used to retrieve and store fish will be washed with Alconox™ soap and rinsed in river water before the sampling effort is initiated at each sampling location.

Once caught, fish will be handled using nitrile gloves, unhooked, and identified. A GPS coordinate will be collected and stored electronically when the fish is brought on-board. Non-target species will be released. Retained smallmouth bass specimens will be measured for both total length and fork length (mm) by placing them on a measuring platform. The total length of a fish will be measured from the anterior-most part of the fish to the tip of the longest caudal fin ray (when the lobes of the caudal fin are compressed dorsoventrally). The fork length of a fish will be measured from the anterior most part of the fish to the center of the fork in the tail. If the total length requirement is not met, the specimen will be returned to the river. All data will be recorded on the field sheets. Smallmouth bass that have met the target size will be rinsed with river water to remove any foreign material from the external surface, and a general fish health examination will be conducted.

Retained fish will be weighed using a handheld hanging scale (in pounds [0.00]), and placed into aerated on-board livewells for holding/ transport. The project logbook and field sheet will record the date, time, specimen identification (ID), and initials of the sampler. Each retained fish will be photographed along with the habitat conditions at each sampling location. Photographs of fish and sampling location will contain the sample ID written on a

white board included in the frame. Sample ID, date, time and other pertinent information will be recorded in the field logbook.

No more than four fish will be in the livewell at any given time. When four fish have been caught, the capture boat will transport the SMB to the on shore surgery station at Swan Island Lagoon. The fish will be transferred to the on shore surgery team for acoustic tag implantation.

References

SEA, Windward, and Kennedy/Jenks. 2002. Fish Tissue Sampling SOP Round 1A Portland Harbor RI/FS. Prepared for Lower Willamette Group, Portland, OR. Striplin Environmental Associates, Inc., Olympia, WA.

STANDARD OPERATING PROCEDURE SOP-05

RECORDING SAMPLE COLLECTION LOCATIONS

Scope and Applicability

This standard operating procedure (SOP) describes procedures recording sampling stations across the Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling (PDI) Site (hereafter the Site). Accurate station positioning is required to ensure quality and consistency in collecting samples and in data interpretation and analysis. Station positioning must be both absolutely accurate in that it correctly defines a position by latitude and longitude, and relatively accurate in that the position must be repeatable.

Latitude and longitude coordinates will be obtained using a global positioning system (GPS) on the vessels operated by Gravity and supplemented by a hand-held differential GPS unit.

The methods described in this SOP should be usable for any hand-held differential GPS unit; however, the owner's manual for any GPS unit used should be consulted and used to support this SOP.

Equipment and Materials

The following is a list of equipment and materials needed by the field sampling team:

- Hand-held differential GPS unit (e.g., Trimble GeoXH or R1)
- Spare batteries
- Charging unit

A GPS hardware system, such as a Trimble GeoXH, R1, or equivalent device, should be used for recording the location of each sample. The standard projection method to be used during field activities is specified in the Data Quality Management Plan.

Positioning System Verification

GPS requires no calibration because all signal propagation is controlled by the United States government (the Department of Defense for satellite signals and the U.S. Coast Guard and U.S. Forest Service for differential corrections). Verification of the accuracy of the GPS requires that coordinates be known for one (or more) horizontal control points within the study area. The GPS position reading at any given station can then be compared to the known control point. GPS accuracy verification shall be conducted at least daily and performed in accordance with equipment manufacturer recommendations.

Station Location Procedures

Sampling area boundaries and other applicable geographic information systems (GIS) data layers (e.g., aerial photographs, topography) will be uploaded into the hand-held GPS unit(s)

prior to the sampling effort. A position will be recorded electronically at each sample location where fish are collected. Ancillary information will be recorded in the field logbook and should include the name of the personnel operating the GPS system and the time samples were collected. Water depth of the sample collection location will be recorded using the research vessel's depth transducer, when available. In shallow water, a visual estimate or lead line measurement of depth may be used.

A brief summary of procedures to locate a specific sampling location using a hand-held GPS unit are as follows:

- Turn on the unit.
- Wait for it to acquire the location of satellites.
- Save the location into the GPS memory (site coordinates may also be noted on field forms or in the field logbook).
- Charge unit and batteries when not in use.

Upon completion of the sampling effort, all data points will be downloaded from the GPS unit and displayed on a GIS map. Any sampling locations outside of the originally defined sampling areas will be mapped and described with supporting documentation in the field sampling report.

STANDARD OPERATING PROCEDURE SOP-06

SAMPLE LABELING

Scope and Applicability

This standard operating procedure (SOP) describes the general procedures for completing sample labels that will be used for all sampling. The project-specific field sampling plan (FSP) should be consulted regarding the rationale behind the sample labeling protocol.

Equipment and Materials

Equipment and materials for this task include the following:

- Sample labels
- Indelible marker
- Copy of the FSP and DQMP

Sample Identifiers

Sample identifiers will be established before field sampling begins and assigned to each sample as it is collected. Sample identifiers consist of codes designed to fulfill three purposes: 1) to identify related samples to ensure proper data analysis and interpretation, 2) to clearly connect sample results to sampling locations, and 3) to track individual samples to ensure that the laboratory receives all of the material associated with a single sample. The Data Quality Management Plan (DQMP) contains details of the location and sample nomenclature to be used in this study.

Sample Labels

Sample ID information will be entered onto the sample label with an indelible marker. Other information that will be entered onto the sample label includes the following:

- Samplers' initials
- Date
- Time

The format for the date and time will be specified as YYYY-MM-DD and 24-hour, Pacific Time. If necessary, corrections will be made on the sample labels by drawing a single line through the error and entering the correct information with an indelible marker. All corrections will be initialed and dated by the person performing the correction (i.e., the individual who made the error).

For fish samples, a weatherproof label will be filled out and adhered to the inside of a smaller resealable plastic bag. The plastic bags containing the fish and the label then will be placed inside a third resealable plastic bag. Sample packaging is discussed in SOP-07.

STANDARD OPERATING PROCEDURE SOP-07

SURGICAL IMPLANTATION OF ACOUSTIC TAGS

Scope and Applicability

This standard operating procedure describes procedures associated with administering electroanesthesia on smallmouth bass and instructions for performing surgery to implant an acoustic tag. This highly specialized surgical procedure is necessary to implant the acoustic tag and monitor the fish during recovery. The methods described herein may be modified in the field based on actual field conditions.

Equipment and Materials

Equipment and materials required by the field surgery team include the following:

- Gloves
- Hemostats
- Forceps
- Scalpel
- Scalpel blades
- Surgical scissors
- Sutures (multiple sizes)
- Salt
- Nolvasan (chlorohexidine diacetate)
- Two approximately 739-milliliter (mL) Tupperware containers for sterilizing instruments
- Acoustic tags (HTI-Vemco V9 tags)
- Surgery platform
- 153-liter Cooler with aquarium pump(s) and bubbler(s) for recovery
- Power supply
- Nylon mesh fish cradle
- Two metal aluminum plates
- Anode and cathode to attach to DOC power supply
- Measuring board
- Scale
- Dip net

- Sharps container
- 10 mL and 20 mL syringes

Electroanesthesia

After the fish has been captured, it will be kept in an aerated holding tank (Figure 1). Prior to being anesthetized, each fish is weighed and measured, and fish scales are removed for aging. Individual fish are then placed into the electronarcosis unit. The electronarcosis system is based on designs described in Hudson et al. 2011. The unit consists of a modified 153-liter marine cooler, fish cradle, and a variable power generation system. Aquarium bubblers are used to maintain dissolved oxygen levels during surgery.

Figure 1. Fish being handled prior to surgery

The HTI-Vemco V9 tag has been selected for this project, and it will not exceed 10% of the weight of the fish. Once the fish is returned to the cooler with its head pointed toward the

positive anode, the electronarcosis unit is turned on to begin acoustic surgery. Simultaneously, another staff member will begin a timer for recording surgery time.

Using the DC power supply, the voltage is increased or decreased until the fish reaches sedation. Prior to anesthesia, V9 tags, hemostats, sutures, and scalpel are disinfected in Nolvasan (Figure 2). Then, before use, the tools and tags are placed into a saline mixture.

Figure 2 – Surgical tools being sterilized

Tagging Procedure

Make an incision 1.5 times the diameter of the ceramic side of the tag (it may need to be larger depending on the batteries in the tag). Locate incision point (Figure 3) as follows (can depend on fish species):

- Find the pelvic girdle. Make incision approximately 3 millimeters (mm) toward the head and 3 mm away from the mid-ventral line, near where the color changes from the mid-ventral line.
- Insert scalpel until you feel you have entered the body cavity and then slide scalpel toward the posterior end of the fish until the incision is 2-3 centimeters in length.

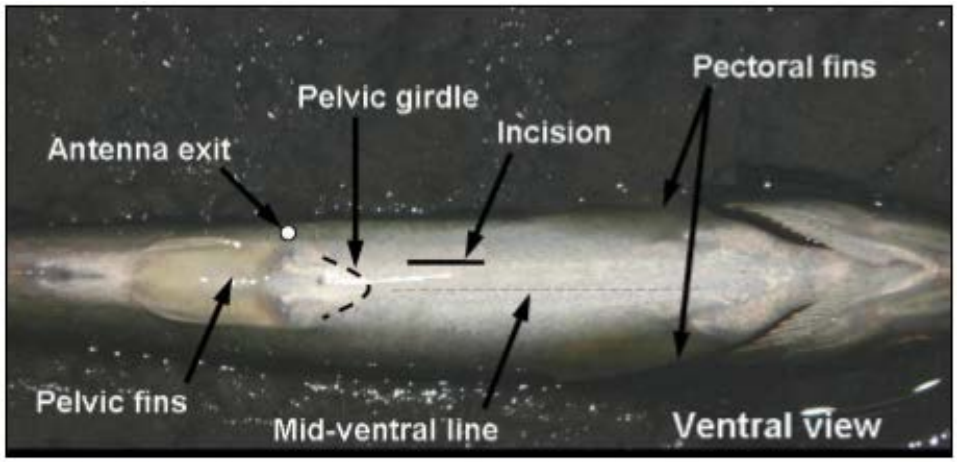

Figure 3. Example schematic of fish anatomy depicting surgery site

1) Insert the ceramic side of tag at an angle and pop inside incision (Figure 4).

Figure 4. Acoustic tag being inserted in fish

2) Make two evenly spaced sutures (Figure 5). Add a third suture if a larger incision is necessary.

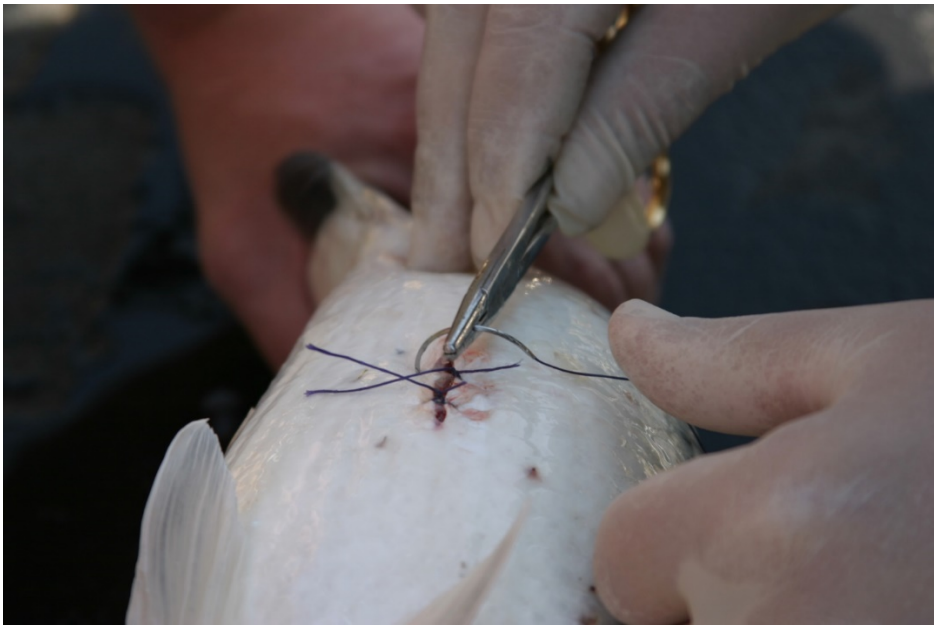

Figure 5. Incision being sutured

4) Tie surgical knot (Figures 6 and 7).

- Run the surgical needle through both sides of the incision and leave a tail of approximately 1 inch.

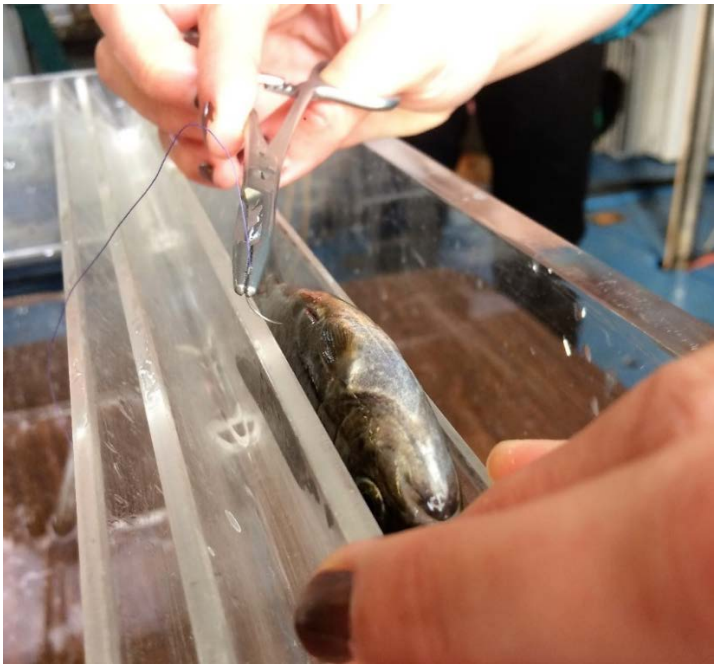

Figure 6. Incision being sutured post tag insertion

Figure 7. Incision with suture

- Wrap the suture around the hemostat three times toward yourself, grab the end of the tail with the hemostat, and holding the hemostat over the suture location, gently pull the loops over the end of the hemostat and tighten the knot.
- Wrap around hemostats two times away from yourself and repeat the knot (Figure 8).

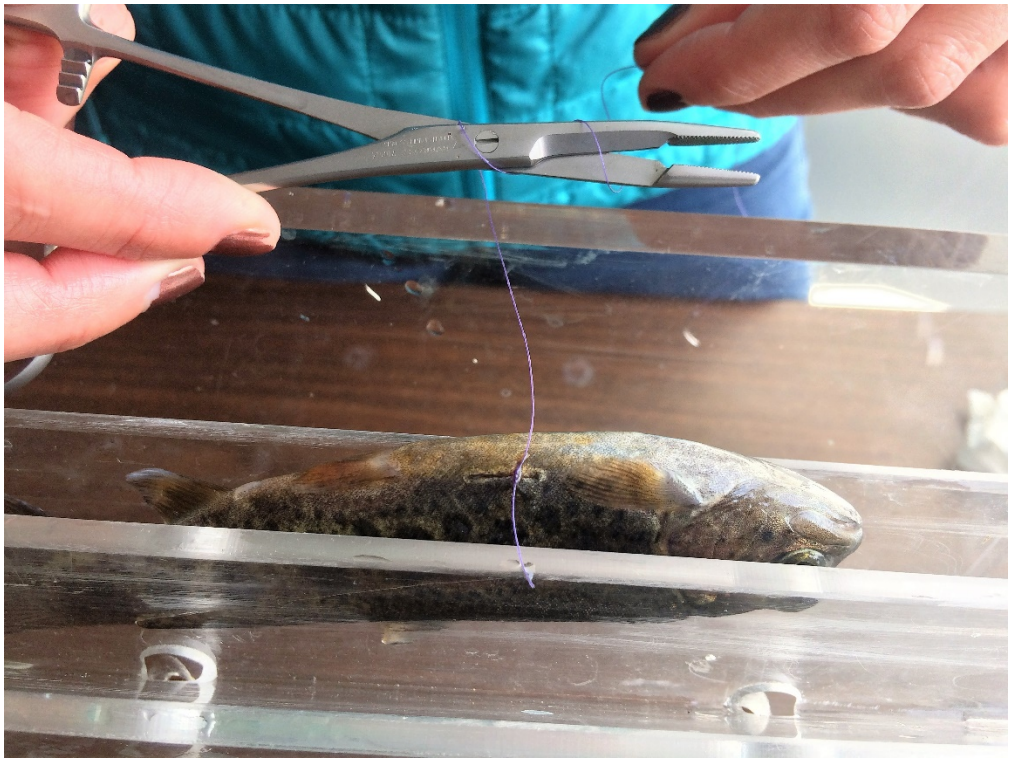

Figure 8. Suture after knot being tied

- Wrap around hemostats two times toward yourself and repeat the knot (or think of it as three times over, two times under, two times over).
- Clip thread ends of your stitch (Figure 9).

Figure 9. Two sutures complete with knots tied

3) When finished, turn of off the electronarcosis unit. The fish should recover within the next minute or so.

Post-surgery, the individual fish will be kept in an aerated recovery tank until they exhibit behavior consistent with pre-surgery observations. It is anticipated that the fish will be held for approximately 2 hours, but hold times may be longer or shorter. Once the fish have recovered, they will be released back in the river. To the extent practicable, fish will be released back into the river in the vicinity of where they were originally caught.

References

Hudson, J. M., J. R. Johnson, and B. Kynard. 2011. A Portable Electronarcosis System for Anesthetizing Salmonids and Other Fish. North American Journal of Fisheries Management 31:335-339.

APPENDIX B

Field Forms and Checklists

- Fishing Effort and Tally Form
- SMB Specimen Tally and Location Form
- Fish Tracking Field Form
- Acoustic Receiver Deployment Form
- Acoustic Fish Tracking Equipment and Materials Checklist
- HTI Data Sheet

FISHING EFFORT AND TALLY FORM

Portland Harbor PDI Studies – 2018 Fish Tissue Study or 2018 Fish Tracking Study (circle one)

Field Crew Initials:

Fishing Technique:

Boat Name:

Sampling Date	Sampling Location (RM, Array)	Angler Initials	Fishing Start Time	Fishing Stop Time	Total Duration (minutes)	Catch Time	Catch Species*	Health	Comments

* Catch Species Abbreviations: BB= brown bullhead, BC= black crappie, BG= bluegill, CC= common carp, LS= largescale sucker, LB= largemouth bass, NP= northern pikeminnow, PS= pumpkinseed, SC= sculpin, SMB= smallmouth bass, WC= white crappie, YP= yellow perch; for ESA species: CHK=Chinook salmon, CM= chum salmon, CO= coho salmon, SWT= steelhead

SMALLMOUTH BASS SPECIMEN TALLY AND LOCATION FORM

Portland Harbor PDI Studies – 2018 Fish Tissue Study or 2018 Fish Tracking Study (circle one)

Field Crew Initials:

Fishing Technique:

Boat Name:

Collection Date	Collection Time	Sample ID*	Fork Length (mm)	Total Length (mm)	Weight	Health	Retained for Analysis or Tagging?	Sample Location Depth to Mudline (ft)	X Coordinate Easting (ft)	Y Coordinate Northing (ft)	Comments

*Sample ID nomenclature is as follows: SMB Tissue Study = PDI-TF-SMB001; Acoustic Tracking Study = PDI-AT-SMBT01.

FISH TRACKING FIELD FORM

Portland Harbor PDI Studies – 2018 Fish Tracking Study

Field Crew Initials:

Fishing Technique:

SMB Sample ID:

Collection		Surgery		Release	
Collection Date:		**Surgery Date:**		**Release Date:**	
Collection Time:		**Surgery Time:**		**Release Time:**	
Species:		**Surgeon:**		**Release Location:**	
Total Length (mm) :		**Vemco Tagcode:**		**Release By:**	
Fork Length (mm) :		**Pre-Surgery Livewell Number: Time In:**		**Post-Surgery Livewell Number: Time In:**	
Weight (lbs. 0.00) :		**Pre-Surgery Livewell Number: Time Out:**		**Post-Surgery Livewell Number: Time Out:**	
Water Depth (ft):		**Dissolved Oxygen (mg/L):**			
Floy Tag ID:					
Comments:					

ACOUSTIC RECEIVER DEPLOYMENT FORM

Portland Harbor PDI Studies – 2018 Fish Tracking Study

Field Crew Initials:

Boat Name:

Date	Receiver Location (e.g. PDI-AR-A01)	Receiver Serial Number	Deployment Start Time	X Coordinate Easting (ft)	Y Coordinate Northing (ft)	Deployment End Time	Receiver Mean Depth (ft)	Comments

ACOUSTIC FISH TRACKING EQUIPMENT AND MATERIALS CHECKLIST

- ☐ Personal protective equipment (PPE) as specified in the project Health and Safety Plan (HASP; PPE to include life vests, eye protection, knee pads, etc.)
- ☐ HASP and project-specific HASP Addendum (i.e., Task Hazard Assessment)
- ☐ Scientific collection permits
- ☐ Field location maps
- ☐ Field data sheets/clipboards
- ☐ Bait-casting or spinning rods, with medium action and rated for an 8- to 12-pound line and 1/4- to 3/4-ounce lure or similar (including backups)
- ☐ Monofilament line (6-12 pound line)
- ☐ Lures: plastic worms, crankbaits (diving plugs), spinnerbaits, jigs, top-water lures, swimbaits
- ☐ Decontamination supplies (e.g., Liquinox)
- ☐ Nitrile gloves
- ☐ Gallon-size zip top plastic bags, black permanent markers, waterproof labels, and aluminum foil
- ☐ Appropriately sized fish measuring board (in millimeters [mL])
- ☐ Hanging fish scale (in pounds [0.00])
- ☐ Three tournament fish weigh bags
- ☐ Plastic bucket(s) (e.g., 5-gallon buckets with lids)
- ☐ Recirculating 150-quart cooler livewells and associated batteries eight
- ☐ Air stones
- ☐ Eight in-river livewells (32-gallon brute black plastic trash cans, polyvinyl chloride [PVC] collars, PVC glue, carabiners, small diameter rope, screw-in eye hooks)
- ☐ Medium-sized soft mesh nets
- ☐ YSI™ (or equivalent) multi-parameter water quality sonde and calibration supplies

- Rite-in-the-rain field notebooks
- White board and dry erase markers
- Boat-mounted global positioning system (GPS) or handheld differential GPS device
- Digital camera with spare batteries
- Hemostats
- Forceps
- Scalpel
- Scalpel blades
- Surgical scissors
- Sutures (multiple sizes)
- Salt
- Nolvasan (chlorohexidine diacetate)
- Two approximately 739-milliliter Tupperware containers for sterilizing instruments
- Acoustic tags (HTI-Vemco V9 tags)
- Surgery station
- Nylon mesh fish cradle
- Two metal aluminum plates
- Anode and cathode to attach to DOC power supply
- Sharps container
- 10 mL and 20 mL syringes

Release:
Species:
Program Date:

For Tagging Ops Use

Recorder : _____
Tagger : _____
Crew: _____
Time start : _____
Time end : _____

Anesthesia : _____
DO (mg/L) : _____
River temp: _____
(°C)

For HTI use

Tag Type : PW : Encoding :

Programmed by : _____
Program file : _____

Delivered by : _____
Coded-out by : _____
Code-out file : _____
Entered in DB : _____

Tagcode								Fish						Release	
Box #	Type	Mfg Lot #	Period	Sub	Verification			Species	Characteristics		Air Time	Tagging Sample #	Comments	Release Date/Time	Comments
					Prog.	Sniffer	Code-out		Length (TL)	Weight					
091	H		2435	9											
092	H		4941	9											
093	H		2197	9											
094	H		2323	9											
095	H		2519	9											
096	H		3275	9											
097	H		4675	9											
098	H		4087	9											
099	H		2057	9											
100	H		4759	9											
101	H		3541	9											
102	H		3933	9											
103	H		2981	9											
104	H		4871	9											
105	H		3247	9											

Additional Comments:

Release: **PR004**
Species: **Various**
Program Date: **3/30/2014**

For Tagging Ops Use

Recorder : _____
Tagger : _____
Crew: _____
Time start : _____
Time end : _____

Anesthesia : _____
DO (mg/L) : _____
River temp: _____
(°C)

For HTI use

Tag Type : PW : Encoding :
Programmed by : _____
Program file : _____
Delivered by : _____
Coded-out by : _____
Code-out file : _____
Entered in DB : _____

Tagcode								Fish						Release	
Box #	Type	Mfg Lot #	Period	Sub	Verification			Species	Characteristics		Air Time	Tagging Sample #	Comments	Release Date/Time	Comments
					Prog.	Sniffer	Code-out		Length (TL)	Weight					
106	H		3023	9											
107	H		4731	9											
108	H		2687	9											
109	H		4353	9											
110	H		4003	9											
111	H		2575	9											
112	H		3597	9											
113	H		4591	9											
114	H		2631	9											
115	H		4073	9											
116	H		3415	9											
117	H		2029	9											
118	H		4451	9											
119	H		3527	9											

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UPDATED FINAL

Porewater Field Sampling Plan

Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling

Portland Harbor Superfund Site

AECOM Project Number: 60554349
Geosyntec Project Number: PNG0767A

Revision 4 (August 20, 2018)

Prepared for:

United States Environmental Protection Agency, Region 10
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On behalf of:

Portland Harbor Pre-RD AOC Group
Portland, Oregon

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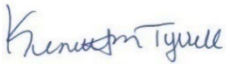
I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.



August 8, 2018

Kenneth M. Tyrrell
PDI Project Coordinator
AECOM Technical Services

Date

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B-3: Water Quality Parameters SOP (Integral 2004)

B-4: Water Quality Monitoring Equipment Calibration, Operation, and Maintenance SOP

B-5: Manufacturer Operating Manuals for Water Quality Parameter Probes

B-6: Management of Investigation-Derived Waste SOP

ACRONYMS AND ABBREVIATIONS

µg/L	microgram per liter
°C	degrees Celsius
AECOM	AECOM Technical Services
ASAOC	Administrative Settlement Agreement and Order on Consent
bml	below mudline
cm	centimeter
CSM	Conceptual Site Model
DGPS	differential global positioning system
DI	deionized
DO	dissolved oxygen
DQOs	data quality objectives
D/U Reach	Downtown/Upriver Reach
EPA	United States Environmental Protection Agency
FC	Field Coordinator
FS	feasibility study
FSP	Field Sampling Plan
Geosyntec	Geosyntec Consultants, Inc.
Germano	Germano and Associates
GPS	global positioning system
ID	identification number
IDW	investigation-derived waste
Integral	Integral Consulting
KBr	potassium bromide
LWG	Lower Willamette Group
mg/kg	milligram per kilogram
mg/L	milligrams per liter
mL	milliliter
mV	millivolts
NaBr	sodium bromide
NOAA	National Oceanic and Atmospheric Administration
ODEQ	Oregon Department of Environmental Quality
ORP	oxidation-reduction potential
PDI	pre-remedial design investigation
PHSS	Portland Harbor Superfund Site
Pre-RD AOC Group	Pre-Remedial Design Agreement and Order on Consent Investigation Group
QA	quality assurance

QAPP	Quality Assurance Project Plan
QC	quality control
RI	remedial investigation
RM	River Mile
RPD	redox potential discontinuity (redox)
ROD	Record of Decision
SiREM	SiREM Laboratories
Site	Portland Harbor Superfund Site
SOP	Standard Operating Procedure
SOW	Statement of Work
SPI	sediment profile imaging
SWI	sediment/water interface
TestAmerica	TestAmerica Laboratories
TOC	total organic carbon

1. INTRODUCTION

The Record of Decision (ROD) described a post-ROD sampling effort for the Portland Harbor Superfund Site (Site or PHSS; Figure 1) located in Portland, Oregon, to delineate and better refine the sediment management area footprints, refine the Conceptual Site Model (CSM), determine baseline conditions, and support remedial design (United States Environmental Protection Agency [EPA] 2017a). Geosyntec Consultants, Inc. (Geosyntec), and AECOM Technical Services (AECOM) developed a detailed Work Plan for Pre-Remedial Design Investigations (PDI) on behalf of a group of industrial parties called the Pre-Remedial Design Agreement and Order on Consent Investigation Group (Pre-RD AOC Group). On December 19, 2017, EPA entered into an Administrative Settlement Agreement and Order on Consent (ASAOC) with the Pre-RD AOC Group to conduct the PDI studies at the Site (EPA 2017b). The ASAOC includes a Statement of Work (SOW) and the Work Plan (as an attachment to the SOW), which generally describe the agreed upon field investigation activities, data analyses, schedule, and deliverables for the PDI.

These PDI studies are a foundational step in what will be a multi-phase effort to update current conditions from the collection of data during the remedial investigation (RI)/feasibility study (FS). The RI/FS was initiated by a group of potentially responsible parties known as the Lower Willamette Group (LWG) and completed by EPA in 2016 (EPA 2016a, 2016b). The RI consisted of three rounds of data collection, including surface and subsurface sediment, bank soils, surface water, sediment traps, porewater, fish tissue, and other media from 2001 through 2007.

This Field Sampling Plan (FSP) was prepared to support the porewater sampling efforts outlined in the PDI Work Plan (Geosyntec 2017) and the project Quality Assurance Project Plan (QAPP) (AECOM and Geosyntec 2018a). To the extent practicable, sampling methods from previously approved FSPs from the RI will be referenced.

1.1 Project Setting

The PHSS is located in Portland, Oregon, on the lower Willamette River immediately downstream of the urban downtown. The Site extends from River Mile (RM) 1.9 near the mouth of the Willamette River upstream to RM 11.8 (Figure 1). There are two reaches located immediately upstream of the Site. The Downtown Reach, which includes the urbanized area of downtown Portland, is defined by EPA as extending from RM 11.8 to RM 16.6. EPA defines the Upriver Reach as extending from RM 16.6 to RM 28.4.

1.2 Data Quality Objectives

The prior RI did not establish background conditions for naturally occurring metals in transition zone or porewater. Arsenic and manganese naturally occur in volcanic rocks that are a significant source to the Willamette River sediments. This porewater FSP will describe the sampling and analysis of data to inform the background metals transition zone/porewater concentrations of arsenic and manganese and refine the CSM regarding these concentrations in the transition

zone/porewater up to 30 centimeter (cm) below mudline (bml). Results will inform remedial action objectives, where appropriate, as described in Section 3.2.8 of the PDI Work Plan (Geosyntec 2017).

This FSP is supported by the QAPP (AECOM and Geosyntec 2018a). Data quality objectives (DQOs) for porewater sampling are detailed in Table 3 of the QAPP.

2. SAMPLING DESIGN AND APPROACH

The sampling design, rationale for approach, and data use objectives are described in detail in the PDI Work Plan and in this FSP. Data collected during the work will be used to assist in the development of background metals porewater concentrations and to further inform remedial action objectives. This FSP has been prepared to meet the project DQOs. To the extent possible, this FSP relies on methods adopted and used in previously approved FSPs from the RI (Integral Consulting [Integral] 2002, 2004, 2006) and the *Round 2 Groundwater Pathway Assessment Sampling and Analysis Plan Attachment 2 Transition Zone Water Field Sampling Plan* (Integral 2005).

2.1 Porewater Sampling Rationale

Background metals concentrations in porewater were not fully defined during the RI. The focus of this background porewater study is to characterize the soluble concentrations of naturally occurring metals arsenic and manganese associated with the upstream Downtown/Upriver Reaches. Porewater samples will be analyzed only for arsenic and manganese based upon the rationale provided below and in the PDI Work Plan (Geosyntec 2017), which was incorporated into the ASAOC.

Metals, especially arsenic and manganese, are present in relatively high concentrations in volcanic rocks, which are the primary geological sources of Willamette River sediment (Trimble 1963). Porewater concentrations above ROD cleanup levels (0.018 micrograms per liter [µg/L] for arsenic and 430 µg/L for manganese) may occur in the transitional zone water near the mudline. This occurrence is a result of the geochemistry that favors dissolution of these metals from the solid mineral components of the sediment. Exceedances of ROD cleanup levels for arsenic and manganese in porewater may arise solely due to the natural presence of arsenic and manganese in sediment. As such, the goal of this FSP is to measure the concentrations of arsenic and manganese in sediment porewater under natural conditions (i.e., in sediments without a known contaminant-derived addition of arsenic and manganese) in order to define and establish background concentrations of arsenic and manganese in porewater. The rationale for selection of locations is detailed in Section 2.2.

The target depth for sampling will be 30 cm bml in areas with a shallow oxic zone (targeting anoxic sediments), as discussed below in Section 2.3. A similar depth was sampled in the RI using peepers (0 to 38 cm bml; 0 to 30 cm for Trident peepers). Depending on field conditions,

an acceptable depth would be about 20 cm; if that is not possible, it is recommended to move to another target station for better penetration depth. Targeting the upper 30 cm of the sediment column is consistent with sampling depth for porewater in the RI and will match the sediment sampling depth for co-located bulk surface sediment samples (0 to 30 cm).

Vertical stratification of redox conditions results from the oxidation of organic matter, and the interface between oxic and anoxic conditions (measured as apparent redox potential discontinuity [RPD]), is very sensitive to metals availability (Germano & Associates [Germano] 2014). As noted in sediment profile imaging (SPI) studies (Striplin Environmental Associates, Inc. 2002; Germano 2014), the average apparent RPD depths throughout the Site ranged from about 0.4 to 5 cm, with an overall Site average of 2.7 cm (Figures 18a-e in Germano 2014). The deepest RPD layers were observed in the depositional nearshore areas (3 to 6 cm depth), and hardly any stations were deeper than 7 to 8 cm RPD depth. The target depth for porewater sampling is 6 to 30 cm in areas with a shallow RPD depth and anoxic conditions as measured during the historical SPI studies.

2.2 Selection and Rationale for Sampling Locations

The Upriver Reach (defined as RM 16.6 to 28.4) was used in the RI as the reference area for evaluating background sediment concentrations (Figure 1). This area extends from the upstream end of Ross Island Lagoon to approximately 2.5 miles above Willamette Falls, which was considered generally representative of upstream sediment loading to Portland Harbor. However, sediments in the Upriver Reach are generally coarser with lower organic carbon. For the PDI porewater study, the Downtown Reach and Upriver Reach (D/U Reach) were both considered for determination of proposed sampling locations for evaluating porewater background.

Proposed sampling locations will target representative areas of background metals in porewater. Both arsenic and manganese are redox sensitive metals that are naturally elevated in reducing conditions often found in groundwater upwelling or high organic carbon content sediment. These conditions represent areas of elevated naturally occurring background concentrations of these metals. Proposed target areas for porewater sampling that are representative of naturally occurring background concentrations were identified based on the following available criteria:

- Areas of thicker sediment zones (depositional)
- Areas of shallow RPD (< 6 cm)
- Areas of fine-grained, high organic carbon content sediments
- Areas with historic presence of methane bubbles and reducing conditions (based on SPI reports)
- Areas downgradient of wetlands
- Areas within Willamette River provenance, but away from known industrial contaminant sources

- Arsenic concentrations less than 8.8 milligrams per kilogram (mg/kg) in co-located bulk sediment samples
- Spatial coverage across upstream area

Available data from the RI and the more recent Oregon Department of Environmental Quality (ODEQ) investigation in the Upriver Reach (GSI Water Solutions and Hart Crowser 2018) were evaluated to determine target sampling areas in collaboration with EPA. Twelve initial target areas for proposed sampling have been identified based on a review of the above criteria (Table 1 and Figure 2). Eight or nine sampling locations will be selected following evaluation of the co-located surface sediment grab sample data. While only one ODEQ sample was co-located within proposed PDI sampling areas, all samples reported arsenic concentrations less than 8.8 mg/kg in bulk sediments. Percent fines for ODEQ samples ranged from 11% to 30%.

Co-located sediment grab samples collected prior to peeper deployment will allow confirmation of grain size, total organic carbon (TOC), and concentrations of arsenic and manganese in sediment at proposed porewater locations to evaluate if sediment concentrations reflect uncontaminated areas and ambient conditions. Of the 12 currently proposed sampling locations, 10 include a co-located PDI D/U Reach surface sediment sampling location (red dot on Figure 2 series); these will be utilized where possible as the co-located grab sample for porewater. An additional three stations may be sampled for arsenic, manganese, TOC, and grain size (blue dot in Figure 2 series).

Additionally, the redox conditions of sediment will be measured *in situ* and in the grab sample to confirm anoxic conditions are present and to measure the RPD (approximately one month prior to deployment of peepers). Following collection of sediment grab samples, the arsenic concentrations will be analyzed first, and if found to be representative of background, additional sample volume will be analyzed for manganese, grain size, and TOC (if not already targeted for analysis). For reference, the EPA-defined background concentration for arsenic in the Portland Harbor is 3 mg/kg in sediment (EPA 2016a)[1] based on upstream conditions. Mean arsenic background concentrations in Southern Willamette Valley soils are closer to 20 mg/kg based on depositional source material in the area (Hurtado 2015), and ODEQ reports regional arsenic background concentrations in soils as 8.8 mg/kg in the Portland basin and 18 mg/kg in the south Willamette Valley (ODEQ 2013).

2.3 Porewater Collection Approach

Porewater peepers will be deployed in triplicate (for three-point composite samples) at eight or nine locations to define the background ranges of arsenic and manganese in porewater. Each peeper will include an array of five peeper vials secured in a peeper frame for deployment in sediment (Figure 3). Each station will include a fourth peeper to evaluate field water quality parameters.

[1] The RI did not establish a background concentration of manganese in sediment.

2.3.1 Confirmation of Anoxic Conditions

A three-step approach will be used to evaluate the redox conditions of porewater/sediment to confirm sample locations and to confirm samples are representative of anoxic conditions. These steps are described briefly below and detailed in Section 4.4.1:

- Step 1 – Approximately 30 Days Prior to Peeper Deployment: During the collection of bulk sediment grab sampling for chemistry at all 12 target locations, an optical dissolved oxygen (DO) probe will be used (i) *in situ* when practicable to confirm the presence/absence of anoxic conditions; and will be used (ii) *ex situ* in the sediment grab sampler brought onboard the vessel deck to measure the sediment vertical profile of DO by depth. An oxidation-reduction potential (ORP) redox probe will be used as a second line of evidence to evaluate anoxic conditions *ex situ*.[2]
- Step 2 – Day 1 Peeper Deployment: Immediately prior to deployment of peepers, the optical DO probe will be used *in situ* when practicable to confirm presence of anoxic conditions (presence/absence and not a DO profile with depth). To minimize the disturbance of sediment in the target area, no sediment sample will be collected for field parameter monitoring.
- Step 3 – Day 30 Peeper Retrieval: Immediately following retrieval, the hand-held DO probe will be used to measure the time-averaged DO of each porewater peeper vial from a dedicated peeper frame, along with other water quality parameters.[3] After a DO profile with depth is determined in the field, only anoxic porewater will be composited for analysis. An ORP redox probe may be used as a second line of evidence to evaluate anoxic conditions.

2.3.2 Porewater Sampling Approach

In situ porewater sampling will be conducted via placement of dialysis equilibrium passive porewater samplers (referred to as peepers) to a target depth of between 6 and 30 cm deep in the sediment bed (bml and below the sediment/water interface [SWI]) in areas that are considered representative of background metals. This target depth was selected because the average apparent RPD below the SWI is approximately 6 cm based on a review of SPI studies (Striplin Environmental Associates, Inc. 2002; Germano 2014). The custom-designed peepers for this project consist of five stacked peeper vials (as described below) contained in a 15-inch-long 3D-printed high-density polyethylene frame. When placed in sediment, the peeper vials sample porewater to the targeted depth (6 to 30 cm bml) (Figure 3). If peepers are unable to be inserted

[2] It will be difficult to get vertical resolution *in situ*, so the vertical profiling will only be conducted in the grab samples with both the DO and ORP redox probes. *In situ* probing only evaluated for presence/absence of anoxic conditions. Additional protection will be added to the probes for insertion into sediment to prevent damage to the probe.

[3] The time-averaged water quality measurement in the peeper vials at the end of the deployment will be the most reliable indicator of anoxic versus oxic over the duration of the deployment.

to the full target depth due to resistance or refusal, only porewater collected from depths represented by anoxic sediment will be collected as described above.

Peeper deployment will target August, when surface water flow is lowest and lateral groundwater discharge to the river is highest. Targeting these months allows for porewater samples reflective of background concentrations relating to low redox conditions of groundwater infiltration in porewater.

Peeper construction includes a glass or polyethylene peeper vial covered with a 0.45-micrometer polyether sulfone membrane. The interior of a peeper vial consists of rows of chambers that are filled with deionized (DI) water prior to deployment.

During deployment, concentrations of arsenic and manganese in ambient sediment porewater will diffuse through the peeper vial membrane into the DI water within the peeper vial. This equilibration process will occur over 28 days (4 weeks), whereupon the peepers will be retrieved and the DI water within the peeper vials extracted at the field laboratory and sent to the designated contract laboratory to be analyzed for arsenic and manganese. As with any *in situ* analysis, there is some potential risk for sampler loss over the deployment period; however, the peeper design includes weights to secure peepers in place, and good retrieval has been achieved at previous sites where peepers have been deployed. Previously, during the RI, a 3-week deployment time was used for peeper deployment (Integral 2005); therefore, a 4-week deployment (proposed in this FSP) should be sufficient for equilibrium to be established.

Additionally, a known amount of chemical tracer (bromide) will be placed in the DI water within each peeper vial and measured after deployment to evaluate achievement of equilibrium based on the methods described in Thomas and Arthur (2010). The methods use the relative known diffusion rates across the peeper vial membrane for arsenic, manganese, and bromide to determine the percent of equilibrium achieved. Calculations based on diffusion rates and peeper volumes indicate that arsenic will reach > 90% equilibrium, and manganese will reach 75% to 80% equilibrium within 28 days. Samples will be considered acceptable if 80% to 100% of equilibrium has been achieved, per the definition of steady-state in Kennedy et al. (2010). For samples that have not reached at least 80% equilibrium, the percentage of equilibrium achieved will be used to correct the reported porewater concentration to an equilibrium equivalent value.

2.4 Sample Identification

2.4.1 Sample Locations and Depths

As discussed in Section 2.2, 12 preliminary target areas have been determined based on desktop review of existing information (see Section 2.2) and coordination with EPA to identify areas representative of background levels of naturally occurring metals (Figure 2). Final sample locations will be determined following field reconnaissance and evaluation of co-located bulk sediment grab samples, and in coordination with EPA. All porewater samples will be taken as three-point composite samples of anoxic porewater. The diameter of the peeper vial membrane is

relatively small, approximately 3.7 cm (inner diameter of peeper is 3.2 cm); therefore, five peeper vials will be stacked in a 15-inch peeper frame, so that when inserted into the sediment, these peepers will sample from the target depth of 6 to 30 cm bml.

2.4.2 Sample Nomenclature

Sample identification will be performed in a manner similar to the LWG Round 1 FSP (Integral 2002: Section 4.2) and consistent with the QAPP (AECOM & Geosyntec 2018a). All samples will be labeled with an identification number (ID) that uniquely identifies the sample and includes the following:

- Project phase (PDI)
- Sample matrix (WP [water, pore])
- Unique, sequential station number based on co-located sediment grab sample Station ID

For example, a porewater sample that is co-located with baseline sediment sample location B060 will be assigned the sample ID of PDI-WP-B060. Quality assurance/quality control (QA/QC) samples, including field duplicates and rinsate blanks are discussed in the QAPP. Trip blanks are not anticipated for this effort, because no porewater samples are being tested for volatile organic compounds.

2.5 Sampling Schedule

The review and selection of proposed sampling locations occurred in April/May 2018, in collaboration with EPA. Confirmation of concentrations of arsenic and manganese at proposed sampling locations will be targeted during the surface sediment sampling effort in July 2018. Following discussions of pre-screening results with EPA, all sampling locations will be finalized. Field sampling of porewater is targeted for August 2018 during periods of low flow.

2.6 Changes from Previously Approved FSPs

Porewater sampling during the RI was performed according to Integral (2005). Key changes from the LWG RI Round 2 FSP are detailed below:

- The RI used divers for deployment. Custom-designed peepers by Geosyntec/SiREM are being used with a diverless deployment system for this PDI sampling effort. These peepers allow for deployment in sediments from a vessel, thereby limiting the need of divers and potential related health and safety concerns.
- Peepers will be deployed for 4 weeks, instead of 3 weeks used in the RI.
- Monitoring of DO and ORP as a pre-screening step in sediment and in porewater samples; the RI did monitor ORP in the porewater using a Trident Probe at some porewater stations. DO was not measured during the RI.

- Depths of porewater sampling will target the anoxic zone only; the RI sampled the full 0 to 30 cm interval bml.
- Porewater samples will only be analyzed for dissolved arsenic, manganese, and the bromide tracer.

3. PROJECT ORGANIZATION

3.1 Team Organization and Responsibilities

Team organization is presented in detail in Section 2 of the QAPP (AECOM and Geosyntec 2018a). As it relates to this FSP, AECOM and Geosyntec are coordinating activities including management of all subcontractors, field sampling, analysis, and reporting scoping tasks. In brief, the PDI Project Coordinator, Mr. Ken Tyrrell, and PDI Project Manager, Dr. Jennifer Pretare, PhD (AECOM), will be responsible for overall project coordination and providing oversight on all project deliverables.

Dr. Jason Conder, PhD (Geosyntec), and Ms. Jennifer Arblaster (Geosyntec) are the Project Technical Leads specifically for porewater. They have deployed similar samplers for the Lower Duwamish Waterway pre-design studies and numerous other sites nationally. They will ensure that appropriate protocols for sample collection, preservation, and holding times are observed and oversee delivery of samples to the designated laboratory for chemical analyses. Ms. Nicky Moody (AECOM) and Mr. Keith Kroeger (Geosyntec) will be the Project Field Coordinators (FCs) and will be generally responsible for general field QA/QC oversight. Project Chemists include Ms. Julia Klens-Caprio (Geosyntec) and Ms. Amy Dahl (AECOM). The Project Chemists are responsible for coordination with labs regarding detection limits and matrix interferences.

Several subcontractors will be used for sampling and analysis. Gravity Marine, of Fall City, Washington, will perform vessel support, with Mr. Shawn Hinz acting as a point of contact. Analytical laboratories include TestAmerica Laboratories (TestAmerica) in Fife, Washington. Peepers will be prepared by SiREM Laboratories (SiREM) in Guelph, Ontario, Canada, with Mr. Jeff Roberts acting as Project Manager for SiREM.

3.2 Communication/Information Flow

The communication strategy is outlined in Section 2 of the QAPP (AECOM and Geosyntec 2018a). The FCs will be the points of contact for field staff during the implementation of this FSP. Deviations from this FSP or the project-specific QAPP will be reported to the PDI Project Manager for consultation. Significant deviations from the FSP/QAPP will be further reported to representatives of the Pre-RD AOC Group and EPA by the PDI Project Coordinator.

3.3 Coordination with EPA

The PDI Project Coordinator will notify the EPA Project Manager 1 to 2 weeks prior to beginning any field activities so that EPA can schedule any oversight activities required. The PDI Project Coordinator will also notify the EPA Project Manager once field activities have been completed.

Split samples for chemical analyses can be provided to EPA upon request. However, for porewater samples, the PDI team would require advance notice (during peeper preparation) so that adequate volumes can be collected. EPA's Project Manager should contact the PDI Project Coordinator to coordinate this activity and determine appropriate logistics.

4. SAMPLE COLLECTION PROCEDURES

The following sections describe the procedures and methods that will be used during porewater sampling. These procedures include sampling protocol; recordkeeping; sample handling, storage, and shipping; and field QC procedures. This field sampling program will be conducted in accordance with the Project Health and Safety Plan (AECOM and Geosyntec 2018b).

4.1 Sampling Vessels and Equipment

Porewater sampling will be conducted from one of two sampling vessels, R/V *Cayuse* or R/V *Tieton*, supplied by Gravity Marine. These vessels have been installed with a newly developed virtual anchoring system that incorporates autopilot and two small motors to keep the vessel on station without needing to set fixed anchors. The R/V *Cayuse* is a 24-foot research vessel with landing craft design, crew cabin, and forward working area. The R/V *Tieton* is a 32-foot research vessel with landing craft design and crew cabin, pilot house, and forward working area. Both vessels have an A-frame assembly for deployment with custom winch and dynamic positioning system.

The diverless deployment system for peepers requires that sampling vessels be maneuvered directly above the targeted sampling location and held steady while the deployment team uses the push poles (described in detail in Section 4.4) to place the peepers in sediment. The equipment for the diverless deployment can be used in water depths up to 30 feet. Supplemental vessels are available if additional or backup support for in-water sampling is needed. Vessels will be mobilized from Swan Island Launch for stations below the Willamette Falls and Willamette Park Boat Launch near RM 28 for stations above the falls.

Equipment and supplies will include all sampling equipment for positioning, sampling, processing, recording, and shipping samples. Sample containers and preservatives (excluding peepers), as well as coolers and packing material, will be supplied by the analytical laboratory. An equipment checklist is provided in Appendix A.

4.2 Station Positioning and Vertical Control

Station positioning and vertical control will be performed as outlined in detail in the attached Standard Operating Procedure (SOP) for station positioning and vertical control (Appendix B-1). A vessel-mounted differential global positioning system (DGPS) unit will be used to confirm the sampling locations to a horizontal accuracy of 1 to 2 meters. The DGPS accuracy will be confirmed each morning and evening to a known land-based survey point. Confirmed station locations will be recorded to the nearest whole foot in North American Datum 1983 Oregon State Plane North Zone datum.

Vertical control will be established using an on-board fathometer or lead line to measure depth to mudline at sampling locations. As per Integral (2002), water depths will be converted to elevations in feet North American Vertical Datum of 1988 (primary) and/or Columbia River Datum (secondary), used by the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Corps of Engineers, depending on the river stage at the time of sampling.[4] Water levels will be recorded to the nearest one tenth of a foot.

4.3 Pre-screening of Redox Conditions and Sediment Grab Sampling

In July 2018, a 3-day field effort will include collection of co-located sediment grab samples for arsenic, manganese, TOC, and grain size. Samples will be analyzed for arsenic to confirm concentrations within background. This step will also include field measurements of DO and redox both *in situ* and in the retrieved sediment material inside the power grab. These analyses will help confirm the appropriate of sampling locations prior to deployment of the passive samplers.

A YSI optical DO meter will be attached to the push pole deployment system and used to probe the surface sediment target area to determine the presence or absence of anoxic conditions (defined as DO < 0.5 milligrams per liter [mg/L]; U.S. Geological Survey 2006) at approximately 10 cm bml. Surface sediment probing will begin in the nearshore shallow areas of each proposed sampling area or at the PDI Primary/Alternate 1 location if a grab sample has already been collected. The optical DO probe will be inserted into the sediment to approximately 10 cm bml, then moving parallel to the shoreline (in 25- to 50-foot increments), and then moving toward the center of the channel as needed (in 25- to 50-foot increments). The DO probe will be rinsed with river water to remove sediments and rinsed with distilled or DI water between probing locations. The YSI optical DO probe will be fitted with a stainless-steel guard and wrapped in stainless-steel mesh as described in Neill et al. (2014). Vertical control of the push pole does not have the precision to accurately determine the RPD (cm) with confidence but will be used to (i) determine presence/absence of redox conditions up to approximately 10 cm bml depending on penetration depths; and (ii) help refine the sampling area. If water depth is greater

[4] NOAA records both datums in real time at the Morrison Street Bridge: (https://waterdata.usgs.gov/usa/nwis/uv?site_no=14211720); David Evans and Associates has calculated datum conversion factors for each RM of the Site.

than 28 feet (the limit of push-pole system), then DO may be measured in the grab sample on the vessel deck.

Once the presence of anoxic sediment is confirmed *in situ*, a single grab sample of at least 10 cm recovery will be taken for the *ex situ* measurement of RPD. The same make/model of optical DO probe used *in situ* will be used to measure RPD *ex situ* in the sediment grab sample (in the power grab) while on the vessel. If two different instruments are used, both will be calibrated each morning (see Appendix B-4). The RPD will be measured by inserting the DO probe in an undisturbed portion of the sediment grab sample to a depth of about 2 cm and allowing the reading to stabilize (a stabilized reading is considered no change in the DO measurement over at least 5 seconds, and may take up to 25 to 30 seconds; field staff will use best professional judgement to determine when parameters are stable). Once stable, the DO reading will be recorded in the field logbook. Without removing the probe, the probe will be inserted about 2 cm deeper and allowed to stabilize; the DO measurement will be recorded in the field logbook. This process will be repeated in approximately 2 cm intervals until the 0 to 10 cm profile of sediment has been measured. The DO probe will be rinsed with river water to remove sediments and rinsed with distilled or DI water between locations.

Additionally, an ORP probe will be used as a second line of evidence to evaluate if sediments are anoxic and characterize the RPD (anoxic conditions are defined as ORP less than 0 millivolts [mV]; however, some anoxic processes occur as high as 50 mV [Gerardi 2007]). The percentage of fines will also be visually characterized from this grab sample.

From the first grab sample, if the RPD is equal to or less than 6 cm (+/- 3 cm) and fines are visually characterized as greater than 25%, the location coordinates will be recorded with DGPS. The field staff will then confirm if the location is within 50 feet of a shallow PDI D/U Reach grab sample. If yes, there is no need to collect a sediment grab sample for analysis, and the data from the collected D/U Reach sediment grab sample will be used to support the porewater sampling. If not, a co-located three-point composite surface sediment sample (0 to 30 cm)[5] will be collected and processed for analysis at the porewater sampling location following the Final Surface Sediment FSP protocols and field wet sieving techniques SOP (Appendix B-2). If the RPD is greater than 6 cm (+/- 3 cm), then the sample may not be processed depending on access and site conditions, and the location will be moved to an appropriate sampling location with anoxic conditions if available in the proposed sampling area. If no sampling locations can be identified within a proposed sampling area, this area may be removed from the proposed sampling area list after discussions with the PDI Project Manager and EPA.

Sediment grab samples will be collected as described in the Final Surface Sediment FSP and analyzed for arsenic, manganese, TOC, and grain size. These results, along with the field-

[5] Acceptable recovery depth for surface grab sampling in the D/U Reach is outlined in the Final Surface Sediment FSP and will be applied to surface grab samples collected as co-located samples for porewater sampling. The minimum target depth is a three-point average composite depth of 10 cm or greater. The best/deepest three of up to six attempts will be collected and processed. Less than three samples may be retained depending on field conditions.

measured DO and ORP, will be collectively considered to confirm that the target area location is appropriate for porewater peeper sampling. EPA will be notified of the sampling results and selected peeper stations at least 5 days prior to peeper deployment.

4.4 Peeper Deployment

Peepers will be deployed in triplicate for a three-point composite sample and allowed to equilibrate for 28 days. Peepers will be deployed from the sampling vessel using Geosyntec's push pole deployment system, which was designed by the United States Navy's Space and Naval Warfare Systems Command in San Diego, California. This system allows the deployment of the peeper vials to a depth of 30 feet below surface water, housed within 3D-printed peeper frames (Figure 3), into the surface sediment without the use of divers. If any sampling locations are at depths greater than 30 feet or are inaccessible by vessel, then locations will be moved to shallower water or divers may be used to place the peepers in the sediment. Diving support will be provided by Global Diving & Salvage, Inc., if required. If divers are required for peeper placement, a dive health and safety plan will be submitted to EPA for review and approval.

4.4.1 Confirmation of Anoxic Conditions

At each sampling location during peeper deployment (i.e., Day 1), the presence of anoxic sediment *in situ* at the proposed sample location will be confirmed as follows:

- Use the optical DO meter attached to the push pole system to probe the sediment and confirm if sediment conditions are anoxic (DO < 0.5 mg/L) at approximately 10 cm bml (+/- 3 cm) (looking for presence/absence).[6]
- If anoxic conditions are present as expected, then install the peeper (assuming the target depth bml can also be reached).
- If oxic conditions are encountered, attempt an additional location in the sampling area within a 25-foot radius. If, after up to six attempts, a sampling location cannot be confirmed anoxic by probing, one of the other proposed 12 sampling areas may be used. During the review of data after Step 1 (Section 2.3.1), the remainder of the 12 sampling areas not selected as targeted sampling locations will be ranked as alternate locations.
- No sediment grab samples will be collected during peeper deployment.

4.4.2 Measurement of Water Quality Parameters in Overlying Water

At each sampling area prior to deployment, water quality parameters including temperature, ORP, conductivity, DO, and pH will be measured in the water column directly above the mudline using a multi-probe *in situ* water quality meter. Water quality parameters will be measured in overlying water using a multi-probe water quality meter (YSI or equivalent). The water quality

[6] Site-wide average discontinuity depth between oxic and anoxic conditions is about 6 cm based on previous SPI studies.

parameters will be recorded before deployment of peepers to avoid recording measurements during potential sediment-disturbing activities.

After water depth is determined, the cable of the water quality meter will be marked with colored tape at the appropriate depth to result in the water quality meter resting 1 foot above the mudline. The water quality meter will be slowly lowered via cable from the vessel to approximately 1 foot above the SWI based on the marked cable. The multi-probe will be operated as described in the Water Quality Parameter SOP (Appendix B-3), the Water Quality Monitoring Equipment Calibration, Operation, and Maintenance SOP (Appendix B-4), and manufacturer's equipment manuals (Appendix B-5). Field parameters will be recorded on the field logs (Appendix A).

4.4.3 Peeper Deployment Procedures

Peeper vials and frames will be prepared by SiREM in Guelph, Ontario, and shipped to Geosyntec's Portland office for deployment at the Site. The peeper vials will be deoxygenated in nitrogen atmosphere by SiREM. Peeper vials will be placed in DI water with a known concentration of sodium bromide and bubbled with nitrogen until DO readings measure 0% or 0 mg/L. The peeper vials will then be filled with the deoxygenated DI water by SiREM. The peeper vials will be shipped in gas impervious mylar bags to avoid oxygenation of the peeper vials.

Peepers will be prepared for deployment as follows:

- The peeper vials with semi-permeable membrane will be placed in a 5-gallon bucket (with lid) of laboratory-supplied DI water and a concentration of sodium bromide (NaBr) or potassium bromide (KBr) equal to that used as a tracer in the peeper (to be supplied by SiREM). The use of NaBr or KBr in the field preparation process will ensure no tracer loss occurs before deployment.
- The 5-gallon bucket will be purged by bubbling high-purity nitrogen gas into it to remove all oxygen from the peeper vials (until a DO meter reads 0% or < 0.5 mg/L). Peeper vials will be purged less than 24 hours before deployment.
- The peeper vials will then be removed from the DI water and secured in the 3D-printed frame.
- To prepare the 3D-printed frame for deployment, two Ziploc® bags will be filled with approximately 500 grams of clean sand and attached to each of the peeper frame wings with zip ties; these sand bags will act as weights to hold the peeper in the sediment. Alternatively, a 10- to 15-pound marine-grade weight may be used, depending on flow conditions.
- A length of rope equal to the measured water depth at the location plus an additional few feet will be attached to the attachment point at the top of the peeper frame, with the other end secured to a weight (typically a gallon-sized Ziploc® bag partially filled with rocks is sufficient, or a 10- to 15-pound marine-grade weight could be used depending on flow

conditions at the target station) as a grapple line. A floating marker buoy can be attached to the weight to assist with retrieval—the floating marker should not be attached to the peeper itself, as this may lift the peeper from the sediment, and the floating marker should not float high enough in the surface water to interfere with or become tangled in vessel traffic. This weight, floating marker, and rope will be used for retrieval.

- The peepers (i.e., peeper assembly, which includes the stack of peeper vials, frame, weights, and retrieval line) are ready for deployment.

Peepers shall be deployed as follows:

- The push pole deployment system consists of multiple 7-foot poles that can be connected to create a single pole of appropriate length to reach the SWI from the sampling vessel.
- At the end of the poles is an attached underwater camera and push pole tail with an approximately 4-inch slot that will hold the peeper. The peeper will be inserted into the slot, so that the hole at the top of the peeper frame is in line with the holes in the push pole frame. Each peeper will be tagged with the Sample ID prior to deployment by attaching a laminated sample ID card to the peeper with a zip tie.
- A spring-loaded pin will then be inserted through the push pole tail and peeper frame and secured with a hitch pin on the opposite side; this will secure the peeper frame to the push pole tail for deployment.
- The push pole tail and peeper frame are then slowly lowered into the water, while the end of the rope that is attached to the hitch pin and the weight are held above water.
- The underwater camera (mounted to the base of the push pole) should be observed to note when the SWI is reached.
- Each peeper frame is fitted with two 6-inch-wide plastic “wings” that rest on the sediment surface to prevent over-penetration. The peeper frame is slowly inserted into the sediment until the frame wings are flush with the sediment surface. Weights are attached to each wing to help secure the peeper in place once deployed.
- The underwater camera will be used to confirm correct placement and vertical orientation of the peeper frame and capture a photograph of the peepers once placed. Correct deployment depth can also be inferred by the degree of resistance to additional pushing. There is a small degree of resistance upon insertion and then a strong degree of resistance once the peeper lander wings reach the SWI.
- Once the peeper frame is in the sediment, a grappling line attached at one end to the peeper frame and at the other end with a weight can be tossed approximately 20 feet downstream. This line will be used for retrieval using a grappling hook as described below. The line direction will be recorded on the field log.
- At this point, the rope secured to the hitch pin can be pulled, releasing the spring-loaded pin and releasing the peeper frame from the push pole tail.

- The peeper frame should remain in the sediment while the push pole tail is lifted out of the surface water; the underwater camera will be used for confirmation.
- The deployment process is then repeated to deploy a second and third peeper frame for a three-point composite sample. The vessel will maintain its position; however, the peeper will be deployed in a circular pattern, targeting 5 to 10 feet from the previously deployed peeper as possible given field conditions (target radius of 25 feet or less).
- A fourth peeper that will be used for dedicated water quality parameter measurements will be deployed in the center of the three-point composite. Redox conditions (DO and ORP) will be measured in each porewater vial (five vertically stacked vials per peeper; see Figure 3) to evaluate DO with depth during retrieval. Other water quality parameters (temperature, pH, conductivity) will be measured from the anoxic composite of these peeper vials and in the overlying water.
- Locations for each peeper sample will be mapped with a global position system (GPS) and recorded in the field logs (Appendix A).
- As a method blank test, three additional peeper vials will be kept in the 5-gallon bucket of DI water with all other peepers (SiREM will supply the appropriate number of extra vials) during deployment. These peeper vials will be used as Time 0 bromide concentrations for the calculations to determine the extent to equilibrium. At the last deployment station, these peeper vials will be removed from the 5-gallon bucket and exposed to the atmosphere for the same length of time as a single peeper deployment (field staff will use their best judgment to determine this time frame). At the end of the exposure period, the deoxygenated DI water will be decanted from the peeper into the appropriate sampling container and sent to the laboratory for analysis of bromine anions by EPA 300.0. This will represent Time 0 deployment conditions.

4.5 Peeper Retrieval and Sample Processing

4.5.1 Measurement of Water Quality Parameters in Overlying Water

At each sampling area prior to retrieval, water quality parameters including temperature, ORP, conductivity, DO, and pH will be measured in the water column directly above the mudline using a multi-probe *in situ* water quality meter (YSI or equivalent) at the locations of the fourth dedicated water quality peeper. The water quality parameters will be recorded before retrieval of peepers to avoid recording measurements during potential sediment-disturbing activities. The water quality measurements will follow the sample procedures described in Section 4.4.2.

4.5.2 Peeper Retrieval

After the equilibration period, peepers will be retrieved per the following protocol:

- At the mapped GPS sampling location, the underwater camera will be used to locate the sampler, marker buoy, or grapple line (if water clarity allows).

- Once the peeper is located, a grappling hook will be used in a perpendicular direction to the noted direction that the weight and retrieval line was tossed.
- The grappling hook should catch on the weighted rope and can then be used to pull the peeper from the sediment after the vessel maneuvers directly over the sampler for straight-pull retrieval.
- Upon retrieval, using new nitrile gloves, peeper vials will be removed from the frame, and any sediment particles will be gently rinsed from the outside of the peeper using laboratory-supplied DI or distilled water.
- Immediately after field retrieval on the sampling vessel, peeper vials will be placed in metal foil-laminated mylar bags purged with nitrogen and placed in coolers filled with ice for transport to the field laboratory for processing. Purging the container with nitrogen displaces oxygen-containing atmospheric air, and metal foil-laminated mylar bags have low gas permeability; therefore, field conditions are not expected to change. Samples will be kept cool at 0 to 6 degrees Celsius (°C) until processed at the field warehouse and will be processed the same day as collection. Mylar bags will be labeled with peeper vial depths. Additionally, the central water quality peeper will be identified and the mylar bags labeled to identify these peeper vials as such. The five mylar bags for each peeper, labeled with depths, will be stored in a large Ziploc® bag, purged with nitrogen, to keep all vials from a single peeper together.
- If one or more of the triplicate field samples is missing, defective, or otherwise not acceptable for processing, then the remaining one or two acceptable samplers/sublocations will be processed and noted in the field logs. If the dedicated water quality parameter peeper is missing, defective, or otherwise not acceptable, one of the triplicate sample peepers will be used for water quality parameters, and a two-point composite sample will be collected. A minimum of four peeper vials is needed for adequate sample volume (280 milliliters [mL] is sufficient volume for primary analysis and for EPA split samples); therefore, if needed, the dedicated water quality parameter peeper may be used for sampling instead. Should this be needed, the measured RPD from the pre-deployment survey will be used as the basis for compositing. The final compositing will be noted in the field logs if different from the three-point composite described in the FSP.

To avoid accidental high bias or sample loss, processing requires the use of needles, and hence for safety precautions should be done in a stable and controlled environment. The porewater compositing and processing will be performed after retrieval of the peepers at the AECOM Sampling Processing Facility at 1115 Caruthers Street, Portland, Oregon. Peepers will be processed at the field laboratory as described in the following section.

4.5.3 Sample Processing: Determination of RPD

- At the field laboratory, select the peeper vials identified as the dedicated water quality peeper vials. Remove the peeper vials from the mylar bags, identify the top vial, and rinse free of sediment using distilled or DI water. DO will be measured in each vial using a narrow (< 3 cm diameter) optical DO probe. The optical DO probe used will be the same make and model as the DO probe used to measure RPD *in situ* and *ex situ* prior to deployment of peepers. Uncap the peeper vial only enough to insert the DO probe. Maintain a low flow of nitrogen over the open peeper vial while measuring DO. Allow instrument to stabilize (a measurement is considered stable in at least 5 seconds without change, and may take up to 25 or 30 seconds) and record the DO measurement on the sampling log form, then re-cap the peeper vial. Rinse the probe with distilled or DI water.
- Uncap the peeper vial under nitrogen flow and insert the Oakton ORP probe. Repeat the same steps for ORP as above.
- Both the DO and ORP meters have uncertainty and variability associated with measurements; therefore, the decision criteria for anoxic porewater will consider both parameters as follows[7]:
    - Scenario 1 (lower DO/higher ORP): DO < 0.5 mg/L is low and ORP < 50 mV = anoxic
    - Scenario 2 (higher DO/lower ORP): DO < 1 mg/L but lower ORP < 0 mV = anoxic
- Repeat this procedure for each peeper vial until the full depth profile has been measured.
- Evaluate the stack of porewater vial measurements to determine the RPD depth. RPD depth is defined as the top of the shallowest peeper determined to be anoxic.
- Use this profile data to select which vials will be composited for analyses, targeting only the vials located in the anoxic zone of sediment. These vials are an integrated measurement over the 30-day exposure period.
- From the fourth water quality monitoring peeper, composite the vials that represent anoxic porewater and measure the remaining water quality parameters (pH, conductivity, and temperature) using the YSI Water Quality Meter. These water parameters best represent the sample aliquots composited for testing from the other three peepers.
- Composite the water from the remaining overlying peeper vials and measure the remaining water quality parameters (pH, conductivity, and temperature) using the YSI Water Quality Meter, if there is adequate water volume (e.g., only one vial is determined to be oxic based on measurements of DO and ORP; the ability to measure other

[7] These criteria will also be used during the pre-deployment measurement of DO and ORP in sediment grab samples to determine RPD.

parameters in the oxic zone may be limited). Measurements will be noted in the field logbook.

4.5.4 Sample Processing: Porewater Sample Compositing Procedures

- Following the identification of the RPD depth, select the peeper vials and depths that will represent the anoxic porewater. These depths will be composited among the three remaining peepers.
- Approximately 140 mL of porewater are needed for analyses, each vial contains about 70 mL of water, and each peeper contains about 350 mL of water (6 to 30 cm depth). A minimum of two sample vials (either one peeper and two vials representing two depths or two peepers and one vial representing one depth) is needed for adequate volume for analytical testing. If EPA collects split samples, then a minimum of four peeper vials is required for sufficient volume.
- Remove the first anoxic peeper vial from the mylar bag. Keep peepers in the nitrogen-purged mylar bag until ready to be composited. Place the peeper vial on its side in a custom holder. Draw 70 mL of high-purity nitrogen gas into a clean syringe by pulling the syringe plunger to the 70-mL mark while it is connected to the nitrogen tank or to a bag that has been filled with nitrogen. Using this syringe and needle, pierce the top of the peeper just below the cap. This top needle should remain in the peeper after piercing until all the water in the peeper has been removed.
- Each peeper vial should yield about 70 mL of sample porewater.
- Pierce the bottom of the peeper with another syringe and needle to create a drainage hole and remove the syringe and needle from the bottom of the peeper. Note, needle points when not in use will be stored in a sharps safe holder.
- Next, move the peeper such that the hole in the bottom is directly over a clean laboratory supplied wide-mouth bottle at least 500 mL in volume—large enough for the volume of porewater from all three peepers (compositing vessel). Purge the compositing vessel with nitrogen gas and then begin adding in the water from the peepers (see bullet below). During compositing, a steady, gentle stream of nitrogen gas will be administered to the compositing bottle. Maintaining a constant stream of nitrogen creates a positive pressure of nitrogen in the bottle, preventing oxygen containing atmospheric air from entering the bottle. Cap the compositing vessel between vial additions.
- Transfer/drain the peeper water into the compositing vessel by plunging the first syringe at the top of the peeper to add a nitrogen gas headspace to the peeper, forcing the water out of the hole in the bottom of the peeper. While adding this peeper water into the compositing vessel, maintain a gentle, steady stream of nitrogen gas to the mouth of the compositing vessel.

- Repeat the above steps with the other vials from all three sampling peepers representing anoxic porewater, adding the porewater from the second and third peepers into the compositing vessel.
- Once the depths representing anoxic porewater from all three peepers have been composited, add nitrogen gas to the headspace and cap the compositing vessel. Mix slowly for 10 seconds until uniform. Transfer the porewater from the compositing vessel to the appropriate laboratory-supplied sampling containers with preservatives for analysis (Table 2). The aliquots for metals analysis will be extracted from the composite container while maintaining a nitrogen atmosphere and placed in the sampling container.
- The oxic porewater sample (vials not composited) will not be submitted to the laboratory for analysis.

4.6 Sample Handling and Transport

Chain-of-custody procedures will follow the Round 1 FSP and SOPs (Integral 2002) and the QAPP (AECOM and Geosyntec 2018a). Samples will be stored on ice at 0 to 6 °C in a field cooler and shipped to TestAmerica's Fife, Washington, laboratory for chemical testing, as detailed in the PDI QAPP (AECOM and Geosyntec 2018a). Additional details on sample handling and transport can be found in Section 4.3 of the QAPP (AECOM and Geosyntec 2018a).

4.7 Field Logbook and Forms

All field activities will be recorded in a field logbook and field forms (Appendix A) as outlined in detail in Section 4.10 of the QAPP (AECOM and Geosyntec 2018a).

4.8 Field Decontamination Procedures

Due to the deployment and retrieval methods of the peeper frames and vials, there is minimal equipment that is re-used between stations. Each peeper is unique to its sampling station and not reused. The push pole deployment system is in minimal contact with sediment at a station and will be rinsed with Site water followed by a distilled or DI water rinse between stations. During sample processing, all needles and compositing containers will be single-use only.

Peepers and peeper frames will be washed with detergent, rinsed with DI water, soaked in an acid wash, and then finally rinsed again with DI water at SiREM laboratories prior to deployment to thoroughly clean the equipment and remove any residual metals.

DO and redox probes will be initially rinsed with river water to dislodge any sediment then rinsed with distilled or DI water between discrete measurements.

4.9 Investigation-Derived Waste

Waste disposal will occur as described in the PDI QAPP (AECOM and Geosyntec 2018a) and the SOP for Investigation-Derived Waste (IDW) Management (Appendix B-6). Tyvek, gloves, paper towels, plastic sheeting, peeper frames, and emptied peeper vials and other waste material generated during sampling will be placed in heavyweight garbage bags or other appropriate containers and placed in normal refuse containers for disposal at a solid waste landfill. Needles will be placed in an appropriate sharps disposal container for disposal by a sharps retrieval program (e.g., Sharps Assure). IDW will include residual sediments, distilled or DI rinse water, and DI water with NaBr used to house the peepers. Residual sediments and distilled or DI rinse water will be collected and disposed of in the river prior to leaving a sampling location. DI water containing NaBr will be disposed of in the sanitary sewer.

4.10 Field Quality Control

Field QC samples are collected to assess variability within samples (e.g., duplicates), to evaluate if potential sources of contamination are present (e.g., rinsate blanks), or to confirm proper storage conditions of samples (e.g., temperature blanks). All QA/QC procedures are detailed in the QAPP (AECOM and Geosyntec 2018a).

Field duplicates are additional samples collected at the same location to characterize variability in sampling and analysis results. Field duplicates will be collected as described in Section 4.6.1 of the QAPP (AECOM and Geosyntec 2018a). One field duplicate will be collected for porewater sampling. Enough porewater will be collected from the three-point composite sample to split for a primary and field duplicate sample. Porewater will be composited into a single sample that will then be split into primary and blind field duplicate containers for analysis.

Rinsate blanks will be collected as outlined in Section 4.6.1 of the QAPP (AECOM and Geosyntec 2018a). Split samples for EPA will be determined at the time of sampling. Rinsate blanks will be conducted about one per event (or 5% of total project samples) using DI water poured over the sampling equipment prior to deployment to avoid potential cross-contamination associated with peeper preparation.

Calibration and field checks of the water quality parameter multiprobe will be performed in accordance with Integral 2004 (excerpted in this FSP as Appendix B-3) and per the Water Quality Monitoring Equipment Calibration, Operation, and Maintenance SOP (Appendix B-4) and the equipment-specific instructions (Appendix B-5). The optical DO probe will be calibrated using a two-point calibration process (100% saturation and 0% saturation) prior to measuring concentrations of DO in the porewater peeper vials to determine RPD.

5. LABORATORY ANALYSIS

TestAmerica's Fife, Washington, laboratory will analyze all porewater samples from *in situ* passive samplers for dissolved arsenic and manganese by EPA Method 6020B and bromide anion by EPA method 300.0. Additional details on the analytical methods, QA/QC requirements and procedures, and laboratory specific QA/QC requirements are detailed in Sections 4.5 and 4.6 of the QAPP (AECOM and Geosyntec 2018a). All samples will be placed in laboratory-supplied sample containers and preserved according to analytical protocols. Sample containers, preservation requirements, holding times, and sample volumes are provided for all analyses in Table 2.

6. DATA MANAGEMENT AND REPORTING

6.1 Data Management

The procedures and activities outlined in this FSP are designed to ensure DQOs are met. Specifically, and as detailed in Section 4 of this FSP and in the QAPP (AECOM and Geosyntec 2018a), the following data management procedures will be performed in the field:

- All samples will be given a unique identifier (Section 2.4 of this FSP).
- All samples will be collected and transported under chain-of-custody control (Section 4.6 of this FSP).
- Field logbooks and data sheets will be maintained (Section 4.7 of this FSP).
- Field QA/QC samples will be collected according to the QAPP (Section 4.10 of this FSP).

Analytical laboratories will be required to adhere to all QA/QC procedures outlined in the QAPP (AECOM and Geosyntec 2018a). Data validation, management, and reporting will be performed according to the QAPP (AECOM and Geosyntec 2018a) and Data Quality Monitoring Plan (AECOM and Geosyntec 2018c).

6.2 Reporting

Results from the implementation of this FSP will be used to support multiple data use objectives as outlined in the PDI Work Plan (Table 5 of the PDI Work Plan). Data summaries and evaluations will be included in the PDI Evaluation Report.

7. REFERENCES

AECOM (AECOM Technical Services) and Geosyntec (Geosyntec Consultants, Inc.). 2018a. Quality Assurance Project Plan Portland Harbor Pre-Remedial Design Investigation Studies Portland Harbor Superfund Site. March.

AECOM and Geosyntec. 2018b. Health and Safety Plan. Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling. Portland Harbor Superfund Site. March.

AECOM and Geosyntec. 2018c. Data Quality Management Plan Portland Harbor Pre-Remedial Design Investigation Studies Portland Harbor Superfund Site. February.

EPA (United States Environmental Protection Agency). 2016a. Portland Harbor RI/FS, Final Remedial Investigation Report, Portland, Oregon. United States Environmental Protection Agency Region 10, Seattle, Washington. 8 February.

EPA. 2016b. Portland Harbor RI/FS, Final Feasibility Study, Portland, Oregon. United States Environmental Protection Agency Region 10, Seattle, Washington. June.

EPA. 2017a. Record of Decision Portland Harbor Superfund Site, Portland, Oregon. United States Environmental Protection Agency Region 10, Seattle, Washington. January.

EPA. 2017b. ASAOC between EPA and the Pre-RD AOC Group for Pre-Remedial Design Investigation Studies, Portland Harbor Superfund Site, Portland, Oregon. United States Environmental Protection Agency Region 10, Seattle, Washington. 18 December

Geosyntec. 2017. Final Work Plan, Portland Harbor Pre-Remedial Design Investigation Studies, Portland Harbor Superfund Site, Portland, Oregon. Prepared for the Pre-RD AOC Group for submittal to EPA Region 10. Attachment to the Statement of Work. 19 December.

Gerardi, M. H. 2007. ORP Management in Wastewater as an Indicator of Process Efficiency. New England Interstate Water Pollution Control Commission (NEIWPCC), reprinted with permission by YSI, 2008.

Germano (Germano & Associates, Inc.). 2014. Sediment Profile Imaging Report, Characterization of the Lower Willamette River with Sediment Profile Imaging: Changes in Space & Time. Prepared for de maximus, Inc. June.

GSI Water Solutions and Hart Crowser. 2018. Final Field and Data Report Upriver Reach Sediment Characterization Lower Willamette River Portland, Oregon. Prepared for Oregon Department of Environmental Quality.

Hurtado, H.A. 2015. Naturally Occurring Background Levels of Arsenic in the Soils of Southwestern Oregon. Dissertations and Theses. Paper 2996.

Integral (Integral Consulting). 2002. Round 1 Field Sampling Plan. Prepared for the Lower Willamette Group (LWG) for submittal and approval by EPA Region 10. 14 June.

Integral. 2004. Round 2 Field Sampling Plan – Sediment Sampling and Benthic Toxicity Testing Prepared for the Lower Willamette Group (LWG) for submittal and approval by EPA Region 10. August.

Integral. 2005. Round 2 Groundwater Pathway Assessment Sampling and Analysis Plan Attachment 2 Transition Zone Water Field Sampling Plan. Prepared for the Lower Willamette Group (LWG) for submittal and approval by EPA Region 10. 8 July.

Integral. 2006. Preliminary Upstream and Downstream Sediment Data Evaluation and Round 3A Field Sampling Plan for Upstream and Downstream Sediment Sampling.

Kennedy, A.J., G.R. Lotufo, J.A. Steevens, and T.A. Bridges. 2010. Determining Steady-state Tissue Residues for Invertebrates in Contaminated Sediment. Prepared for United States Army Engineer District, New York. ERDC/EL TR-10-2. May.

Neill, M., N. Walsh, and L. Lucey. 2014. Direct measurement of oxygen in river substrates. Water and Environment Journal, 28: 566–571.

ODEQ (Oregon Department of Environmental Quality). 2013. Development of Oregon Background Metals Concentrations in Soil. March.

Striplin Environmental Associates, Inc. 2002. Sediment Profile Image Survey of the Lower Willamette River. Prepared for the Lower Willamette Group (LWG). 26 April.

Thomas, B., and M.A. Arthur. 2010. Correcting porewater concentration measurements from peepers: Application of a reverse tracer. Limnology and. Oceanography: Methods 8, 2010, 403–413.

Trimble, D. 1963. Geology of Portland, Oregon and Adjacent Areas. Geological Survey Bulletin 1119 United States Department of the Interior.

United States Geologic Survey. 2006. Volatile Organic Compounds in the Nation's Ground Water and Drinking-Water Supply Wells. National Water-Quality Assessment Program.

TABLES

Table 1. Station Location Coordinates and Identification Scheme

Proposed Target Area[a]	Proposed Sample ID[b]	Approximate Location	Estimated Mudline Elevation (CRD - Feet)[c]	Proposed Location Coordinates (NAD 1983; Intl Feet)[d]		Deployment Duration[e]
				Easting	*Northing*	
1	PDI-WP-B441	RM 14.0 E	No Data	7647802	675636	28 days (at 8 or 9 final selected locations)
2	PDI-WP-B455	RM 15.6 E	No Data	7648051	667208	
3	PDI-WP-B453	RM 15.6 W	-8.6396	7646045	667770	
4	PDI-WP-B460	RM 17.0 W	No Data	7647231	660249	
5	PDI-WP-B466	RM 18.5 W	No Data	7651174	654197	
6	PDI-SG-B467 or PDI-WP-B468	RM 18.8 E	No Data	7651328	652982	
7	PDI-SG-S264[f] or PDI-WP-B472	RM 20.0 W	No Data	7648406	647388	
8	PDI-WP-B474	RM 22.7 E	No Data	7655566	636887	
9	PDI-WP-B475 or PDI-WP-B476	RM 23.2 W	No Data	7655744	634467	
10	PDI-WP-B477	RM 24.2 W	No Data	7657537	629980	
11	PDI-WP-S265[f] or PDI-WP-B483	RM 27.3 W	No Data	7654430	619948	
12	PDI-WP-B487 or PDI-WP-S266[f]	RM 28.7 W	No Data	7650213	617199	
Blind Field Duplicates						
TBD	PDI-PW-001-D	TBD				28 days
Total Sample Count for Analysis			9 or 10			

General Notes:

All porewater samples will be collected to a target depth of 30 cm below the sediment/water interface.

All porewater samples will be 3-point composites over a small footprint (< 25 feet between samplers) with a 4th dedicated peeper for water quality parameters.

Co-located surface sediment grab samples will be collected and analyzed for grain size, TOC, and metals (As, Mn).

Rinsate blank samples will be collected once per event during deployment.

Footnotes:

a) Only 8 or 9 of 12 Proposed Target Areas will be sampled, plus one field duplicate.

b) Sample IDs reflect a PDI Surface Sediment Station ID within the Target Area. As some Target Areas have multiple stations, these may be revised when final sample locations are determined. If no surface sediment sampling is planned within an area, a new sample ID has been assigned sequentially using the SMA surface sediment grab sample numbers.

c) Vertical Datum: CRD (Feet); based on 2004 bathymetry.

d) Horizontal Projection: NAD 1983 Oregon State Plane North (International Feet). Coordinates for a centroid of the Porewater Sampling Area or an available D/U Reach Surface Sediment grab sample location are provided as reference for field crews only and are not reflective of targeted sampling locations. Sampling coordinates will be refined following pre-deployment field survey.

e) Samples will be deployed during summer low river flow conditions (August 2018) for a target duration of 28 days.

f) A co-located sediment grab may be added in these areas as these were not included under the PDI surface sediment sampling.

Abbreviations:

CRD = Columbia River Datum

ID = identification number

NAD = North American Datum

RM = river mile

TBD = to be determined

Table 2. Sample Containers, Preservation, Holding Times, and Sample Volume

Porewater Analysis	Container		Preservation	Holding Time	Minimum Sample Volume (mL)
	Type	*Size*			
Metals (EPA Method 6020B)	HPDE	100 mL	HNO_3 to pH <2	180 days from collection to analysis	100
Bromide (EPA 300.0)	HDPE	125 mL	Cool to 0-6°C	28 days	40

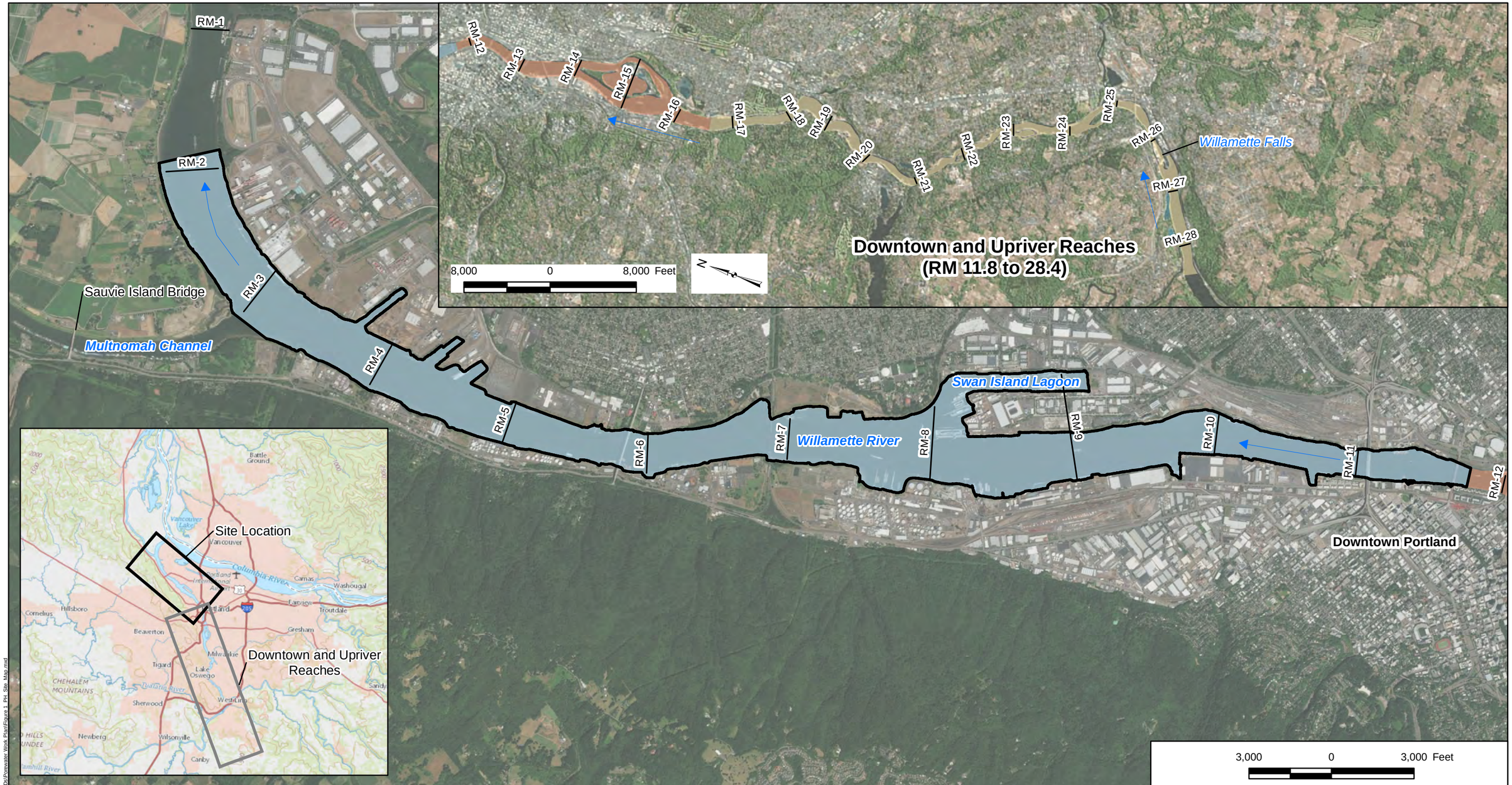
Notes:

1. Only arsenic and manganese will be reported.

Abbreviations:

EPA = [United States] Environmental Protection Agency
HDPE = high-density polyethylene
HNO_3 = nitric acid
mL = milliliter

FIGURES



Legend

- Flow Direction
- River Mile Marker
- Superfund Site Boundary (RM 1.9 to 11.8)

Study Area

- Site Area (RM 1.9 to 11.8)
- Downtown Reach (RM 11.8 to 16.6)
- Upriver Reach (RM 16.6 to 28.4)

Note:
1. Aerial Imagery provided by ESRI Basemaps 2016

Portland Harbor Site Map

Portland Harbor Superfund Site
Porewater FSP

AECOM | Geosyntec consultants

Figure 1

MI/SEA | January 18, 2018

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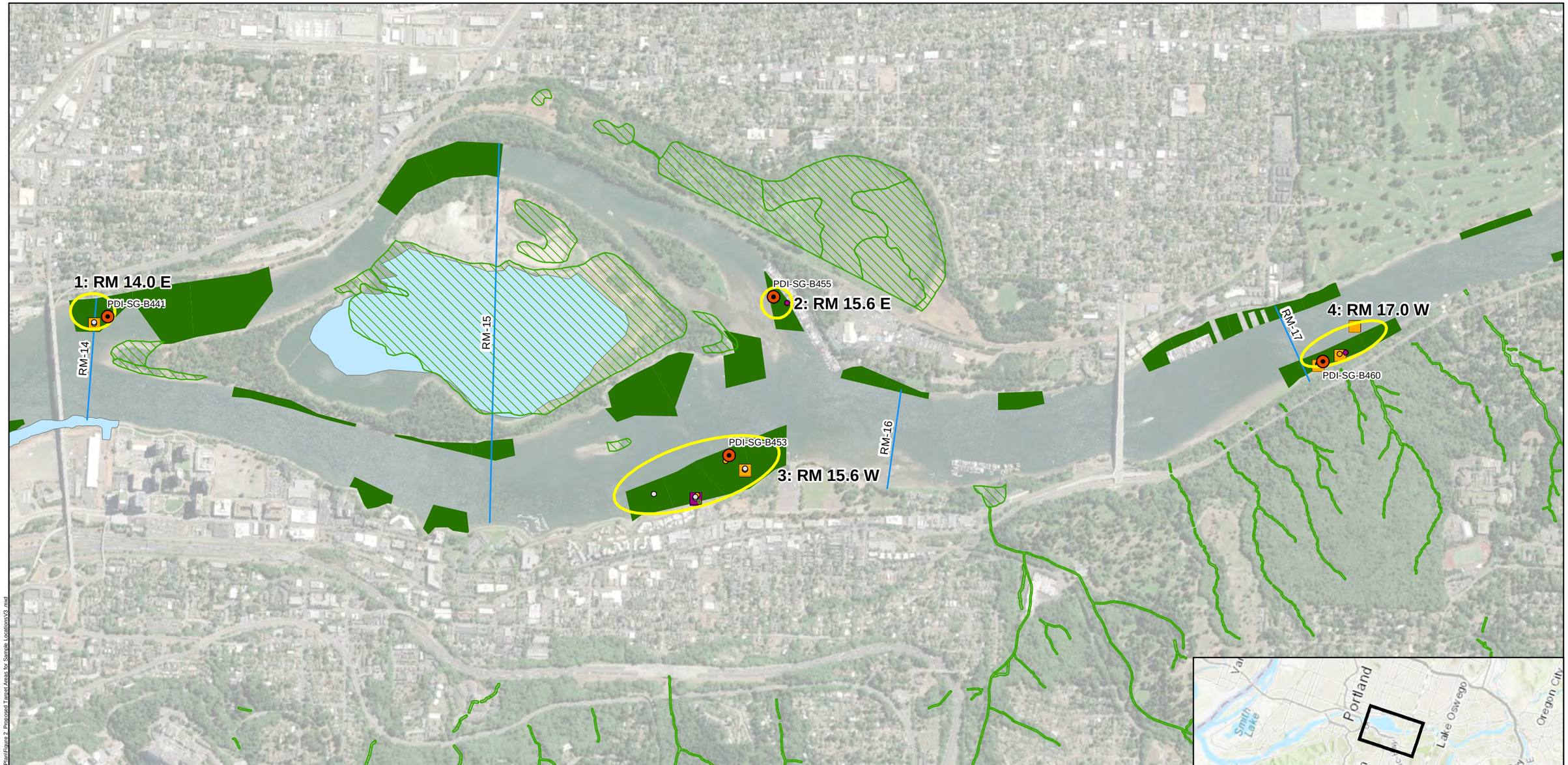

Legend

- Porewater Sample Area
- Proposed D/U Reach Stratified Random Sediment Grab Sample Location
- Co-located Sediment Grab Sample for Porewater Sampling

Percent Fines - Historic and Current RI Surface Sediment

- < 30 %
- 30 - 60 %
- > 60%

Percent TOC - Historic RI Surface Sediment

- < 0.5 %
- 0.5- 2.5 %
- > 2.5 %
- Areas of Soft Sediment Based on 2018 Hand Probing Data
- Wetland Area
- Capped Area (Existing)
- River Mile Marker

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Concentrations of Arsenic in all target sampling areas are < 5 mg/kg.
3. Wetlands data from National Wetlands Inventory.
4. RM - river mile.
5. If no D/U Reach surface sediment sampling was planned within an area, a new sample ID has been assigned sequentially using the SMA surface sediment grab sample numbers (S264 and S265).

N

1,000 500 0 1,000 2,000 Feet

Proposed Target Areas for Porewater Sample Locations Areas 1 to 4

Portland Harbor Superfund Site
PDI Pore Water FSP

AECOM Geosyntec consultants

Figure 2a

MI/SEA | August 8, 2018

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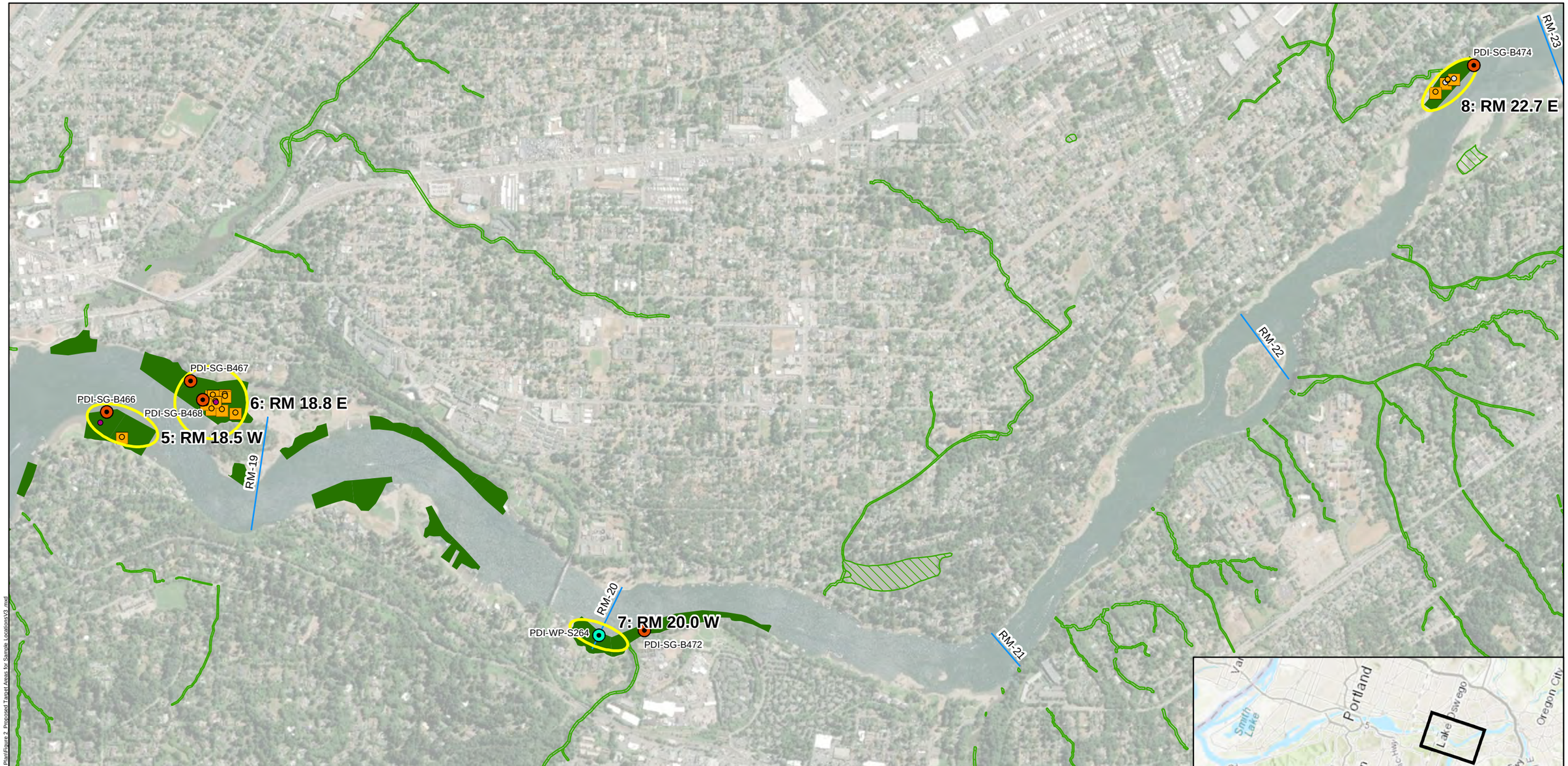
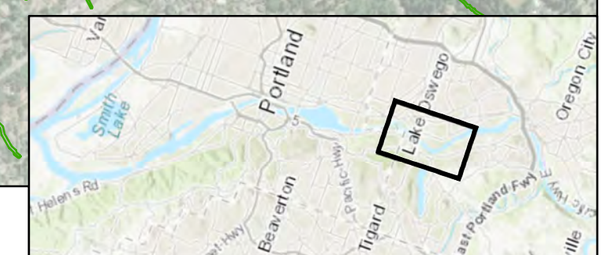




Legend

- Porewater Sample Area
- Proposed D/U Reach Stratified Random Sediment Grab Sample Location
- Co-located Sediment Grab Sample for Porewater Sampling

Percent Fines - Historic and Current RI Surface Sediment

- < 30 %
- 30 - 60 %
- > 60%

Percent TOC - Historic RI Surface Sediment

- < 0.5 %
- 0.5- 2.5 %
- > 2.5 %
- Areas of Soft Sediment Based on 2018 Hand Probing Data
- Wetland Area
- Capped Area (Existing)
- River Mile Marker

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Concentrations of Arsenic in all target sampling areas are < 5 mg/kg.
3. Wetlands data from National Wetlands Inventory.
4. RM - river mile.
5. If no D/U Reach surface sediment sampling was planned within an area, a new sample ID has been assigned sequentially using the SMA surface sediment grab sample numbers (S264 and S265).

N

1,000 500 0 1,000 2,000 Feet

Proposed Target Areas for Porewater Sample Locations Areas 5 to 8

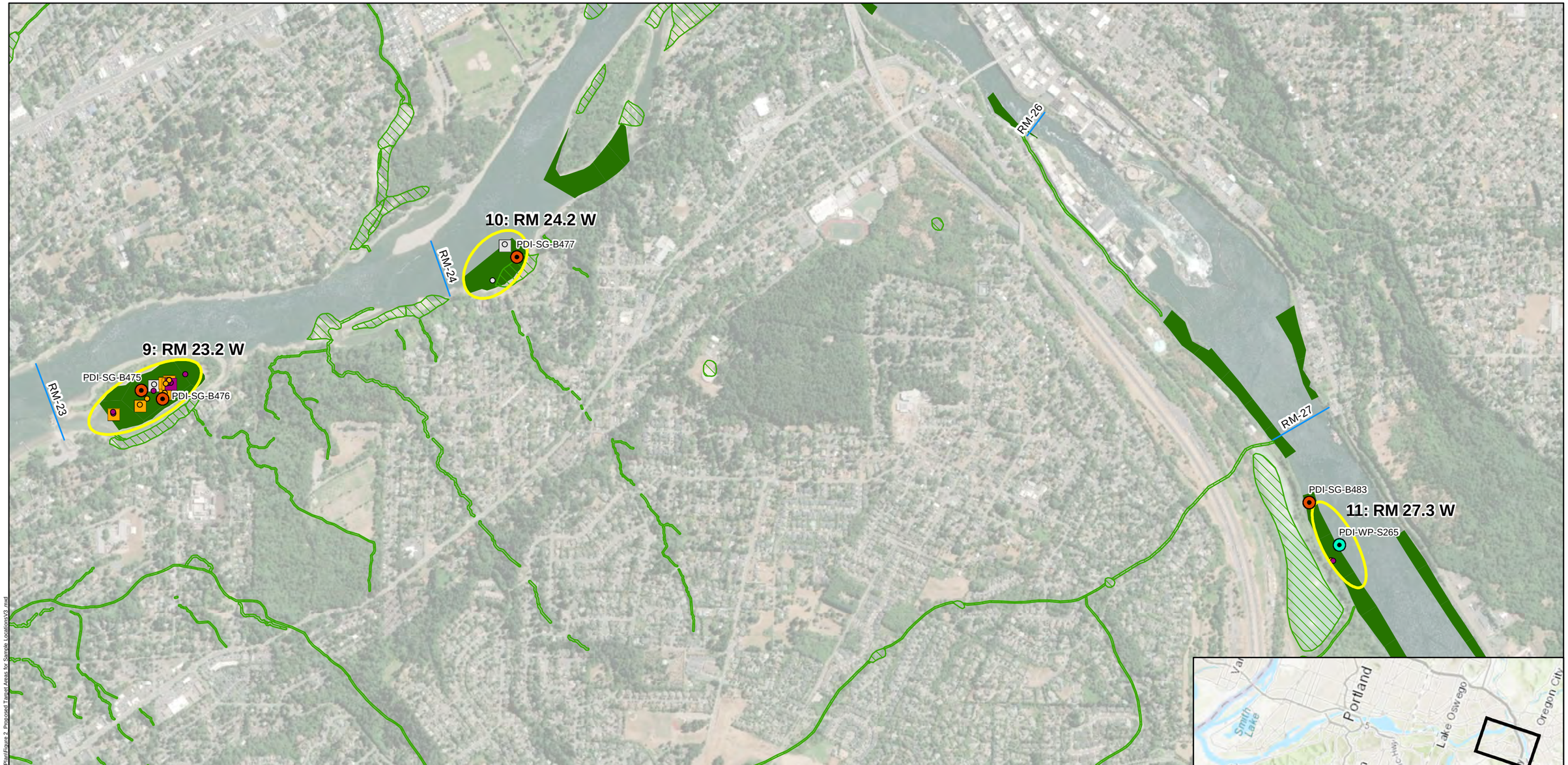
Portland Harbor Superfund Site
PDI Pore Water FSP

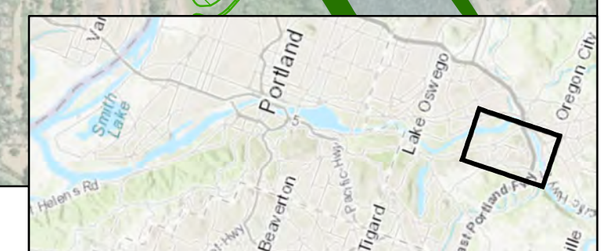
AECOM Geosyntec consultants

Figure **2b**

MI/SEA | August 8, 2018

Path: P:\Projects\Portland Pre-Design PN\60767\A\900 GIS and CAD\MXDs\Porewater Work Plan\Figure 2_Proposed Target Areas for Sample Locations\V3_.mxd





Legend

- Porewater Sample Area
- Proposed D/U Reach Stratified Random Sediment Grab Sample Location
- Co-located Sediment Grab Sample for Porewater Sampling

Percent Fines - Historic and Current RI Surface Sediment

- < 30 %
- 30 - 60 %
- > 60%

Percent TOC - Historic RI Surface Sediment

- < 0.5 %
- 0.5- 2.5 %
- > 2.5 %
- Areas of Soft Sediment Based on 2018 Hand Probing Data
- Wetland Area
- Capped Area (Existing)
- River Mile Marker

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Concentrations of Arsenic in all target sampling areas are < 5 mg/kg.
3. Wetlands data from National Wetlands Inventory.
4. RM - river mile.
5. If no D/U Reach surface sediment sampling was planned within an area, a new sample ID has been assigned sequentially using the SMA surface sediment grab sample numbers (S264 and S265).

N

1,000 500 0 1,000 2,000 Feet

Proposed Target Areas for Porewater Sample Locations Areas 9 to 11

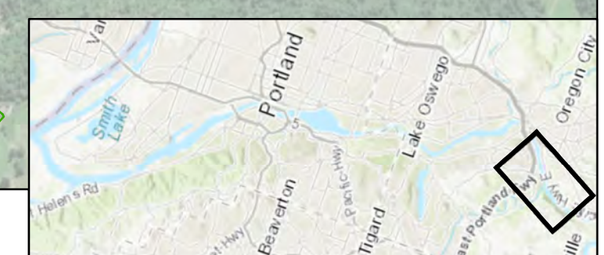
Portland Harbor Superfund Site
PDI Pore Water FSP

AECOM Geosyntec consultants

Figure 2c

MI/SEA | August 8, 2018

Path: P:\Projects\Portland Pre-Design\PN\G0767A\9\90\GIS and CAD\MXD\Porewater Work Plan\Figure 2_Proposed Target Areas for Sample Locations\V3_.mxd



Legend

- Porewater Sample Area
- Proposed D/U Reach Stratified Random Sediment Grab Sample Location
- Co-located Sediment Grab Sample for Porewater Sampling

Percent Fines - Historic and Current RI Surface Sediment

- < 30 %
- 30 - 60 %
- > 60%

Percent TOC - Historic RI Surface Sediment

- < 0.5 %
- 0.5- 2.5 %
- > 2.5 %
- Areas of Soft Sediment Based on 2018 Hand Probing Data
- Wetland Area
- Capped Area (Existing)
- River Mile Marker

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2. Concentrations of Arsenic in all target sampling areas are < 5 mg/kg.
3. Wetlands data from National Wetlands Inventory.
4. RM - river mile.
5. If no D/U Reach surface sediment sampling was planned within an area, a new sample ID has been assigned sequentially using the SMA surface sediment grab sample numbers (S264 and S265).

N

1,000 500 0 1,000 2,000 Feet

Proposed Target Areas for Porewater Sample Locations Areas 11 to 12

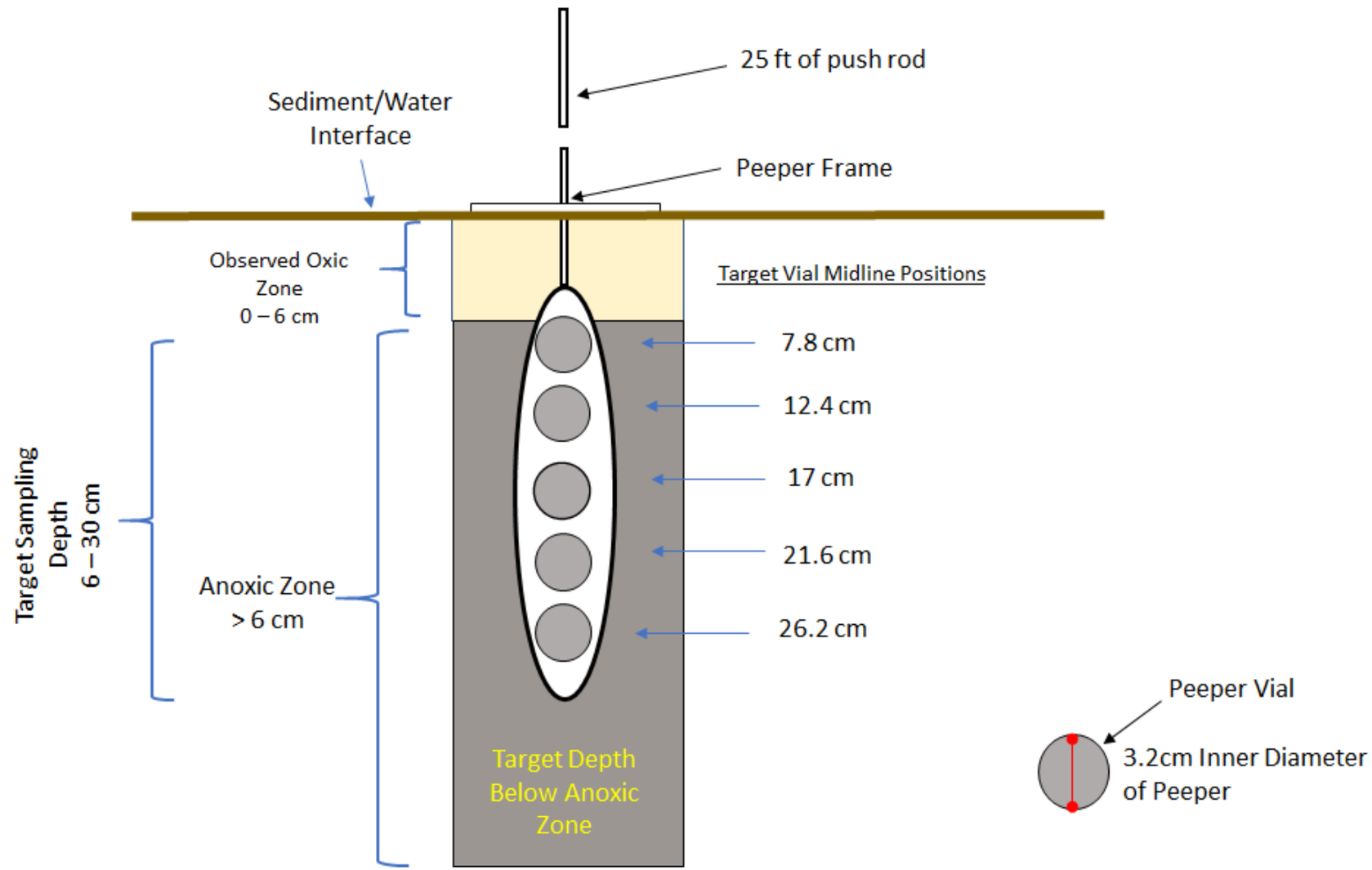
Portland Harbor Superfund Site
PDI Pore Water FSP

AECOM Geosyntec consultants

Figure **2d**

MI/SEA | August 8, 2018

Path: P:\Projects\Portland Pre-Design PN\G276\A\900\GIS and CAD\MXDs\Porewater Work Plan\Figure 2_Proposed Target Areas for Sample Locations\V3.mxd



Vertical Stratification of Redox Conditions and Sampling Depth Intervals

Portland Harbor Superfund Site
PDI Porewater FSP

AECOM | Geosyntec consultants

Figure 3

MI/SEA | June 10, 2018

Path: P:\Projects\Portland Pre-Design PNG0767A\900 GIS and CAD\MXDs\Porewater Work Plan\Figure 2_Porewater Sample Intervals.mxd

APPENDIX A

Equipment Checklist and Field Forms

AECOM

Geosyntec consultants

Portland Harbor PDI Porewater Peeper Deployment Log **Porewater Station ID:**_____

Deployment Date:	_____	**Sampling Vessel:**	_____
Peeper Interval:	_____	**Field Personnel:**	_____
Weather Conditions:	_____	**Water Depth (ft):**	_____
Proposed Coordinates:	N _____	**Mudline Elevation (ft)*:**	_____
	E		

Sediment Conditions (during pre-deployment grab sampling / peeper deployment):

Substrate Description: _____

DO/ Redox/ RPD Depth in Sediment: _____

Presence of Anoxic Conditions During Deployment (Y/N): _____

Peeper Deployment:

Triplicate Peeper #	Time	Actual Coordinates		Water Depth (ft)	Drive Depth (ft bml)	Radius Distance to Target Loc. (ft.)	Direction of Retrieval Line/Deployment Notes:
		Northing	Easting				
1							
2							
3							
4 - Water Quality							

* Surface Water Elevation as measured at Morrison Bridge by NOAA:

Water elevation datum:

Overlying Surface Water Quality Parameters:

Water Depth: _____

Temp: _____ D.O.:_____ Other: _____

ORP: _____ Cond: _____ pH:_____

Oversight During Sampling? No Yes: _____

Additional Comments:	**Sketch of Peeper Array:**

last revised August 8, 2018

AECOM

Geosyntec consultants

Portland Harbor PDI Porewater Peeper Field Retrieval **Porewater Station ID:**_____

Peeper Station ID:_____	**Field Personnel:** _____
Retrieval Date: _____	**Sampling Vessel:** _____
Deployment Duration: _____	
Weather Conditions: _____	

Peeper #	Time	Coordinates		Water Depth (ft)	Peeper Condition (not acceptable, fair, good, very good)	Retrieval Notes
		Northing	Easting			
1						
2						
3						
4						

* Tide as measured at Morrison Bridge by NOAA Water Elevation Datum:

Overlying Surface Water Quality Parameters

Water Depth: _____

Temp: _____ D.O.:_____ Other: _____

ORP: _____ Cond: _____ pH:_____

QA/QC Report			
QA/QC Type	**QA/QC Sample ID**	**Time**	**Parent**

Oversight During Sample Collection? No Yes: _____

Additional Comments

last revised Aug. 8, 2018

AECOM

Geosyntec consultants

Portland Harbor PDI Porewater Peeper Processing Log **Porewater Location ID:**_____

Peeper Station ID:_____ **Field Personnel:** _____
Retrieval Date: _____ **Sampling Vessel:** _____
Deployment Duration: _____
Weather Conditions:

Pore Water Quality Parameters (in vial) Peeper Used: _____

Parameter(Unit)	Vial 1	Vial 2	Vial 3	Vial 4	Vial 5
DO (mg/L)					
ORP (mV)					

Oxic Composite Water Quality Peeper Vials / Volume:

Pore Water Quality Parameters (Oxic Composite)
Temp: _____ D.O.:_____
ORP: _____ Cond: _____ pH:_____

Anoxic Composite Water Quality Peeper Vials / Volume:

Pore Water Quality Parameters (Anoxic Composite)
Temp: _____ D.O.:_____
ORP: _____ Cond: _____ pH:_____

Sample ID: _____ **Analysis:** _____

Additional Comments/Sketch of Compositing:

last revised Aug. 8, 2018

Porewater Sampler Deployment/Retrieval Packing List

Job Title	Portland Harbor PDI	
Number Peepers (4 peepers per location; 8 locations + 2 Field Duplicates) =	40	
Number of Locations (4 peepers per location)	8 or 9	+ 1 field duplicate
Deployment Duration	28 days	
Deployment Method	Push pole	

Item	Qty	Category
Peeper Deployment		
Push poles (5 ft sections, 7 ft long)	1	Push Pole Deployment
Whale tail	1	Push Pole Deployment
Extra whale tail spring pins	3	Push Pole Deployment
Extra spring pin cotter pins	3	Push Pole Deployment
Underwater camera, padding and mount	1	Push Pole Deployment
Rope, nylon - floating (10-15 ft per peeper + 100 ft extra)	700	Push Pole Deployment
Floats, large - 10 for job. misc. use.	10	Push Pole Deployment
Floats, small - 1 per location + extras	60	Push Pole Deployment
Peeper frames & associated materials (with 10% extra)	44	Push Pole Deployment
Peeper vials - 5 per frame + 20% extra	240	Push Pole Deployment
Peeper filter papers	264	Push Pole Deployment
6-gallon bucket for nitrogen purging	4	Push Pole Deployment
Deionized water (gallons) (enough for 4 x 6-gallon bucket for purging)	24	Push Pole Deployment
Nitrogen tank, high purity gas if possible, and regulator	1	Push Pole Deployment
Misc. flexible tubing for nitrogen tank	1	Push Pole Deployment
YSI Optical DO probe	1	Monitoring
YSI Multiparameter Probe (temperature, conductivity, DO, ORP, and pH)	1	Monitoring
Peeper Retrieval and Sample Processing		
Deionized water - gallons (in squeeze bottle for rinsing)	3	Peeper Retrieval
YSI Optical DO Probe (< 2.7 cm wide)	1	Monitoring
YSI Multiparameter Probe	1	Monitoring
pH and Conductivity Probe (< 2.7 cm wide)	1	Monitoring
ORP probe (< 2.7 cm wide)	1	Monitoring
Packing type tape - 2 rolls	2	Peeper Processing
Nitrogen tank, high purity gas if possible, and regulator	1	Peeper Processing
Misc. flexible tubing for nitrogen tank	1	Peeper Processing
Grapple line and hook	1	Peeper Retrieval
Syringes and sharps containers (1 per peeper vial plus extra)	180	Peeper Processing
Cooler and ice	4	Peeper Retrieval
Mylar bags (1 per peeper vial)	220	Peeper Processing
Compositing vessel (narrow mouth glass jar; 1 L)	1	Peeper Processing
Laboratory-supplied sample bottles	20	Peeper Processing
Supplies & Tools		
Garbage bags	4	General Sampling Equipment
Gloves, 12 X No. locations	96	General Sampling Equipment
Weighted measuring tape (50 ft long)	1	General Sampling Equipment
Measuring tape	1	General Sampling Equipment
Paper towels - 1 role per 8 locations	1	General Sampling Equipment
1-gallon Ziploc bags - 2 per device	80	General Sampling Equipment
Sandwich-size Ziploc bags - 3 per peeper	140	General Sampling Equipment
Cable ties - medium - 10 per location	80	General Sampling Equipment
Cable ties - long - 3 per location	24	General Sampling Equipment
Camera	1	General Sampling Equipment
Field notebook	1	General Sampling Equipment
Pens & Sharpies	3	General Sampling Equipment
Tin snips	1	Tools
Needle-nosed pliers	1	Tools
Slip joint pliers	1	Tools
Phillips head screw driver	2	Tools
3/8-inch wrench	1	Tools
3/8-inch socket on screw driver handle	1	Tools
Knife	1	Tools

Safety Supplies and PPE

Boots, waterproof, steel-toed	pp	PPE
Gloves, nitrile, heavy outer	pp	PPE
Gloves, nitrile, thin inner	pp	PPE
Hard hats	pp	PPE
Hearing protection	pp	PPE
Rain slicks	pp	PPE
Safety glasses/goggles	pp	PPE
Warm/dry clothes	pp	PPE
Work gloves - cut resistant	pp	PPE
US Coast Guard-approved Type III or V PFD or life jacket	pp	PPE
GPS	1	Safety Equipment
Cell phones (fully charged) or satellite phone (if no cell coverage)	1	Safety Equipment
VHF radios	1	Safety Equipment
Rescue rope in throw bag	1	Safety Equipment
Air horns and/or whistles	1	Safety Equipment
Waterproof flashlight	1	Safety Equipment
Secondary “kicker” motor or alternative propulsion	1	Safety Equipment
Bailer or bilge pump/emergency pump	1	Safety Equipment
Length of rope for securing boat	1	Safety Equipment
Type 4 throwable ring or cushion	1	Safety Equipment
Type BC fire extinguisher (10 pound) if extra fuel is carried in portable containers.	1	Safety Equipment
Anchor with appropriate length of line	1	Safety Equipment
First-aid kit and AED	1	Safety Equipment
Oil booms	1	Safety Equipment
PID	1	Safety Equipment
Bottled water	1	Safety Equipment
Snacks	1	Safety Equipment
Float plan	1	Safety Equipment

Notes:
AED = automated external defibrillator
cm = centimeter
DO = dissolved oxygen
ft = foot/feet
GPS = global positioning system
L = liter
ORP = oxidation-reduction potential
PDI = pre-remedial design investigation
PFD = personal flotation device
PID = photoionization detector
pp = per person
PPE = personal protective equipment
VHF = very high frequency

Last revised August 8, 2018

APPENDIX B

Standard Operating Procedures (SOPs)

B-1: Horizontal and Vertical Station Control SOP (revised August 2018)

B-2: Field Wet Sieving for Grain Size SOP

B-3: Water Quality Parameters SOP (Integral 2004)

B-4: Water Quality Monitoring Equipment Calibration, Operation, and Maintenance SOP

B-5: Manufacturer Operation Manuals for Water Quality Parameter Probes

B-6: Management of Investigation-Derived Waste SOP

APPENDIX B – Standard Operating Procedures

B-1. Horizontal and Vertical Station Control

STANDARD OPERATING PROCEDURE
HORIZONTAL AND VERTICAL SURVEY CONTROL

Introduction

This Standard Operating Procedure (SOP) has been developed for the Pre-Remedial Design Sampling and Baseline Investigations (PDI) at the Portland Harbor Superfund Site located in Portland, Oregon to confirm accurate positioning of vessels and samples during sample collection activities. The survey control requirements described in this SOP are specifically for environmental sample collection and will generally comply with map-grade precision and accuracy in contrast to the geodetic-grade precision and accuracy performed for the Bathymetric Survey conducted by David Evans and Associates (DEA). However, the same survey control points and geodetic parameters will be used in both surveys for consistency, and a portion of the quality assurance/quality control (QA/QC) process will involve consultation with DEA Oregon Professional Land Surveyor (PLS) staff to review the map-grade data collected for the environmental sample collection.

The organization of this SOP is as follows:

- Methodology Overview
- Project Geodetic Parameters
- Survey Accuracy, Precision, and Control
- Primary Equipment
- Hand-Held GPS Operation
- Vessel Navigation and Equipment Operation
- Data Processing and QA/QC Procedures

Tables, figures, and attachments are presented at the end of the SOP.

Methodology Overview

Horizontal (Map) Data Collection

A combination of vessel-mounted and hand-held GPS receivers will be used to navigate to sampling locations and to collect map location coordinates (Northings, Eastings) for those sampling locations. The vessel-mounted GPS receivers will be the primary tool used for navigation to the pre-planned sampling locations in a GIS file, which will be pre-loaded into the vessel navigational system. The hand-held GPS devices will be used as a backup and confirmation of vessel position only if there are problems with the vessel GPS navigation system or if there is no specific vessel navigation system (i.e., smaller boats). Since the inception of field work, the vessel GPS coordinates have been consistently verified and deemed to be sufficient to meet position and accuracy requirements for the project. The hand-held GPS devices will primarily be used for studies involving small vessels. These devices will also have the pre-loaded basemap content depicting planned sampling locations.

The vessel GPS will operate in two modes, collecting both a separate continuous data stream of positional information (line file) and recording GPS soundings (target file) when a sample is specifically collected. The sample location target file will be recorded when the sampling device is in position for the grab (e.g., when sampler is on the river bottom). The specific Location ID associated with the sample will also be recorded in the GPS device log. Field personnel will be required to write that same Location ID on their field data collection forms at the same time. Both the continuous and episodic dataset will be timestamped to allow comparison of the two types of data. This data will be recorded and maintained on the vessel, and will also be exported from the vessel navigation system and archived to project servers on a daily basis.

The hand-held GPS devices will be operated independently of the vessel's systems and will be used to record a location sounding wherever a sample is collected only for studies unable to use the vessel GPS navigation system. The sample location sounding will be recorded approximately at the same time as when the vessel GPS measurement is collected (e.g., when sampler is in position). The specific Location ID associated with the sample will also be recorded on the GPS device. Field personnel will write this Location ID on the field forms only if the vessel measurement described earlier cannot be collected for some reason (e.g., equipment failure). These measurements will also be timestamped. The data from the hand-held GPS devices will be wirelessly synchronized to a "cloud" web service in near real-time; the data from the "cloud" will also downloaded and saved to project servers daily.

Vertical Data Collection

Vertical (elevation) data is also required for water levels, sample collection depth below surface water, and bottom (mudline) depth location for some types of sample locations. For increased precision and accuracy, it is proposed that bottom (mudline) depth locations (e.g., for sediment cores) be calculated from the 2018 bathymetric surface to be developed by the hydrographic survey performed by DEA (since the data will be collected within a few months of each other). The NAVD88 elevation will be calculated from the intersection of the surface map location coordinates collected as described earlier, projected vertically down to the bathymetric surface (United States Army Corps of Engineers [USACE], 2004). The elevation from the intersection of the bathymetric surface will be used as the final or "best" elevation for the sample.

In contrast, for depth measurements that require less precision (e.g., water levels, depth to samples below water surface), the onboard vessel sonar will be used to record depth and then subsequently calculate elevation. All depths will be recorded relative to the water surface and time tagged to correct with time tagged gauge data for obtaining riverbed elevations. The elevation will be calculated to NAVD88 datum (in feet). To correct elevations, gauge data from the Northwest River Forecast Center will be downloaded for gauge PRT03, which is representative of the former Morrison gauge which has been moved. This gauge does not report NAVD88 elevations but rather reports a value that is 0.3 feet above Columbia River Datum (CRD). Corrections from CRD to NAVD88 differ moving down the river from the gauge due to the fact that NAVD88 is a reference normal to gravity (water does not flow if the elevation is unchanging), and CRD is a gradient datum that follows the lower water surface. In Portland Harbor, the difference between CRD and NAVD88 (Geoid12b) ranges from 0.00 feet CRD = -5.16 feet NAVD88 (Geoid12b) at Willamette River river mile (RM) 2.0, to 0.00 feet CRD = -5.41

feet NAVD88 (Geoid12b) at Willamette River RM 12.8 (approximate location of PRT03 Gauge). Accordingly, a correction to the Willamette Gauge in Portland would be -5.41+0.3 or -5.11 feet at RM 12.8. An approximation would be to subtract 5 feet from the gauge reading for the full length of the study area, but precision will vary depending on tides and river gradient.

For sample locations requiring vertical information, depth will be recorded by field staff on their data collection forms relative to the water surface, and these values will be loaded to the project database as described in the Data Quality Management Plan (DQMP). Final calculated NAVD88 elevation data (feet) will also be entered into a separate data field in the project database after completion of spatial analysis, calculations, and QA/QC. DEA will provide support during the QA/QC process to verify proper calculation of NAVD88 elevation data.

Location Position Recording in Project Database

Discrete Samples

When discrete samples are collected, the Location ID and the location coordinates (Northing/Easting) will be recorded on the GPS device(s) and the field data collection form(s). The location coordinates will be based on the vessel GPS instantaneous target measurement. This target measurement will be the location coordinate pair loaded initially to the project database. After the field event is completed, the target measurement will be compared to the line file (vessel continuous GPS measurement) to confirm that the coordinate pair loaded to the project database is appropriate. If analysis reveals precision or accuracy issues, the loaded location coordinate pair in the project database may be updated and edited with a better value derived from the line file. In general, the hand-held GPS devices will be used as a backup and confirmation of vessel position only if there are problems with the vessel GPS navigation system or an independent navigation system is not available on the vessel. These coordinates will be loaded to the project database only if there is a significant problem with the vessel GPS (e.g., equipment failure) or if there is no vessel GPS.

Composite Samples

When composite samples are collected, location coordinates will also be recorded as both target measurements and continuous measurements using the vessel GPS. The continuous GPS measurements will be recorded during the entire compositing event, and instantaneous target measurements will be collected when the sampler is in position for each individual composite grab. At each compositing location, a target measurement will be recorded in the vessel GPS along with the Location ID with an “a,” “b,” or “c” suffix. These measurements will be recorded on the field forms in the same manner (e.g., there will be three sets of location coordinates, lithologic descriptions, etc.).

When the location data is loaded to the project database, a single set of location coordinates will be recorded in the project database with a Location ID that excludes the “a,” “b,” or “c” suffix. As a presumed middle time point, the “b” set of coordinates will be loaded with the primary Location ID to the project database. After the field event is completed, the target measurement associated with the “b” location composite will be compared to the line file (vessel continuous GPS measurement) to assess vessel position and the timeframe of the entire sampling event to confirm if the coordinate pair loaded to the project database is appropriate. The goal will be to finalize the location coordinate information in the project database based on the most representative position based on this analysis. Similar to

discrete sample collection, a hand-held GPS device and related data will only be loaded to the project database if there is a significant problem with operation of the vessel GPS or if the vessel does not have a GPS.

Finally, after field data are collected and surveys are completed, as defined in the DQMP, the location coordinate data will be joined with the tabular data collected by the field teams and loaded to the project database.

Project Geodetic Parameters

The geodetic parameters to be used for the PDI field studies will be as follows:

Horizontal Datum: North American Datum of 1983 (2011)
Projection: State Plane Coordinate System (SPCS) Oregon North Zone
Vertical Datum: North American Vertical Datum of 1988 (NAVD88) Geoid12b
Horizontal Units: International Feet
Vertical Units: Feet

Survey Accuracy, Precision, and Control

The anticipated horizontal accuracy of environmental sampling associated with vessel and hand-held GPS devices is a range of 1 to 5 meters (target 1 to 2 meters for the DGPS unit itself). This should be consistent with RI target accuracy (Integral 2002) and best practices (Puget Sound Estuary Protocols [PSEP] 1998 and US Environmental Protection Agency [EPA] 2008).

The anticipated vertical accuracy of final elevation calculations derived from vessel sonar systems is anticipated to be 1.0 meter.

Table 1 summarizes the survey control locations used in the DEA Bathymetric Survey, which will be used for the environment sample collection work described in this SOP. Figure 1 shows the PH2 piling at the Fred Devine boat dock, and Figure 2 shows the approximate locations of the survey control references for PH1 and PH2. Figure 3 shows approximate location of PH3 for survey control above the Willamette Falls. Attachment 1 contains detailed survey sheets of the following control points: Raindeer, PH1 and PH2, and PH3. Additional information regarding the DEMSI and 2100 control points is available upon request.

Primary Equipment

- Trimble® SPS 461 GPS with dual antennas (vessel GPS)
- A-frame assembly, sampling winch (vessel boom)
- Trimble® R1 (hand held GPS), tethered to Bluetooth® capable smartphone or tablet, ESRI Collector software with Trimble® GNSS Status middleware
- GPS owner's manual
- Writing tools (pencils, Sharpie®)

- Field logbook
- Spare batteries and/or battery charger
- Compass
- Tape measure

Hand-Held GPS Operations

For ease of use, the project team will utilize smartphones tethered to the Trimble® R1 GNSS Receiver via a Bluetooth® connection. The smartphone will be configured with Trimble's middleware software called GNSS Status to convert and stream NMEA satellite data to the smartphone for real-time correction and display to a simple electronic data collection form developed on the ESRI Collector platform. The form will contain a limited number of data fields, including location, study name and operator, date, and notes or comments. This form is not intended to duplicate the content and scope of the field data collection forms, but rather clearly link the GPS data to those forms via the unique Location ID. There are metadata fields available as well from these GPS records, such as estimated horizontal accuracy.

Collected data recorded onto the phone will be transmitted wirelessly via a synchronization process invoked when data is "saved" to the device. The data will be pushed to AECOM Online's Portal and ArcGIS Server for storage of "corrected" location coordinates, Location ID, and other information captured when the GPS sounding is recorded. The sampling event will be trackable in near-real-time as samples are collected on the ArcGIS Portal Interface. Either dedicated, experienced GPS-operators will be collecting the measurements on the smartphones, or, due to the very simple nature of the interface, field personnel will be trained to use the devices. Initial training sessions were already successfully conducted March 19-20, 2018 on use of the smartphone GPS interface. These handheld devices were successfully used for the first 2 weeks of field work. For some studies, such as the smallmouth bass tracking study, these handhelds may be used as the primary GPS due to smaller vessel configuration.

Vessel Navigation and Equipment Operation

Vessel positioning will be conducted through the marine navigation and hydrographic software package HYPACK. This software package allows the visualization of the vessel over navigable charts, the processing of satellite corrections, stored hardware, and vessel parameters, as well as the storing of physical target locations during sampling activities. HYPACK version 2017 will be used for this project.

Vessel position is measured using a Trimble SPS 461 GPS dual antenna receiver. The dual antennas provide precise vessel positioning via both satellite and differential radio corrections along with heading correction to 0.09 degree. GPS data is output through a serial connection into computer running the HYPACK software, for vessel positioning and target collection.

At each sampling location, depth to mudline will be measured using an onboard fathometer (with lead line as confirmation as needed) immediately prior to or during the sampling. Water depths are measured at each station using an Airmar ss510 survey sonar at the sampling point and confirmed daily with a lead line with reference to water surface. Vertical measurements will be recorded to the

nearest 0.1 foot. Water depths will be converted to elevations in NAVD88 based on the river stage at the time of sampling as recorded at the closest available tide gage.

Data Processing and QA/QC Procedures

All GPS devices will be subject to a position check to confirm the accuracy of the on-vessel GPS and hand-held GPS devices and to validate the positions derived from each GPS receiver. Correctors will be applied as needed, resulting in a position that is within specified positioning accuracy of the DEA published position for control monuments PH1, PH2, and PH3 (or future control point approved by EPA). At the start and end of each field day, the benchmark location will be visited to perform a position check.

At the piling serving as the PH2 control monument (accessible by boat), the on-vessel GPS calibrated to the top of A-frame assembly will be maneuvered as close to the benchmark piling as possible to record a point. The GPS-derived position of the sampling vessel is compared with the known horizontal location; results will be recorded in HYPACK to confirm that accuracy is within +/- 2 meters.

For handheld GPS, field staff will occupy the PH1 at the Swan Island boat launch parking lot or PH3 at the Willamette Park boat launch. Using the R1 and phone/tablet combination GPS setup, the field staff will hold the R1 above PH1 or PH3 and wait for a satellite "fix," and when ready, the staff will record the GPS location in Collector. This GPS location will be compared to the known coordinates to confirm the accuracy is within +/- 2 meters. The survey control monuments act as a known location to allow for corrected station location coordinates during post-processing of data as needed. If a need arises to locate another benchmark, there are several USGS control points near the project area and near the AECOM project warehouse. Experienced GPS operators on the project team will be involved in all aspects of field data collection events to troubleshoot devices and assist in daily review of extracted geospatial datasets. Additional details on QA/QC procedures can be found on the DQMP.

References

AECOM (AECOM Technical Services) and Geosyntec (Geosyntec Consultants, Inc.). 2018. Data Quality Management Plan Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling. Portland Harbor Superfund Site. 22 February.

Integral (Integral Consulting). 2002. Round 1 Field Sampling Plan. Prepared for the Lower Willamette Group (LWG) for submittal and approval by EPA Region 10. June 14.

EPA (United States Environmental Protection Agency). 2008. National Geospatial Data Policy. August 24.

PSEP. 1998. Recommended Guidelines for Station Positioning in Puget Sound. Prepared for United States EPA Region 10 and the Puget Sound Water Quality Action Team. September.

USACE (United States Army Corps of Engineers). 2004. Engineering and Design Hydrographic Surveying Manual, EM 1110-2-1003, U.S. Army Corps of Engineers, April 2004

Tables and Figures

Table 1. Benchmark Monument Coordinates and Description

Figure 1. Photograph of Piling PH2, at the end of the Fred Devine Boat Dock

Figure 2. Locations of control monuments PH1 and PH2 at Swan Island Boat Launch and Fred Devine Boat Dock, respectively

Figure 3. PK nail in the middle of Willamette Park Boat Launch parking is survey monument PH3

Attachments

Detailed survey sheets of PH Control Points of Portland Harbor (PH1, PH2, and PH3), and Raindeer survey monuments

Table 1. Benchmark Monument Coordinates and Description

Designation	Approx. Location	Description	NAD83 (2011), Oregon SPCS North (ft)		NAVD88 Elevation (ft)
			Northing	Easting	
DEMSI-BASE	Columbia River	Fixed antenna with height at antenna reference point	718172.70	7654431.05	73.58
DEMSI- CHECK	Columbia River	Fixed antenna with height at antenna reference point	718170.73	7654419.84	71.67
RAINDEER	RM 2	USACE Brass Cap	722443.24	7614886.64	35.44
Portland Harbor 1 (PH1)	Swan Island Boat Ramp	1/2" Iron Rod with red plastic cap stamped "DEA Control" Point is 0.3 feet south of the back of curb at the Swan Island Boat Ramp, 10.5 feet north of a cyclone fence, and 60 feet east of a light post	698702.46	7637426.37	33.38
Portland Harbor 2 (PH2)	Fred Devine Boat Dock	Reference point is 0.2 feet SE of the SE side of a 1-1/2-foot diameter steel pile. This is the furthest SE pile at the end of the Fred Devine Diving and Salvage Company dock in the Swan Island Lagoon.	700967.87	7634507.67	NA
Portland Harbor 3 (PH3)	Willamette Park Boat Launch (above the falls)	PK nail in trailer parking lot of boat launch ramp, near center of loop and approximately even with seventh parking space.	617123.76	7649701.80	72.42
2100	RM 13	5/8" bolt on SW corner of screen wall at DEA office 2100 SW River Parkway, Portland, OR	678400.01	7645190.81	159.51

General Notes:

1. The two DEMSI and the 2100 stations (indicated with green shading) are transceiver beacon stations in upland areas. These stations will not be used for daily location control checks by sampling team. More information regarding these stations is available upon request.
2. PH1 is located at the Swan Island boat ramp parking lot and accessible by foot.
3. PH2 is located at a piling at the boat dock where project-related vessels will be docked and is accessible by boat. This pile is to be used for daily position checks for sediment sampling operations. Pile is for position only and not elevation.
4. PH3 is located in the parking lot of the boat launch above the Willamette Falls and is accessible by foot.
5. Raindeer station is located adjacent to the river and accessible by foot (for the hand-held GPS).

Acronyms:
DEA = David Evans and Associates; ft = feet; NAD83 = North American Datum of 1983; NAVD88 = North American Vertical Datum of 1988; PH = Portland Harbor; RM = river mile; PK nail = survey marker; USACE = US Army Corps of Engineers; SPCS = State Plane Coordinate System

Figure 1. Photograph of Piling PH2, at the end of the Fred Devine Boat Dock. Piling was surveyed during and captured in DEA bathymetric survey. Photo is facing northwest.

PH2 is located on the SE corner of the Fred Devine Boat Dock, where Gravity's boats berth every night.

PH1 is located on the SW side of the Swan Island Boat Launch parking lot, where field crews park to meet the boats at the launch dock.

Figure 2. Locations of control monuments PH1 and PH2 at Swan Island Boat Launch and Fred Devine Boat Dock, respectively.

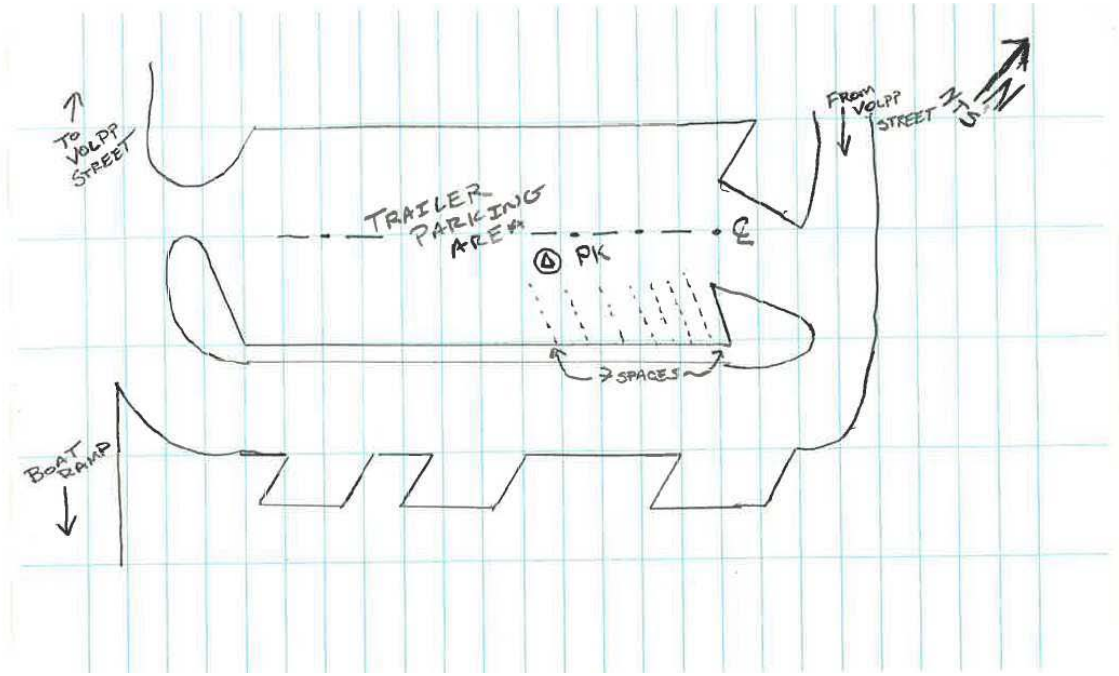


Figure 3. PK nail in the middle of Willamette Park Boat Launch parking marks survey monument PH3. It was land-surveyed by DEA and marked with pink survey tape. Photo shows survey equipment set-up over PH3.

NOTE: This form intended for field use. Unsolicited data submitted to NGS must be converted to bluebook format.

GPS STATION OBSERVATION LOG
April 16, 2003

Station Designation: (check applicable:__ FBN__ CBN__ PAC__ SAC __BM) Portland Harbor 1 (PH1)		Station PID, if any:	Date (UTC): 06-Mar-18
General Location: Swan Island Boat Launch	Airport ID, if any:	Station 4-Character ID:	Day of Year: 065
Project Name: Portland Harbor - AETR00000034	Project Number: GPS-	Station Serial # (SSN):	Session ID:(A,B,C etc)

NAD83 Latitude: o ' "
NAD83 Longitude: o ' "
NAD83 Ellipsoidal Height: meters
NAVD88 Orthometric Ht.: meters
GEOID99 Geoid Height: meters

Agency Full Name: David Evans and Associate, Inc.
Operator Full Name: David T. Moehl
Phone #: ( ) (360) 314-3200
e-mail address: dtm@deainc.com

Observation Session Times (UTC):
Sched. Start _____ Stop _____
Actual Start 19:30 Stop 21:32

Epoch Interval= 1 Seconds
Elevation Mask = 10 Degrees

Receiver Brand & Model: Trimble SPS985
P/N: 82500-60
S/N: 5616F59510
Firmware Version: 5.30
❒ CamCorder Battery, ❒ 12V DC, ❒ 110V AC, ✓ Other

Antenna Code*, Brand & Model: Trimble SPS985 Internal
P/N:
S/N:
Cable Length, meters: n/a
Vehicle is Parked 10 meters N (direction) from antenna.

Antenna plumb before session?	(✓ / N)	Circle
Antenna plumb after session?	(✓ / N)	Yes or No
Antenna oriented to true North?	(Y / N✓)	-If no,
Weather observed at antenna ht.	(Y / N✓)	explain
Antenna ground plane used?	(Y / N✓)	"
Antenna radome used?	(Y / N✓)	If yes,
Eccentric occupation (>0.5 mm)?	(Y / N✓)	describe.
Any obstructions above 10°?	(Y / N✓)	Use
Radio interference source nearby	(Y / N✓)	Vis. form

Tripod or Antenna Mount: Check one:
✓ Fixed-Leg Tripod, ❒ Collapsible-leg tripod ❒ Fixed Mount
Brand & Model: Seco fixed height
P/N:
S/N: 5115-00-FLY
Last Adjustment date: 2018-03-05

Psychrometer (if used) Brand & Model:
P/N:
S/N:
Last Calibration or check Date:

** ANTENNA HEIGHT **	Before Session Begins: Meters	Feet	After Session Ends: Meters	Feet
A= Datum point to Top of Tripod (Tripod Height)	2.000		2.000	
B= Additional offset to ARP if any (Tribrach/Spacer)	0.000		0.000	
H= Antenna Height = A + B = Datum Point to Antenna Reference Point (ARP)	2.000	6.56	2.000	6.56

Meters = Feet x (0.3048)
Height Entered Into Receiver = 2.000 meters.
Note &/or sketch **ANY** unusual conditions. Be **Very Explicit** as to where and how Measured!

Barometer (if used) Brand & Model:
S/N:

Weather Data	Weather Codes	Time (UTC)	Dry-Bulb Temp Fahrenheit	Dry-Bulb Temp Celsius	WetBulb Temp Fahrenheit	WetBulb Temp Celsius	Rel. % Humidity	Atm. Pressure inches Hg	Atm. Pressure millibar
Before	00000	19:30							
Middle									
After	00000	21:32							

Remarks, Comments on Problems, Sketches, Pencil Rubbing, etc:

Control point is a 1/2" iron rod with red plastic cap stamped "DEA CONTROL" set 0.1' below natural grade. Control point is 0.3' south of the back of curb, 10.5' north of a cyclone fence and 60' easterly of the 2nd light post east of the boat ramp. See detached sketch and photos.

Weather codes are required. Weather data are optional but encouraged. *Antenna code comes from ant_info file furnished by project coordinator.

Data File Name(s): 95100650.T02
(Standard NGS Format = aaaaddds.xxx)
where aaaa=4-Character ID, ddd=Day of Year, s=Session ID, xxx=file dependant extension

Updated Station Description: ❒ Attached ❒ Submitted earlier
Visibility Obstruction Form: ❒ Attached ❒ Submitted earlier
Photographs of Station: ✓ Attached ❒ Submitted earlier
Pencil Rubbing of Mark: ❒ Attached

LOG CHECKED BY: Jon Dasler

Table of Weather Codes

CODE	PROBLEM	VISIBILITY	TEMPERATURE	CLOUD COVER	WIND
0	did not occur	Good, over 15 miles	Normal, 32° F- 80° F	Clear, below 20%	Calm, under 5mph (8km/h)
1	did occur	Fair, 7-15 miles	Hot, over 80°F (27 C)	Cloudy, 20% to 70%	Moderate, 5 to 15 mph
2	- not used -	Poor, under 7 miles	Cold, below 32° F (0 C)	Overcast, over 70%	Strong, over15 mph (24km/h)

Examples: 00000 = No problem, good visibility, normal temp, clear, calm wind 12121 = Problems, poor visibility, hot, overcast, moderate wind

Sketch of Monument PH1

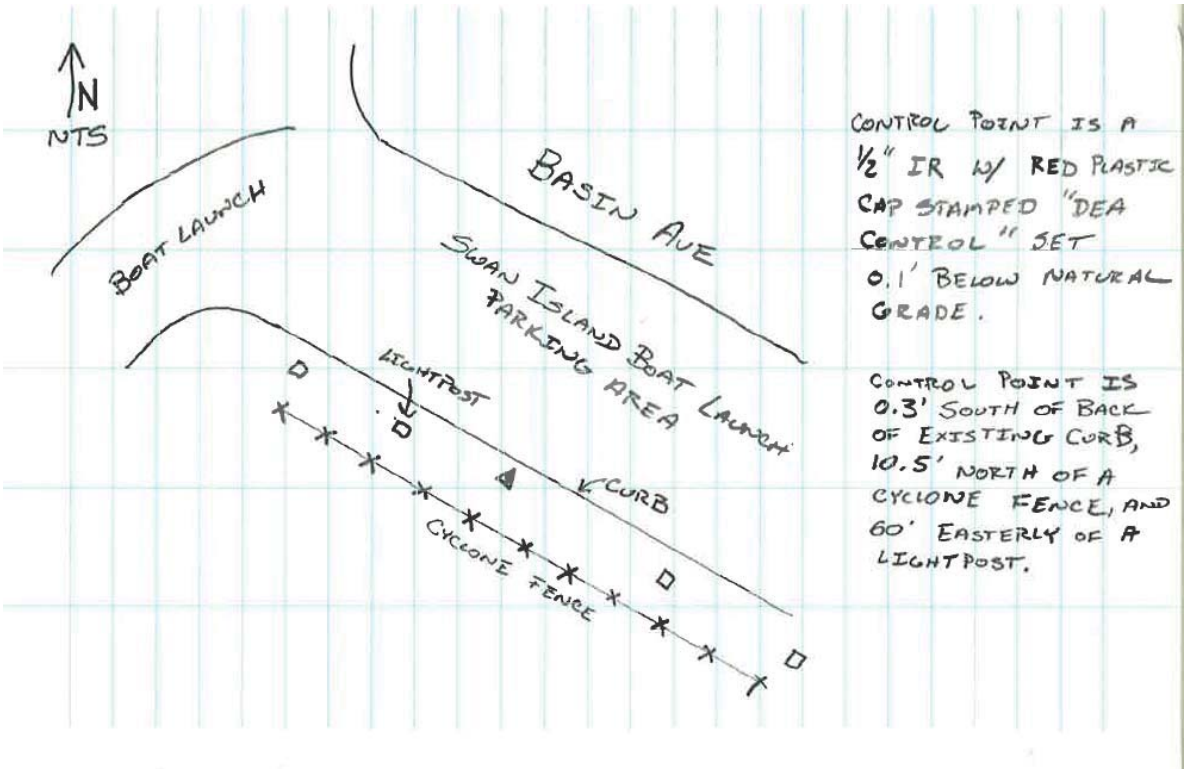


Photo of Monument PH1

GNSS Setup on PH1

NOTE: This form intended for field use. Unsolicited data submitted to NGS must be converted to bluebook format.

GPS STATION OBSERVATION LOG
April 16, 2003

Station Designation: (check applicable:__ FBN__ CBN__ PAC__ SAC __BM) Portland Harbor 2 (PH2)		Station PID, if any:	Date (UTC): 20-Apr-18
General Location: Fred Devine Boat Dock	Airport ID, if any:	Station 4-Character ID:	Day of Year: 111
Project Name: Portland Harbor - AETR00000034	Project Number: GPS-	Station Serial # (SSN):	Session ID:(A,B,C etc)

NAD83 Latitude o ' "	NAD83 Longitude o ' "	NAD83 Ellipsoidal Height meters	Agency Full Name: David Evans and Associate, Inc.
Observation Session Times (UTC): Sched. Start _____ Stop _____ Actual Start 19:45 Stop 19:49	Epoch Interval= 1 Seconds Elevation Mask = 10 Degrees	NAVD88 Orthometric Ht. meters GEOID99 Geoid Height meters	Operator Full Name: David T. Moehl Phone #: ( ) (360) 314-3200 e-mail address: dtm@deainc.com

Receiver Brand & Model: Trimble SPS985	Antenna Code*, Brand & Model: Trimble SPS985 Internal	Antenna plumb before session? (Y / N) ✓ Circle
P/N: 82500-60	P/N:	Antenna plumb after session? (Y / N) ✓ Yes or No
S/N: 5616F59510	S/N:	Antenna oriented to true North? (Y / N) ✓ -If no,
Firmware Version: 5.30	Cable Length, meters: n/a	Weather observed at antenna ht. (Y / N) ✓ explain
❒ CamCorder Battery, ❒ 12V DC, ❒ 110V AC, ✓ Other	Vehicle is Parked n/a meters ____(direction) from antenna.	Antenna ground plane used? (Y / N) ✓ "
		Antenna radome used? (Y / N) ✓ If yes,
		Eccentric occupation (>0.5 mm)? (Y / N) ✓ describe.
		Any obstructions above 10°? (Y / N) ✓ Use
		Radio interference source nearby (Y / N) ✓ Vis. form

Tripod or Antenna Mount: Check one:
✓ Fixed-Leg Tripod, ❒ Collapsible-leg tripod ❒ Fixed Mount
Brand & Model: Seco fixed height
P/N:
S/N: 5115-00-FLY
Last Adjustment date: 2018-03-05

Psychrometer (if used) Brand & Model:
P/N:
S/N:
Last Calibration or check Date:

** ANTENNA HEIGHT **	Before Session Begins: Meters	Feet	After Session Ends: Meters	Feet
A= Datum point to Top of Tripod (Tripod Height)	2.000		2.000	
B=Additional offset to ARP if any (Tribrach/Spacer)	0.000		0.000	
H= Antenna Height = A + B = Datum Point to Antenna Reference Point (ARP)	2.000	6.56	2.000	6.56

Meters = Feet x (0.3048)
Height Entered Into Receiver = 2.000 meters.
Note &/or sketch **ANY** unusual conditions. Be **Very Explicit** as to where and how Measured!

Barometer (if used) Brand & Model:
S/N:

Weather Data	Weather Codes	Time (UTC)	Dry-Bulb Temp Fahrenheit	Dry-Bulb Temp Celsius	WetBulb Temp Fahrenheit	WetBulb Temp Celsius	Rel. % Humidity	Atm. Pressure inches Hg	Atm. Pressure millibar
Before	00010	19:45							
Middle									
After	00010	19:49							

Remarks, Comments on Problems, Sketches, Pencil Rubbing, etc:

Reference point is 0.2 feet SE of the SE side of a 1-1/2 foot steel pile. This is the furthest SE pile at the end of the Fred Devine Diving and Salvage Company dock in the Swan Island Lagoon. This pile is to be used for daily position checks for sediment sampling operations. Pile is for position only and not elevation.
NAD83(2011) Oregon North Zone International Feet Coordinates
North 700967.9 East 7634507.7

Weather codes are required. Weather data are optional but encouraged. *Antenna code comes from ant_info file furnished by project coordinator.

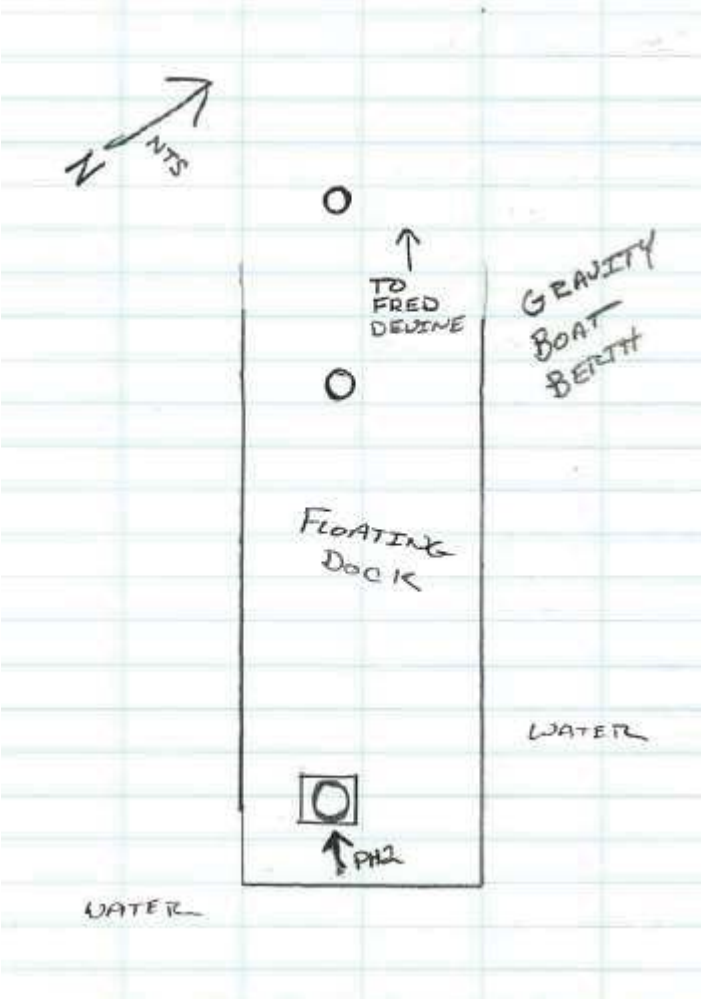
Data File Name(s):
(Standard NGS Format = aaaaddds.xxx)
where aaaa=4-Character ID, ddd=Day of Year, s=Session ID, xxx=file dependant extension

Updated Station Description: ❒ Attached ❒ Submitted earlier
Visibility Obstruction Form: ❒ Attached ❒ Submitted earlier
Photographs of Station: ✓ Attached ❒ Submitted earlier
Pencil Rubbing of Mark: ❒ Attached

LOG CHECKED BY: Jon Dasler

Table of Weather Codes	CODE	PROBLEM	VISIBILITY	TEMPERATURE	CLOUD COVER	WIND
	0	did not occur	Good, over 15 miles	Normal, 32° F- 80° F	Clear, below 20%	Calm, under 5mph (8km/h)
	1	did occur	Fair, 7-15 miles	Hot, over 80°F (27 C)	Cloudy, 20% to 70%	Moderate, 5 to 15 mph
	2	- not used -	Poor, under 7 miles	Cold, below 32° F (0 C)	Overcast, over 70%	Strong, over15 mph (24km/h)
Examples:	00000 = No problem, good visibility, normal temp, clear, calm wind				12121 = Problems, poor visibility, hot, overcast, moderate wind	

Sketch and Fieldnotes



200 CHK PH1

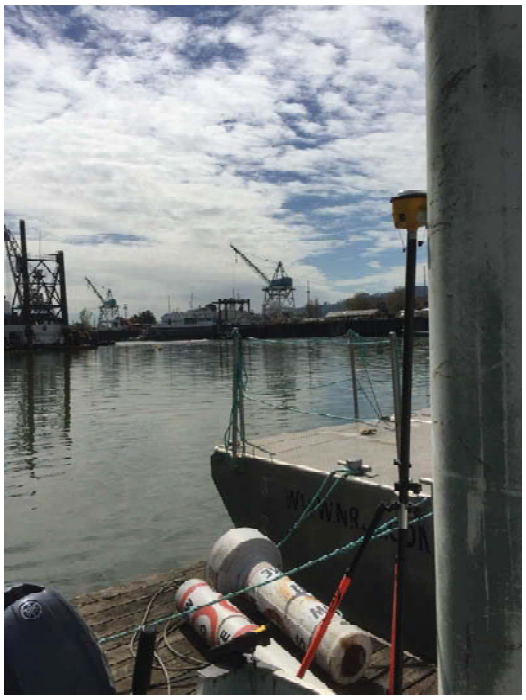
	KNOWN COORDS	OBS	Δ (FT)
	N = 698702.46	N = 698702.45	0.01
	E = 7637426.37	E = 7637426.39	0.02
	Z = 33.38	Z = 33.37	0.01

201 SE FACE OF PILE
3-MIN OBS
N = 700967.87
E = 7634507.64
Z = N/A

202 SW FACE TOPO
203 NW FACE TOPO
204 NE FACE TOPO

Overview of PH2 Pile

GNSS Setup on PH2 Pile



View facing south

View facing northwest

NOTE: This form intended for field use. Unsolicited data submitted to NGS must be converted to bluebook format.

GPS STATION OBSERVATION LOG
April 16, 2003

Station Designation: (check applicable:__ FBN__ CBN__ PAC__ SAC __BM)		Station PID, if any:	Date (UTC):
General Location:	Airport ID, if any:	Station 4-Character ID:	Day of Year:
Project Name:	Project Number: **GPS-**	Station Serial # (SSN):	Session ID:(A,B,C etc)

NAD83 Latitude o ' "	NAD83 Longitude o ' "	NAD83 Ellipsoidal Height meters NAVD88 Orthometric Ht. meters GEOID99 Geoid Height meters	Agency Full Name: Operator Full Name: Phone #: ( ) e-mail address:
Observation Session Times (UTC): Sched. Start _____ Stop _____ Actual Start _____ Stop _____	Epoch Interval=____ Seconds Elevation Mask = _____ Degrees		

Receiver Brand & Model:

P/N:
S/N:
Firmware Version:

❒ CamCorder Battery, ❒ 12V DC, ❒ 110V AC, ❒ Other

Antenna Code*, Brand & Model:

P/N:
S/N:
Cable Length, meters:

Vehicle is Parked _____ meters ____(direction) from antenna.

Antenna plumb before session?	(Y / N)	Circle Yes or No -If no, explain "
Antenna plumb after session?	(Y / N)	
Antenna oriented to true North?	(Y / N)	
Weather observed at antenna ht.	(Y / N)	
Antenna ground plane used?	(Y / N)	
Antenna radome used?	(Y / N)	If yes, describe. Use Vis. form
Eccentric occupation (>0.5 mm)?	(Y / N)	
Any obstructions above 10°?	(Y / N)	
Radio interference source nearby	(Y / N)	

Tripod or Antenna Mount: Check one:
❒ Fixed-Leg Tripod, ❒ Collapsible-leg tripod ❒ Fixed Mount
Brand & Model:
P/N:
S/N:
Last Adjustment date:

Psychrometer (if used) Brand & Model:

P/N:
S/N:
Last Calibration or check Date:

** ANTENNA HEIGHT **	Before Session Begins: Meters	Before Session Begins: Feet	After Session Ends: Meters	After Session Ends: Feet
A= Datum point to Top of Tripod (Tripod Height)				
B=Additional offset to ARP if any (Tribrach/Spacer)				
H= Antenna Height = A + B = Datum Point to Antenna Reference Point (ARP)	2.003	6.57	2.003	6.57

Meters = Feet x (0.3048)
Height Entered Into Receiver = _____ meters.
Note &/or sketch **ANY** unusual conditions. Be **Very Explicit** as to where and how Measured!

Barometer (if used) Brand & Model:

S/N:

Weather Data	Weather Codes	Time (UTC)	Dry-Bulb Temp Fahrenheit	Dry-Bulb Temp Celsius	WetBulb Temp Fahrenheit	WetBulb Temp Celsius	Rel. % Humidity	Atm. Pressure inches Hg	Atm. Pressure millibar
Before									
Middle									
After									

Remarks, Comments on Problems, Sketches, Pencil Rubbing, etc:

Weather codes are required. Weather data are optional but encouraged. *Antenna code comes from ant_info file furnished by project coordinator.

Data File Name(s):

(Standard NGS Format = aaaaddds.xxx)
where aaaa=4-Character ID, ddd=Day of Year, s=Session ID, xxx=file dependant extension

Updated Station Description: ❒ Attached ❒ Submitted earlier
Visibility Obstruction Form: ❒ Attached ❒ Submitted earlier
Photographs of Station: ❒ Attached ❒ Submitted earlier
Pencil Rubbing of Mark: ❒ Attached

LOG CHECKED BY:

Table of Weather Codes

CODE	PROBLEM	VISIBILITY	TEMPERATURE	CLOUD COVER	WIND
0	did not occur	Good, over 15 miles	Normal, 32° F- 80° F	Clear, below 20%	Calm, under 5mph (8km/h)
1	did occur	Fair, 7-15 miles	Hot, over 80°F (27 C)	Cloudy, 20% to 70%	Moderate, 5 to 15 mph
2	- not used -	Poor, under 7 miles	Cold, below 32° F (0 C)	Overcast, over 70%	Strong, over15 mph (24km/h)

Examples: 00000 = No problem, good visibility, normal temp, clear, calm wind 12121 = Problems, poor visibility, hot, overcast, moderate wind

Sketch of Monument PH3

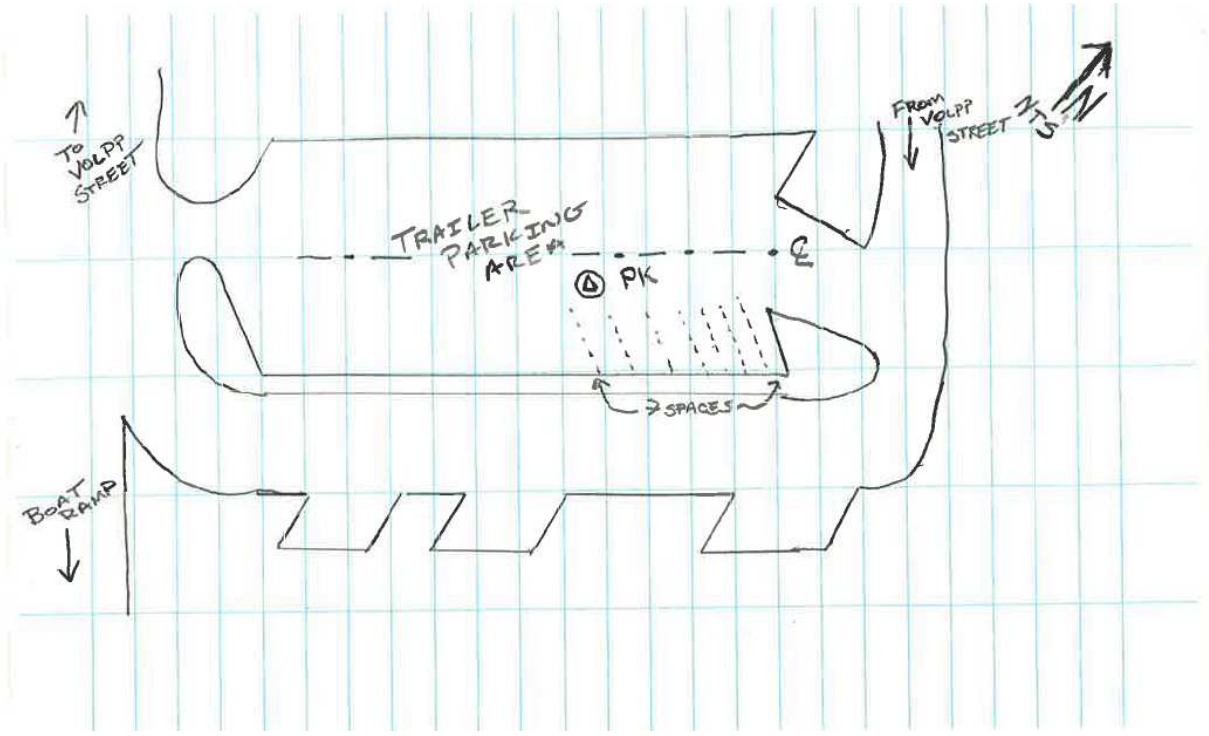


Photo of Monument PH3

GNSS Setup on PH3

NOTE: This form intended for field use. Unsolicited data submitted to NGS must be converted to bluebook format.

GPS STATION OBSERVATION LOG
April 16, 2003

Station Designation: (check applicable:__ FBN__ CBN__ PAC__ SAC __BM) Raindeer		Station PID, if any:	Date (UTC): 06-Mar-18
General Location: Sauvie Island, Willamette River	Airport ID, if any:	Station 4-Character ID:	Day of Year: 065
Project Name: Portland Harbor - AETR00000034	Project Number: GPS-	Station Serial # (SSN):	Session ID:(A,B,C etc)

NAD83 Latitude ° ' "	NAD83 Longitude ° ' "	NAD83 Ellipsoidal Height meters	Agency Full Name: David Evans and Associates, Inc.
Observation Session Times (UTC): Sched. Start _____ Stop _____ Actual Start 17:38 Stop 23:45	Epoch Interval= 1 Seconds Elevation Mask = 10 Degrees	NAVD88 Orthometric Ht. meters GEOID99 Geoid Height meters	Operator Full Name: David T. Moehl Phone #: ( ) (360) 314-3200 e-mail address: dtm@deainc.com

Receiver Brand & Model: Trimble SPS855	Antenna Code*, Brand & Model: Trimble Zephyr 3 Base	Antenna plumb before session? (✓Y / N) Circle
P/N: 69855-60	P/N: 115000-00	Antenna plumb after session? (✓Y / N) Yes or No
S/N: 5506R0074	S/N: 1551129193	Antenna oriented to true North? (✓Y / N) -If no,
Firmware Version: 5.30	Cable Length, meters: 10	Weather observed at antenna ht. (Y / N✓) explain
❒ CamCorder Battery, ✓❒ 12V DC, ❒ 110V AC, ❒ Other	Vehicle is Parked n/a meters ____(direction) from antenna.	Antenna ground plane used? (Y / N✓) "
		Antenna radome used? (Y / N✓) If yes,
		Eccentric occupation (>0.5 mm)? (Y / N✓) describe.
		Any obstructions above 10°? (Y / N✓) Use
		Radio interference source nearby (Y / N✓) Vis. form

Tripod or Antenna Mount: Check one:
✓❒ Fixed-Leg Tripod, ❒ Collapsible-leg tripod ❒ Fixed Mount
Brand & Model: Seco fixed height
P/N:
S/N: 5115-00-FLY
Last Adjustment date: 2018-03-05

Psychrometer (if used) Brand & Model:
P/N:
S/N:
Last Calibration or check Date:

** ANTENNA HEIGHT **	Before Session Begins: Meters	Feet	After Session Ends: Meters	Feet
A= Datum point to Top of Tripod (Tripod Height)	2.000		2.000	
B=Additional offset to ARP if any (Tribrach/Spacer)	-0.003		-0.003	
H= Antenna Height = A + B = Datum Point to Antenna Reference Point (ARP)	1.997	6.55	1.997	6.55

Meters = Feet x (0.3048)
Height Entered Into Receiver = 2.000 meters.
Note &/or sketch **ANY** unusual conditions. Be **Very Explicit** as to where and how Measured!

Barometer (if used) Brand & Model:
S/N:

Weather Data	Weather Codes	Time (UTC)	Dry-Bulb Temp Fahrenheit	Dry-Bulb Temp Celsius	WetBulb Temp Fahrenheit	WetBulb Temp Celsius	Rel. % Humidity	Atm. Pressure inches Hg	Atm. Pressure millibar
Before	00000	17:38							
Middle									
After	00000	23:45							

Remarks, Comments on Problems, Sketches, Pencil Rubbing, etc:

Weather codes are required. Weather data are optional but encouraged. *Antenna code comes from ant_info file furnished by project coordinator.

Data File Name(s): 00740650.T02
(Standard NGS Format = aaaaddds.xxx)
where aaaa=4-Character ID, ddd=Day of Year, s=Session ID, xxx=file dependant extension

Updated Station Description: ❒ Attached ❒ Submitted earlier
Visibility Obstruction Form: ❒ Attached ❒ Submitted earlier
Photographs of Station: ✓Attached ❒ Submitted earlier
Pencil Rubbing of Mark: ❒ Attached

LOG CHECKED BY: Jon Dasler

Table of Weather Codes	CODE	PROBLEM	VISIBILITY	TEMPERATURE	CLOUD COVER	WIND
	0	did not occur	Good, over 15 miles	Normal, 32° F- 80° F	Clear, below 20%	Calm, under 5mph (8km/h)
	1	did occur	Fair, 7-15 miles	Hot, over 80°F (27 C)	Cloudy, 20% to 70%	Moderate, 5 to 15 mph
	2	- not used -	Poor, under 7 miles	Cold, below 32° F (0 C)	Overcast, over 70%	Strong, over15 mph (24km/h)
Examples:	00000 = No problem, good visibility, normal temp, clear, calm wind			12121 = Problems, poor visibility, hot, overcast, moderate wind		

Photo of Monument RAINDEER

Photo of Monument RAINDEER

GNSS Setup on RAINDEER

APPENDIX B – Standard Operating Procedures

B-2. Field Wet Sieving for Grain Size

STANDARD OPERATING PROCEDURE

FIELD WET SIEVING FOR GRAIN SIZE

INTRODUCTION

This Standard Operating Procedure (SOP) has been developed for the Pre-Remedial Design Sampling and Baseline Investigations (PDI) at the Portland Harbor Superfund Site located in Portland, Oregon. The objective of this SOP is to establish standard procedures for conducting wet sieving of sediment samples in the field for grain size screening. Conducting a wet sieve analysis is a useful field application to understand the percentage of fine grained sediments, by volume. Fine-grained sediments are classified as material that passes through a No. 200 sieve (nominal sieve opening size 0.074 millimeters).

This SOP provides basic steps to guide the process of conducting wet sieving in the field. The intended audience of this document includes all personnel involved in planning, field sampling, and conducting wet sieve analysis.

Equipment will include:

- No. 200 sieve (stainless-steel is preferred)
- 200 milliliter (ml) graduated cylinder with leveling edge at the top (or 100 ml depending on size if sieve screen)
- Disposable gloves
- Mixing bowl and utensil
- Squirt bottle
- Rinse water for helping the material pass through sieve
- Writing tools (pencils, Sharpie®)
- Field log book

FIELD WET SIEVE METHODS

The following sections outline the basic steps involved in conducting wet sieving techniques by the field team.

1. Put on a pair of disposable gloves.
2. Homogenize a representative aliquot of sediment using appropriate nonreactive processing equipment:

a. Collect an appropriate aliquot of sediment of at least 200 ml and place in a stainless-steel bowl.

b. Homogenize the sediment by mixing with stainless-steel utensil until uniform consistency and color is reached.

c. Decant excessive water from homogenized mix.

d. Visually inspect homogenized composite and record color and texture information in field notes.

3. Measure out 200 ml of sediment and place on No. 200 sieve (100 ml of sediment could also be used depending on the size of the sieve screen):

   a. Remove any large objects that would not be sampled (gravel or larger, clams, large sticks, etc.).

   b. Completely fill a 200 ml graduated cylinder with the homogenized sediment and scrape off any excess sediment so that the sediment is flush with the top of the graduated cylinder.

   c. Empty contents from 200 ml graduated cylinder onto surface of No. 200 sieve. Make sure all sediment from cylinder is in sieve; use a squirt bottle and spray water, if needed, to help ensure all sediment gets onto the sieve.

4. Wet sieving:

   a. Carefully use river water to help push fine-grained sediment through No. 200 sieve, making sure not to splash out any sediment from the sides of the sieve. Wash all sediment in sieve, as fine grain sediment can adhere to coarse sediment, leaves, or other small debris.

   b. Shaking of the sieve from side-to-side to allow passage of material smaller than the sieve openings is appropriate; however, care must be taken not to spill any sediment out the sides of the sieve.

   c. Slow mixing of sediment within the sieve, using a gloved hand or appropriate nonreactive utensil, may be conducted to help work the finer particle-size fractions through the sieve. Care must be taken not to press on the sieve screen or scrape materials, as to prevent compromising sieve openings.

5. Measuring sieved material:

   a. Once all wash water has passed through the sieve, begin collecting material retained on the sieve using a nonreactive spoon, taking care not to damage the screen. Water can again be used to help gather sediment that did not pass through the screen to a single area on the sieve, making it easier to collect sediment with a spoon. Sediment that did not pass through the sieve will be placed back into the 200 ml graduated

cylinder for a final volume check. Make sure that all sediment is collected from the sieve and placed in the 200 ml graduated cylinder.

b. Allow sediment within graduated cylinder to settle, as best as possible, and then record new volume of sediment.

6. Determine percentage of fines in sediment sample:

   a. Record the initial volume of sediment before sieving.

   b. Record the new (residual) sediment volume in the 200 ml graduated cylinder after sieving.

   c. Divide the volume of the sediment remaining in the graduated cylinder by 200 ml (initial volume).

   d. Take the new number and subtract from 1. (For example, if 150 ml remains, then divide 150 by 200 = 0.75. Then, 1 – 0.75 = 0.25, or 25% fines.)

   e. Record the percent fines by volume in the field notebook.

APPENDIX B – Standard Operating Procedures

B-3. Water Quality Parameters (Integral 2004)

Note: Appendix E (MultiProbe YSI 556 SOP) in Integral 2004 (August) is dated April 2, 2004, in the source document.

APPENDIX E

MULTI PROBE YSI 556 SOP

MULTI PROBE YSI 556 PROCEDURES

The purpose of this standard operating procedure (SOP) is to describe the procedures for the measurement of general water quality parameters using a Multi Probe YSI 556 handheld unit. This multi-parameter system will be used to simultaneously measure dissolved oxygen, conductivity, temperature, and optional pH and oxidation-reduction potential while in the field.

This SOP should be used in conjunction with the operating manual supplied by the manufacturer, *YSI 556 MPS Operations Manual* (YSI Environmental, Yellow Springs, Ohio). A goal of this SOP is to ensure that the highest quality, most representative data be collected, and that these data are comparable to data collected by different programs that follow these same guidelines.

For the purpose of this SOP, surface water is defined as water collected from 0.3 meter (1 foot) below the air/water interface and within 1 meter (3 feet) above the river bottom. The actual definition of surface water is typically program-specific and is dependent on the purpose of the study and the regulatory criteria (if any) to which the data will be compared.

SUMMARY OF METHOD

The YSI 556 multi probe is used for measuring conventional water parameters in the field. After surface water samples are collected at each sampling station, the multi probe will be used for measuring parameters such as temperature, pH, dissolved oxygen, conductivity, oxidation-reduction potential. These measurements are then recorded in the same order as described in the water sample log sheet (Appendix F).

Once measurements are made *in situ,* the probe is rinsed with deionized water and replaced into the transport/calibration cup with 1/8 of the volume filled with deionized water. The unit will come pre-calibrated from the laboratory and will be checked daily for proper functioning and drift. If necessary, the multi probe can be calibrated in the field using the procedures provided in the Operations Manual.

PROBE MODULE EQUIPMENT

The YSI 556 multi probe is a rugged handheld unit with the sensors enclosed in a heavy-duty probe sensor guard with attached sinking weight. A 20-meter cable is directly connected to the probe module body making the entire unit waterproof. The following equipment is needed in the field to operate the unit:

- Instrument with barometer option
- 20-m cable and DO/temp/conductivity/pH/ORP probe

- Rechargeable battery pack kit (includes battery, adapter, charger)
- Charger, cigarette lighter (optional)
- Large carrying case, soft-sided (comes with 556 standard)
- Transport/calibration cup
- Probe sensor guard.

PROCEDURES

INSTRUMENT/CABLE CONNECTION

Attach the cable to the instrument as follows:

1. Line up the pins and guides on the cable with the holes and indentations on the cable connector at the bottom of the YSI 556 instrument. See Figure 2.1 of the Operations Manual (YSI Environmental, Yellow Springs, Ohio).
2. Holding the cable firmly against the cable connector, turn the locking mechanism clockwise until it snaps into place.
3. Remove the cable from the instrument by turning the cable connector counterclockwise until the cable disengages from the instrument.
4. Remove probe sensor guard from other end of cable, if already installed.
5. Ensure that an o-ring is installed in the o-ring groove on the threaded end of the probe module body.
6. Screw the transport/calibration cup on the threaded end of the probe module and securely tighten.

   NOTE: Do not overtighten as this could cause damage to the threaded portions. See Figure 3.7 of the Operations Manual (YSI Environmental, Yellow Springs, Ohio).

EQUIPMENT PRE-TESTING

The following steps describe how each probe is checked everyday prior to sampling.

pH Measurements

To test the pH probe, two buffers of pH 4 and pH 7 are used. Different buffers may be used if the general pH range of the water to be sampled is higher. The pH probe

will remain in pH 7 buffer solution between measurements. Prior to taking pH measurements, the pH probe is rinsed with deionized water and excess water gently shaken off before insertion into a buffer solution. Once measurement is made, the probe is again rinsed with deionized water and replaced into the container with deionized water. The pH probe is ready for field measurements.

Conductivity Measurements

To test the conductivity probe, a standard conductivity solution is used that is in the general range of conductivities expected from the water to be sampled. Temperature compensation is corrected using the appropriate scale for the temperature and conductivity of the calibration solution. The conductivity meter is adjusted until the conductivity reading agrees with the value of the standard solution. The probe is removed from the standard solution and rinsed with deionized water. The conductivity probe is ready for field measurements.

Dissolved Oxygen (DO) Measurements

The oxygen electrode is measured as % saturation inside a probe-specific measuring cup containing 1/8 inch of water. The probe is ready for measurements after saturation reading.

Temperature Measurements

Temperature is measured using a temperature probe attached to the multiprobe system. An additional certified glass thermometer filled with environmentally safe red liquid and protected with an armor casing is used to confirm accuracy of meter used. After temperature measurement with the probe is compared to reading of glass thermometer, the probe is ready for field measurements.

OPERATION OF THE MULTI PROBE

The unit is removed from its case and attached to the 20-meter cable by inserting the cable connector into the instrument as described above. Care should be taken when handling the probe at the other end of the cable.

Daily Check Procedures

1. Press the **On/off** key OR select Run from the main menu to display the run screen.

2. Make sure the probe transport/calibration cup is installed.

3. Add the appropriate standard solution, as described above, to the transport/calibration cup and gently hold the probe module in the solution. Be sure to completely immerse all the sensors.

4. Watch the readings on the display until they are stable.

5. Press the **Escape** key to display the main menu screen.

6. Use the arrow keys to highlight the **Sensor** selection.

7. Press the **Enter** key to display the sensors enabled screen. A black dot to the left of a sensor indicates that sensor is enabled. Sensors with an empty circle are disabled.

8. Use the arrow keys to highlight the sensor to be changed, then press the **Enter** key to enable or disable it.

9. Repeat step 6 for each sensor to be changed.

10. Press the **Escape** key to return to the main menu screen.

11. Use the arrow keys to highlight the **Report** selection.

12. Press the **Enter** key to display the report setup screen.

    NOTE: A black dot to the left of a parameter indicates that parameter is selected for display. Parameters with an empty circle will not be displayed. It may be necessary to scroll down past the bottom of the screen to see all the parameters.

13. Use the arrow keys to highlight the parameter to be changed, then press the **Enter** key. If a parameter cannot be found, even after scrolling down past the bottom of the screen, the sensor used for that parameter is disabled.

14. If temperature, specific conductivity, conductivity, resistance or total dissolved solids are selected, the Units screen will appear.

15. Use the arrow keys to select the units desired, then press the **Enter** key to return to the report setup screen.

16. If salinity, dissolved oxygen %, dissolved oxygen mg/L, pH, pH mv or ORP mv are selected, the selection dot will simply toggle on or off.

17. Repeat steps 14 and 15 for each parameter needed to be changed.

    NOTE: All parameters may be enabled at the same time.

18. Press the **Escape** key to return to the Main menu screen.

19. Watch the readings on the display until they are stable.

20. Read value for each parameter being measured and check against values of standard solution. Note all measurements in field log book.

21. Once all measurements are read, remove probe from last solution and rinse with deionized water.

22. Gently remove the probe guard and replace it with the transport/calibration cup.

23. Turn off instrument. Blot it dry with a paper towel, unscrew cable from unit and place it back on its case.

    NOTE: If the YSI 556 unit displays high drift when measuring standard solutions, it may be required to re-calibrate the probe. See Operations Manual for instructions on calibration procedures (YSI Environmental, Yellow Springs, Ohio).

Real-Time Data

Once all samples are collected, the measurement of general water quality parameters will be taken using the YSI 556 multi probe unit.

Before measuring samples, the probe module must be prepared by removing the transport/calibration cup and replacing it with a probe guard.

1. Press the **On/off** key OR select Run from the main menu to display the run screen.
2. Make sure the probe sensor guard is installed.
3. Place the probe module in the sample (e.g., river water). Be sure to completely immerse all the sensors.
4. Rapidly move the probe module through the sample to provide fresh sample to the DO sensor.
5. Watch the readings on the display until they are stable.
6. Read values top to bottom and from first column second column to a dedicated recordkeeping person.
7. Once all measurements are read, remove probe from water and rinse with deionized water.
8. Gently remove the probe guard and replace it with the transport/calibration cup.
9. Turn off instrument. Blot it dry with a paper towel, unscrew cable from unit and place it back on its case.

APPENDIX B – Standard Operating Procedures

B-4: Water Quality Monitoring Equipment Calibration, Operation, and Maintenance

STANDARD OPERATING PROCEDURE

WATER QUALITY MONITORING EQUIPMENT CALIBRATION, OPERATION, AND MAINTENANCE

Introduction

The standard operating procedure (SOP) for water quality monitoring equipment calibration describes a procedure to confirm that equipment used for measuring water quality parameters (dissolved oxygen [DO], oxidation-reduction potential [ORP], pH, and conductivity) are operating within manufacturer specifications.

Calibration

Water quality probes will have a 1-point or 2-point calibration check (depending on probe capabilities and manufacturer specifications) performed daily, at the beginning of each day prior to field work. Equipment will be recalibrated to operate within the manufacturer specifications as needed on a daily basis. Calibration checks will be performed by inserting each probe into a calibration standard, allowing the reading to stabilize and comparing the reading to the standard value. All probes must read the standard value accurately within the manufacturers' specified accuracy to be considered calibrated. The project-specific target accuracy range of the probes is as follows:

- YSI Pro DO Optical DO meter: ± 2% or 0.2 milligrams per liter (mg/L)
- Oakton ORP meter: ± 2 millivolts (mV)
- YSI 556 Multimeter:
    - pH: ± 0.2 units
    - Conductivity: ± 2.0% of reading or ± 0.001 millisiemens per centimeter (mS/cm)

Any probes that fall outside the range during calibration checks will be recalibrated prior to use. Recalibration will be performed according to manufacturer specifications.

Special attention shall be noted by field crew to instruments that may be affected by the change in the ambient temperature or humidity. Calibration checks should also be performed when sampling conditions change significantly, sample matrix changes, and/or readings are unstable or there is a change of parameter measurements that appear unusual.

Maintenance

All field monitoring equipment and accessories are to be maintained in accordance with manufacturer recommendations and specifications and/or established field practices. All maintenance will be performed by qualified personnel and documented in the field logbook or returned to the manufacturer for maintenance.

Equipment requiring battery charging shall be charged as recommended by the manufacturer. Backup batteries for meters requiring them shall be included as part of the meters' accessories.

Care must be taken to protect meters from adverse elements. Protective measures may involve placing the meter in a large plastic bag to shield it from the weather.

Documentation

All field equipment calibration, maintenance, and operation information shall be recorded in the field logbook to document that appropriate procedures have been followed and to track the equipment operation.

Logbook entries shall contain, but are not necessarily limited to, the following:

- Equipment model and serial numbers
- Date and time of calibration or maintenance performed
- Calibration standard used
- Calibration lot number and expiration date, if listed on bottle
- Calibration procedure used if there are multiple options
- Calibration and calibration check readings, including units used
- Problems and solutions regarding use, calibration, or maintenance of the equipment
- Other pertinent information

Field records should contain sufficient detail to provide a clear understanding of which equipment was used and how equipment was calibrated. All documentation shall be placed in the project files and retained following completion of the project as described in the Data Quality Management Plan.

APPENDIX B – Standard Operating Procedures

B-5: Manufacturer Operating Manuals for Water Quality Probes

ProODO™

USER MANUAL

Item #626279
Rev C
Drawing # A626279
March 2009

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WARRANTY

The YSI Professional ODO™ Instrument is warranted for three (3) years from date of purchase by the end user against defects in materials and workmanship, exclusive of batteries and any damage caused by defective batteries. ProODO™ field cable/probe assemblies are warranted for two (2) years from date of purchase by the end user against defects in material and workmanship. ProODO sensor caps are warranted for one (1) year from date of purchase by the end user against defects in material and workmanship. ProODO systems (instrument & cable/probe assemblies) are warranted for 90 days from date of purchase by the end user against defects in material and workmanship when purchased by rental agencies for rental purposes. Within the warranty period, YSI will repair or replace, at its sole discretion, free of charge, any product that YSI determines to be covered by this warranty.

To exercise this warranty, call your local YSI representative, or contact YSI Customer Service in Yellow Springs, Ohio at +1 937 767-7241, 800-897-4151 or visit www.YSI.com (Support tab) for a Product Return Form. Send the product and proof of purchase, transportation prepaid, to the Authorized Service Center selected by YSI. Repair or replacement will be made and the product returned, transportation prepaid. Repaired or replaced products are warranted for the balance of the original warranty period, or at least 90 days from date of repair or replacement.

LIMITATION OF WARRANTY

This Warranty does not apply to any YSI product damage or failure caused by:

1. Failure to install, operate or use the product in accordance with YSI's written instructions;
2. Abuse or misuse of the product;
3. Failure to maintain the product in accordance with YSI's written instructions or standard industry procedure;
4. Any improper repairs to the product;
5. Use by you of defective or improper components or parts in servicing or repairing the product;
6. Modification of the product in any way not expressly authorized by YSI.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. YSI'S LIABILITY UNDER THIS WARRANTY IS LIMITED TO REPAIR OR REPLACEMENT OF THE PRODUCT, AND THIS SHALL BE YOUR SOLE AND EXCLUSIVE REMEDY FOR ANY DEFECTIVE PRODUCT COVERED BY THIS WARRANTY. IN NO EVENT SHALL YSI BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES RESULTING FROM ANY DEFECTIVE PRODUCT COVERED BY THIS WARRANTY.

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INTRODUCTION

Thank you for purchasing the YSI Professional Optical Dissolved Oxygen (Pro ODO) instrument. The YSI ProODO™ measures dissolved oxygen in water using lifetime luminescence technology and uses a digital signal to send information between the instrument and probe. Key advantages of the new ProODO include the elimination of sensor flow dependence and sensor warm-up time, greater stability, the ability to zero the sensor for more accurate measurements at low dissolved oxygen levels, and the elimination of frequent membrane/electrolyte changes. The ProODO also features a waterproof (IP-67) case, a rugged MS-8 cable connector, backlit display and keypad, user-selectable cable lengths, USB connectivity, large memory with extensive site list capabilities, and a rugged, rubber over-molded case. For product specification information, please visit www.ysi.com or contact Technical Support at 800-897-4151 (+1 937 767-7241).

Reading the entire manual before use is recommended for an overall understanding of the instrument's features.

GETTING STARTED

INITIAL INSPECTION

Carefully unpack the instrument and accessories and inspect for damage. Compare received parts with items on the packing list. If any parts or materials are damaged or missing, contact YSI Customer Service at 800-897-4151 (+1 937 767-7241) or the authorized YSI distributor from whom the instrument was purchased.

BATTERY INSTALLATION

The ProODO uses 2 alkaline C-cell batteries. Battery life depends on sampling mode and usage. When used in Manual Sampling mode, under normal conditions, battery life is approximately 80 hours at room temperature. The use of Automatic Sampling mode may slightly reduce the battery life. See the **System** section of this manual for more information on Sampling Modes.

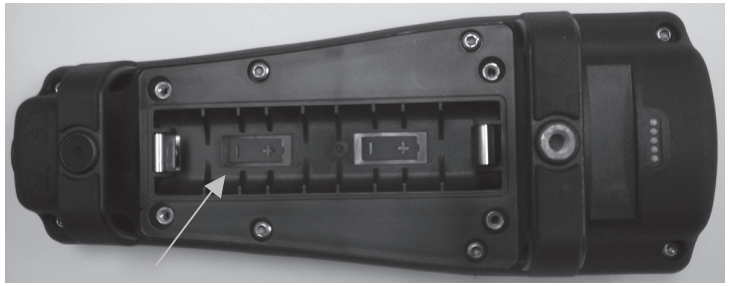


Figure 1. ProODO with battery cover removed. Notice battery symbols indicating polarities.

To install or replace the batteries:

1. Turn the instrument over to view the battery cover on the back.
2. Unscrew the four captive battery cover screws.
3. Remove the battery cover and install the new batteries, ensuring correct polarity alignment on the instrument or the removed cover (Figure 1).
4. Replace the battery cover on the back of the instrument and tighten the four screws. Do NOT over-tighten.

KEY PAD

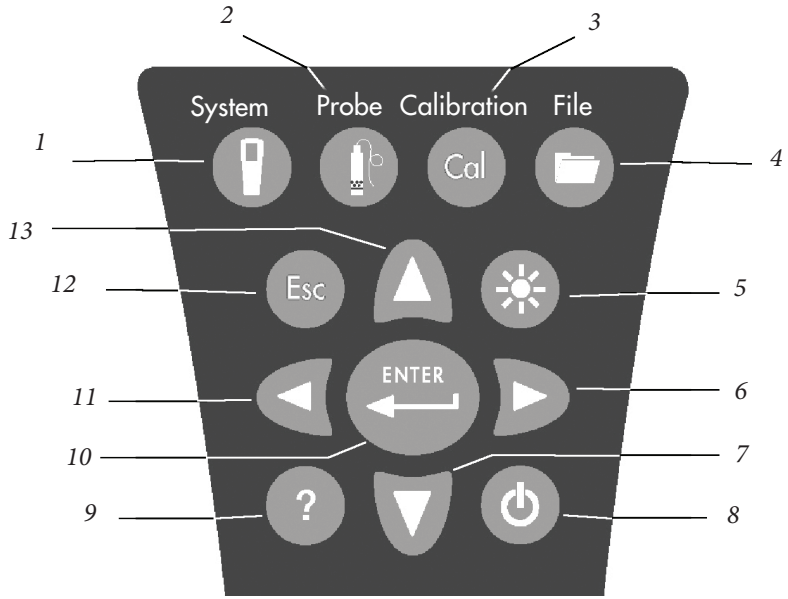


Figure 2

Number	*Key*	*Description*
1		**System** Opens System Menu from any screen. Use to adjust system settings.
2		**Probe** Opens Probe Menu from any screen. Use to setup DO probe, sensor cap, and display units.
3	Cal	**Calibrate** Opens Calibrate Menu from any screen. Use to calibrate dissolved oxygen.

Number	*Key*	*Description*
4		**File** Opens File Menu from any screen. Use to view data and GLP files, set up site and folder lists, and delete data.
5		**Backlight** Press to turn the instrument backlight on and off and to adjust the display contrast when pressed with the left or right arrow key.
6		**Right Arrow** Use to navigate right in alpha/numeric entry screens. Can be pressed simultaneously with Backlight button to increase display contrast.
7		**Down Arrow** Use to navigate through menus and to navigate down in alpha/numeric entry screens.
8		**Power** Press and hold for 2 seconds to turn the instrument on. Press to turn off.
9	?	**Help** Press to receive hints & tips during operation.
10	ENTER	**Enter** Press to confirm selections, including alpha/numeric key selections.
11		**Left Arrow** Use to navigate left in alpha/numeric entry screens. Press to return to previous menu in all screens except alpha/numeric entry. Can be pressed simultaneously with Backlight button to decrease display contrast.
12	Esc	**Exit/Escape** Exits back to Run Screen. When in alpha/numeric entry screen, escapes to previous menu.
13		**Up Arrow** Use to navigate through menus and to navigate up in alpha/numeric entry screens

INITIAL SETUP

Throughout the manual, the term "probe" refers to the end of the cable where the sensor is located, the term "sensor" refers to the Optical Dissolved Oxygen sensing portion of the cable/probe assembly, and the term "sensor cap" refers to the removable sensing cap that is replaced about once per year (Figure 3).

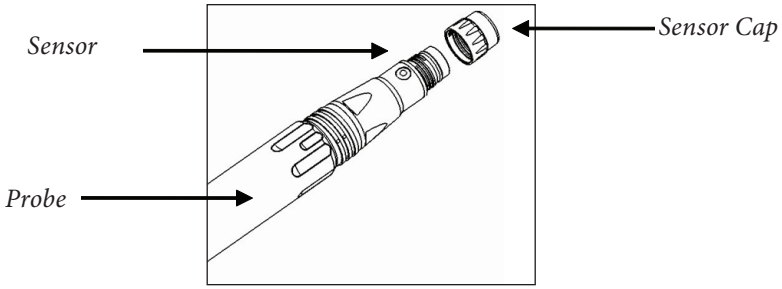


Figure 3

UNPACKING THE ODO PROBE

> ⓘ *Each ProODO cable/probe assembly and replacement ODO sensor cap includes an instruction sheet with important information unique and specific to each individual sensing cap.*

Remove the cable/probe assembly from the shipping container and locate the instruction sheet included with your assembly. This instruction sheet is important because it includes the calibration coefficients for your sensor cap. After using this sheet for general probe setup, be sure to store it in a safe place in case you need to reload these calibration coefficients in the unlikely event that they are ever deleted from the probe.

> ⓘ *Note - A new cable/probe assembly already has a sensor cap installed and the sensor cap coefficients are preloaded into the probe at the factory.*

Preparing the probe for the first time:

1. Remove the metal probe guard from the probe by turning it counterclockwise.
2. Remove the red storage cap which contains a moist sponge from the end of the probe by pulling it straight off the sensor. Save this to use later for long term storage.

3. Reinstall the probe guard by sliding it carefully over the sensor and then threading it onto the cable/probe assembly with a clockwise rotation (Figure 4).
4. Locate the grey calibration/storage sleeve that was shipped with your probe/cable assembly. Moisten the sponge in the grey calibration/storage with a small amount of clean water.
5. Slide the calibration/storage sleeve over the probe guard to keep the probe in a moist atmosphere for storage or calibration (Figure 5). It is important to always keep your sensor in a moist environment so the sensor cap does not dry out. (See Care, Maintenance, and Storage for more information.)

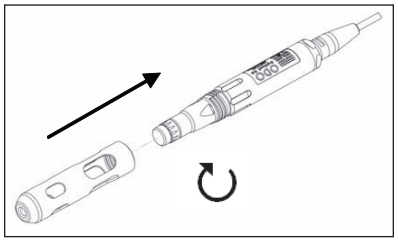


Figure 4

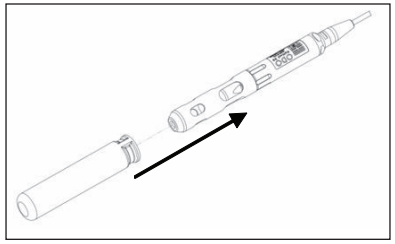


Figure 5

CONNECTING THE PROBE/CABLE ASSEMBLY TO THE INSTRUMENT

To connect the cable, align the keys on the cable connector to the slots on the instrument connector. Push together firmly, then twist the outer ring until it locks into place (Figure 6). This MS-8 (Military Spec) connection is water-proof.

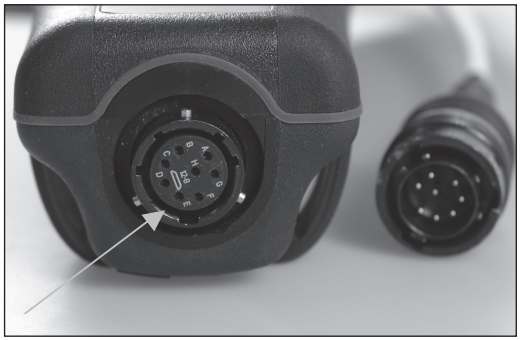
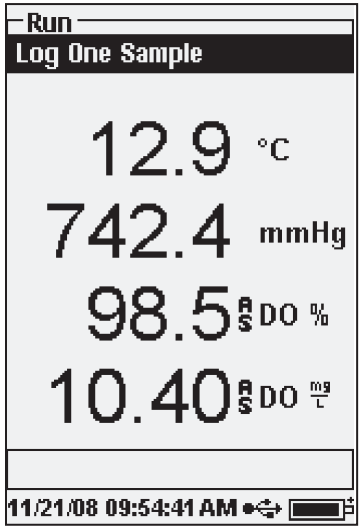


Figure 6. Note the keyed connector. The cable and instrument connectors can only be mated once the keyed sections are properly aligned. When disconnected, the cable connector and the connector on the instrument maintain an IP-67 rating.

MAIN DISPLAY

Press and hold the Power key ⏻ for two seconds to turn the instrument on. The instrument will briefly display two splash screens then go directly to the main run mode screen. The first time the instrument is powered up, you will need to set the date and time. Follow the instructions under the **Setup | System | Date/Time** section of this manual.



The display at the left shows the run mode (main display) with temperature in °C, barometric pressure in mmHg, DO in % and mg/L as the reported parameters. The date, time and battery level are indicated at the bottom of the screen. The logging preference of Log One Sample at a time is indicated at the top of the screen.

This screen also shows the message line towards the bottom of the display above the date and time. In this case, it doesn't show a message. However, messages will appear frequently to indicate successful calibrations, saved configuration changes, etc.

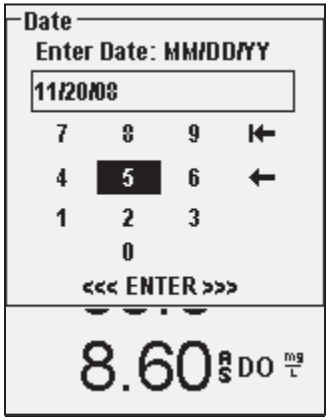
A USB symbol will show up on the bottom of the display when connected through USB with the communications saddle. The instrument will display full battery power when it is receiving power through the USB connection.

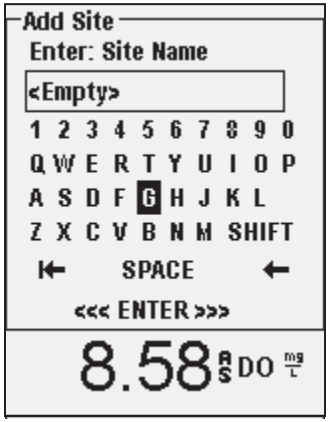
> ⓘ ***Contrast** – the contrast adjustment can be accomplished by repeatedly pressing the backlight key and the left or right arrow key at the same time.*

MENU LAYOUT

Press Esc at anytime in the menus to escape back to the Run screen. The left arrow ◀ can be used to go back to the previous menu in all screens except alpha/numeric entry screens. You must use Esc to get out of the alpha/numeric screens if you want to exit before finishing or without saving changes. Functions that are enabled appear as a circle with a dot ⊙. Disabled functions appear as a circle only ○. In addition, some options appear as an empty box ☐ or a box with a check mark ☑.

ALPHA/NUMERIC ENTRY





The numeric screens will display numbers only (shown above, left). Alpha/numeric screens will display numbers across the top and letters along the bottom rows (shown above, right). Letters appear as a common keyboard arrangement.

When an alpha or numeric character is required, the display will show the alpha/numeric entry screen. To select a character, highlight it by using the arrows to move the highlight box over the desired selection. Then, press **Enter** on the keypad to confirm the selection. After confirming the selection, it will appear in the line at the top of the display.

For capital letters or lower case entry, highlight "SHIFT" and press **Enter** on the keypad to change the characters from upper to lower case.

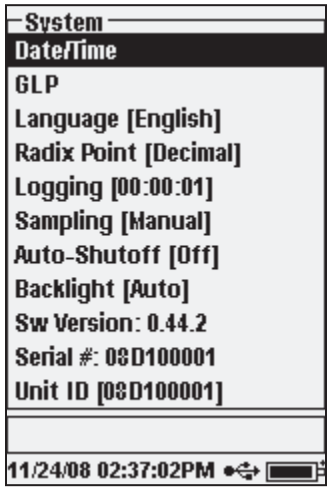
To delete the entire line of the current entry, highlight ⇤ and press **Enter** on the keypad. The ← symbol functions as a backspace key in the alpha/numeric entry screens by deleting one character at a time. Use the "SPACE" function to add a space between characters.

When you have finished entering the correct information (16 character max), highlight <<<ENTER>>> at the bottom of the screen and press **Enter** on the keypad to confirm.

> ⓘ *The ◀ key cannot be used to escape to the previous menu from an alpha/numeric entry screen. Instead, use the Esc key to go back to the previous menu when in alpha/numeric entry screens.*

SYSTEM

Press System to access any of the following menu items.



The System menu will allow you to access the setup options of the instrument including; **Date/Time**, **GLP**, **Language**, **Radix Point**, **Logging, Sampling, Auto Shutoff**, **Backlight**, **Sw** (Software) **Version**, **Serial #**, and **Unit ID**. Any item with [brackets] shows the current setting inside the brackets. For instance, in the example at the left, Radix Point is currently set to [Decimal].

DATE/TIME

Highlight **Date/Time** from the **System** menu. Press enter to select.

Date Format – Highlight and press enter to open a sub menu for selecting the preferred date format: YY/MM/DD, MM/DD/YY, DD/MM/YY, or YY/DD/MM.

Date – Highlight and press enter to use the numeric entry screen to set the correct date.

Time Format – Highlight and press enter to open a submenu to select the preferred time format from 12-hour or 24-hour.

Time – highlight and press enter to use the numeric entry screen to set the correct time.

GLP

The GLP or 'Good Laboratory Practice' file saves detailed information about calibrations. It also includes diagnostic information about the sensors. Calibrations are logged into a file, the GLP, for later review as needed. A single GLP file is utilized to store all calibration records and is capable of storing 500

records. Once the GLP file is full, the instrument will begin to overwrite the oldest record with each new calibration record.

> ⓘ *In order to keep all of your GLP records, periodically download the GLP to Data Manager and export it to another program. Otherwise, the instrument will overwrite the oldest record once the memory is full. Also, since Data Manager saves GLP files under the Unit ID, you must periodically export and rename the GLP file on your PC or it will be overwritten each time you upload the GLP file from the instrument.*

Several calibration parameters are saved for each calibration including optional ones that can be enabled by the user. Standard parameters include date/time stamp, calibration method, and sensor information. Optional, user selectable parameters include User ID, Probe ID, and User Fields 1 and 2.

In addition, there will be information specific to the Dissolved Oxygen or Barometer calibration record. A Dissolved Oxygen calibration record will contain the following calibration specific parameters:

DO
Sensor - Serial Number of the Sensor
Calibration Method - Zero, %, or mg/L
Cal Value
Sensor Value - Tangent of the angle between reference and signal LED, must be within 0.2 of the default value in the sensor, typically between -0.53 and -2.17
Salinity Mode - Always manual
Salinity Value - Value entered by the user
Barometer - Barometric Pressure during calibration
Temperature - Temperature during calibration
Calibrate Status - Calibrated

A Barometer calibration record will contain the following calibration specific parameters:

Barometer
Barometer - Calibrate value in kPa
Calibrate Status - Calibrated

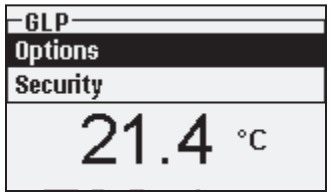
An example of a GLP record

(Operation Performed is % DO Calibration)

*** Calibrate – DO ***

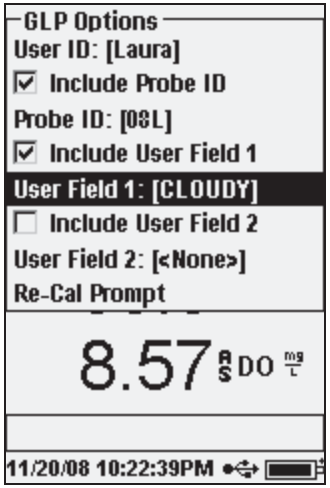
Date:	11/01/2008 MM/DD/YY
Time:	04:03:05 PM
User ID:	Tech0001
Probe ID:	SN: 08D
User Field #1	Cloudy
Sensor:	08F000015
Method:	DO Air Calibrate
Cal Value:	100.0 %
Sensor Value:	-0.591150
Salinity Mode:	Manual
Salinity Value:	0.000000 SAL PSU
Barometer	767.09 mmHg
Temperature	19.2 °C
Calibrate Status:	Calibrated

– –



In the System menu, highlight **GLP** and press enter to view and modify the GLP settings.

Highlight Options and press enter to access **User ID**, **Probe ID**, **User Defined Fields**, and **Re-Cal Prompt**.

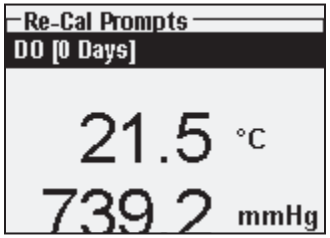


User ID may be used to identify the person calibrating the instrument. Highlight **User ID** and press enter to select or edit a User ID from a list of previously entered IDs. Or, highlight **Add New** and press enter to create a new User ID using the alpha/numeric entry screen. The User ID may also be changed in the **Calibration** menu during the calibration process. The selected User ID will be stored in the GLP file with each calibration record. A User ID could be a person's initials or badge number. The character limit is 16 characters.

Probe ID is stored with the calibration record and may be used to distinguish one cable/

probe assembly from another, typically by serial number. Highlight **Include Probe ID** and press enter to turn this function on and off. There will be a check mark in the box when the function is enabled. Highlight **Probe ID** and press enter to add, view, edit, or select a Probe ID. Probe ID may also be changed in the **Calibration** menu during the calibration process. The character limit is 16 characters.

User Fields 1 and 2 are stored with the calibration record and may be used to enter other parameters pertinent to the user, such as weather conditions, elevation, etc. Highlight **Include User Field 1** or **Include User Field 2** and press enter to turn this function on and off. Highlight **User Field 1** or **User Field 2** and press enter to add, view, edit, or select a User Field. The character limit is 16 characters. When enabled, a prompt for selecting a User Defined Field will appear during the calibration process.



Re-Cal Prompt may be used to remind the user to perform a calibration. To set a time interval, highlight DO and press enter to access the numeric entry screen. Enter a value in days and press enter to confirm the reminder time. To turn off the Re-cal prompt, set the reminder to zero (0) days (this is the default).

The **Security** section of the GLP menu is a password protected area. This area includes options to set a new password and to lock access to the calibration menu. When first viewing the security menu, you will be required to enter a password. Use the "shift" on the alpha/numeric screen to switch to lower case and enter "ysi123". This is the default password.

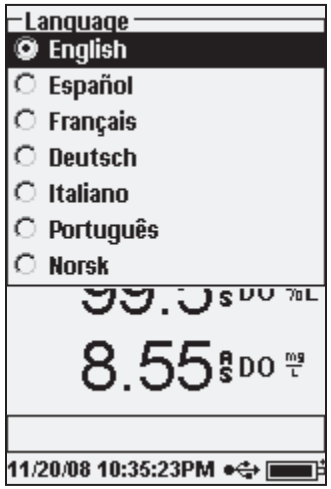
Protect Cal can be enabled or disabled. When enabled, the user must know and enter the instrument's password to enter the calibration menu option. Highlight **Protect Cal** and press enter to enable (☑) or disable (☐) this feature.

Set Password allows a user to set the security password. Highlight **Set Password** and press enter. Using the alpha/numeric entry screen, enter the new password. The password can have up to 16 characters.

Contact YSI Technical Support at environmental@ysi.com or +1 937 767-7241 if you forget or misplace your password.

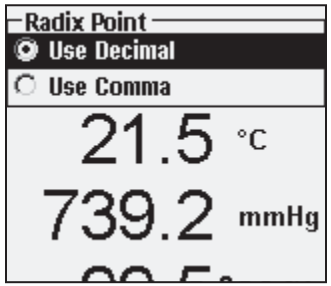
> ⓘ *Once a password is set, and the GLP security screen exited, a password must be entered to make changes under GLP security. Keep passwords in a safe place.*

LANGUAGE



To change the instrument's language setting, highlight **Language** in the **System** menu and press Enter. Highlight the desired language and press enter to confirm. Languages include English, Spanish, French, German, Italian, Portuguese, and Norwegian.

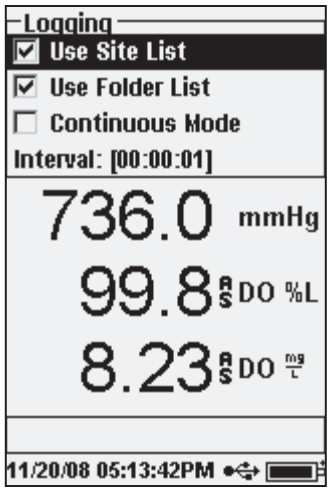
RADIX POINT



Radix Point allows the user to select between a comma or a decimal in numeric radix point for displayed values. For example, 1.00 becomes 1,00 when **Use Comma** is selected. Highlight **Use Decimal** or **Use Comma** and press enter to make your selection.

LOGGING

From the System menu, highlight **Logging** and press enter to view or change the logging options. Logging options include **Use Site List**, **Use Folder List**, **Continuous Mode**, and **Interval**.



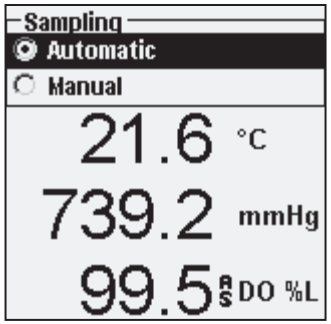
Use Site List and **Use Folder List** are optional ways of filing or 'tagging' your logged data points. If these settings are enabled, you will be prompted to select a Site and/or Folder to 'tag' to logged data points. See the **File and Site Lists** section of this manual for information on creating Site and Folder Lists.

Check the box for **Continuous Mode** if you want to log samples continuously at a specific time interval. To set the length of time between logged samples, highlight **Interval** and press Enter. Enter the interval as HH:MM:SS. This interval will display at the top of the screen when you select the **Start Logging** option in run mode. If operating the unit in Manual mode, see next section, the continuous logging interval must be set to 10 seconds or greater in order to log data.

To log one sample at a time, uncheck **Continuous Mode**.

SAMPLING MODE

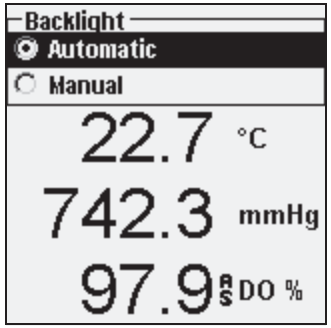
The **Sampling** mode can be set to **Automatic** or **Manual**. In **Automatic** mode, which is the default mode, the readings are constantly updated. In **Manual** mode, the readings are held or 'locked' on the display once they reach the stability of the **Auto Stable** setting in the **Probe** menu. The user must then press a key to either log the held data or update the measurements. Selecting Manual mode may increase the instrument's battery life. Highlight either Automatic or Manual and press enter to make your selection. If continuously logging in Manual mode, the logging interval must be set to 10 seconds or greater.



AUTO SHUTOFF

Auto Shutoff powers the instrument off after a user specified time period. Highlight **Auto Shutoff** and press enter. Using the numeric entry screen, enter a value between 0 and 360 minutes. To disable auto shutoff, set the value to 0 (zero).

BACKLIGHT



Backlight can be set to **Automatic** or **Manual**. Automatic turns the backlight on when you turn the instrument on and when you press any key. Manual allows you to turn the backlight on or off with the backlight key. When in Automatic mode, the instrument will turn the backlight off after 60 seconds without any keys being pressed. If a key is pressed during that time, the instrument will "reset" the 60 second time period. The lighted keypad will turn off after approximately 20 seconds.

SW VERSION (SOFTWARE VERSION)

SW Version shows the instrument's software version.

SERIAL

Serial # shows the instrument's serial number and allows you to match it with the number engraved on the back of the instrument's case. The Serial # is also the default Unit ID.

UNIT ID

Unit ID is used to identify instruments in the Data Manager software included with your instrument. It is also used to identify GLP files, Site Lists, Configuration Files, and Data files transferred from the instrument to the PC. The default Unit ID is the Instrument's serial number. To modify the Unit ID, highlight **Unit ID**, press enter and use the alpha/numeric entry screen. The character limit is 16 characters.

OPTICAL DISSOLVED OXYGEN (ODO™)

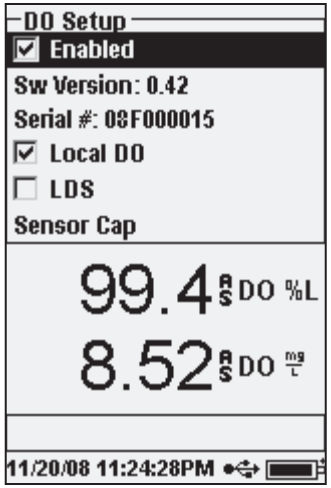
> *Each ProODO cable/probe assembly and replacement ODO sensor cap includes an instruction sheet with important information unique and specific to each individual sensing cap. This instruction sheet is important because it includes the calibration coefficients for the sensor cap. After using this sheet for general probe setup, be sure to store it in a safe place in case you need to reload these calibration coefficients in the unlikely event that they are ever deleted from the probe.*

See **Initial Setup | Unpacking the ODO Probe** for initial setup instructions**.**

> *It is important to always keep your sensor in a moist environment so the sensor cap does not dry out. (See Maintenance and Storage for more information.)*

ODO PROBE SETUP

Press Probe, Highlight DO, press enter.



Enabled allows you to enable or disable the DO sensor. Highlight **Enabled** and press enter to activate or deactivate dissolved oxygen.

The DO Setup menu also displays the ODO probe's **SW Version** and **Serial #**. This information is programmed into the probe at the factory and digitally sent to the instrument when the cable is connected.

Local DO allows for localized DO% measurements. This sets the calibration value to 100% regardless of the altitude or barometric pressure. Highlight **Local DO** and press enter to enable or disable this function. Local DO is a method for the ProODO to factor in the barometric pressure on each DO measurement. In essence, even if the barometric pressure changes you wouldn't notice the difference with the DO% readings in air-saturated water or water-saturated air.

Local DO is ideal for EU compliance. When Local DO is enabled, an L will appear next to DO% on the run screen. DO mg/L readings are unaffected by the selection of DO Local.

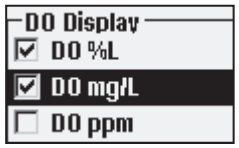
LDS (Last Digit Suppression) rounds the DO value to the nearest tenth; i.e. 8.27 mg/L becomes 8.3 mg/L. Highlight LDS and press enter to activate or deactivate LDS. Some users may not want to read out to the hundredths place since the DO mg/L accuracy spec is to the tenths place.

Sensor Cap allows you to view and enter information specific to the sensor cap installed on the probe. Highlight Sensor Cap and press enter to view the sensor cap's Serial #, Temperature Coefficient, and Sensor Cap Coefficients. This information is programmed into the sensor at the factory and sent to the instrument when the cable is connected. Since the Temperature Coefficient is programmed into the sensor at the factory, it should not be modified unless instructed by YSI Technical Support.

The **Sensor Cap Coefficients** need to be updated when the sensor cap is replaced. The sensor cap should be replaced about once per year. See the Dissolved Oxygen **Sensor Maintenance** section of this manual or the instruction sheet included with replacement sensor cap for instructions on updating the Sensor Cap Coefficients. When updating the Coefficients, the sensor cap serial # will be updated automatically based on your entries.

DISPLAY - DISSOLVED OXYGEN

Press Probe, highlight **Display** and press enter. Highlight **DO** and press enter. Note, you will not be able to display dissolved oxygen unless it is **Enabled** in the DO Setup menu first, see previous section.



DO % will show DO readings in a percent scale from 0 to 500%.

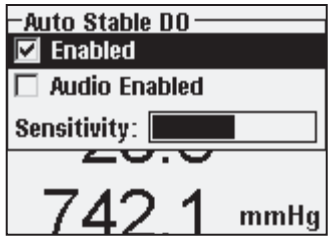
DO mg/L will show DO readings in milligrams per liter (equivalent to ppm) on a scale from 0 to 50 mg/L.

DO ppm will show DO readings in parts per million (equivalent to mg/L) on a scale from 0 to 50 ppm.

All units can be displayed simultaneously on the screen. Highlight the desired unit(s) and press enter to select. A check mark in the box next to the unit will indicate that it is enabled.

AUTO STABLE - DISSOLVED OXYGEN

Press Probe, highlight **Auto Stable** and press enter. Highlight **DO** and press enter.



Auto Stable indicates when a reading is stable. Highlight **Enabled** and/or **Audio Enabled** (instrument will beep when the stability is achieved) and press enter to confirm. When Auto Stable is enabled, **AS** will blink next to the parameter until it is stable. Once the parameter is stable, **AS** will stop blinking.

The Auto Stable **Sensitivity** can be decreased or increased. Highlight **Sensitivity** and use the left and right arrow keys to slide the bar. The more sensitive you make it (larger black bar) the harder it is to achieve stability in a changing environment.

The **Auto Stable** system works by examining the previous 5 readings, computing the percent change in the data and comparing that change against a % threshold value. The % threshold value is determined by the **Sensitivity** bar setting. The following chart can be used as a guide when setting the Sensitivity bar.

Sensitivity selected by User	*% Data Variance Threshold*
100 - Most Sensitive, Sensitivity bar is set to the far right	0.05%
75	0.62525%
50	1.275%
25	1.8875%
0 - Least Sensitive, Sensitivity bar is set to the far left	2.5%

Example:

The instrument obtained the following data:

Reading #1 95.5 DO%
Reading #2 95.7 DO%
Reading #3 95.8 DO%
Reading #4 96.1 DO%
Reading #5 95.3 DO%

The instrument is programmed to determine the minimum and maximum data value over the previous 5 samples, and to compute the percent difference between those values. In this example, that gives a percent change of:

% Change = 100 * ((96.1 – 95.3) / 95.3)
% Change = 0.83%

In this example, if the Sensitivity Bar is set to the far right, the Auto Stable requirement would not be met and AS would continue to blink. However, if the sensitivity bar is set to the median threshold (1.275%), the Auto Stable requirement would be met and AS would display steadily on the display.

If the **Manual Sampling** mode in the System menu is enabled, the Auto Stable function will automatically be enabled and the sensitivity setting will be used to determine when to hold the readings on the display. See Sampling Mode in the System section of this manual for more information on the two Sampling mode options.

SALINITY CORRECTION

The last feature in the **Probe** menu is the **Salinity** correction value for the mg/L readings. Press Probe, highlight Salinity, and press enter. Then, use the numeric entry screen to enter the Salinity value of the water you will be testing from 0 to 70 ppt.

The value entered here will be used when calculating mg/L from the temperature and % saturation readings. As the salinity of water increases, its ability to dissolve oxygen decreases. For example, fully oxygenated 20 °C water at sea level with zero salinity will hold 9.092 mg/L of dissolved oxygen. If that same sample had a salinity value of 9 ppt, then it would hold 8.621 mg/L of dissolved oxygen. Therefore, to obtain accurate mg/L readings, it is important that you know the salinity of the water you will be testing and input the value into the instrument. The salinity of fresh water is typically 0-0.5 ppt and seawater is typically 35 ppt. You will also have the opportunity to enter or modify the Salinity correction value during DO calibration. Appendix B shows the oxygen solubility table.

CALIBRATION - DISSOLVED OXYGEN

The ProODO sensor is an optical luminescent sensor which has greater stability and is less susceptible to calibration drift than traditional electrochemistry sensors. This increased stability means that the instrument may hold its calibration for many months. However, for the highest data accuracy, YSI recommends verifying the instrument's calibration on a daily basis. To verify the instrument's calibration, place the sensor in its calibration environment and check to see that the DO% is reading its calibration value based on the

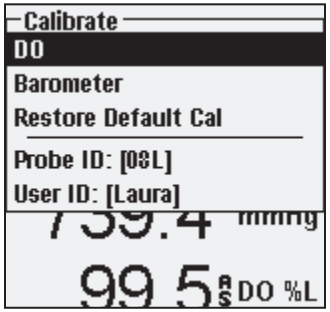
barometric pressure. Refer to Appendix A for the DO% calibration values based on barometric pressure.

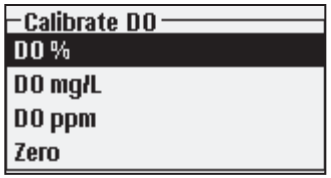
The ProODO offers several options for calibrating dissolved oxygen. The first and second methods calibrate the DO % saturation value to either water saturated air or air saturated water. The third and fourth calibrates in mg/L or ppm to a solution with a known DO concentration (usually determined by a Winkler Titration). The fifth option is a zero calibration. If performing a zero calibration, you must also perform a %, mg/L, or ppm calibration following the zero calibration. For both ease of use and accuracy, YSI recommends performing the following DO % water saturated air calibration:

> ⓘ *It is not necessary to calibrate in both % and mg/L or ppm. Calibrating in % will simultaneously calibrate mg/L and ppm and vice versa.*

CALIBRATING DO % IN WATER SATURATED AIR: **1-POINT CALIBRATION**

Moisten the sponge in the storage sleeve with a small amount of clean water. The sponge should be clean since bacterial growth may consume oxygen and interfere with the calibration. Make sure there are no water droplets on the sensor cap and temperature sensor and then install the storage sleeve over the probe. Make sure the DO and temperature sensors are not immersed in water. The storage sleeve ensures venting to the atmosphere. Wait approximately 5 to 10 minutes for the storage container to become completely saturated and to allow the temperature and dissolved oxygen sensors to stabilize.



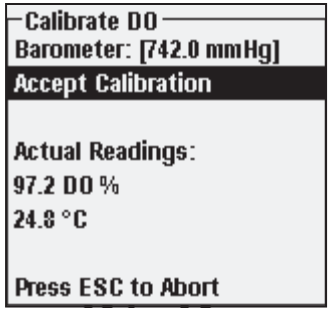


Press Calibration Cal. If Probe ID or User ID are enabled in the System GLP menu you will be able to highlight these features and add, select, edit, or delete an ID. When enabled these IDs are stored with each calibration record in the GLP file.

After selecting the Probe ID and/or User ID if appropriate, highlight DO and press enter.

Highlight **DO %** and press enter to confirm.

The instrument will use the value from the internal barometer during calibration and will display this value in brackets at the top of the



display. Highlight the barometer value and press enter to adjust it if needed. If the barometer reading is incorrect, it is recommended that you calibrate your barometer. Note - the barometer should be reading "true" barometric pressure (see Barometer section for more information on "true" barometric pressure). If the value is acceptable, there is no need to change it or perform a barometer calibration.

Wait for the temperature and DO% values under "Actual Readings" to stabilize, then highlight **Accept Calibration** and press enter to calibrate. If User Field 1 or 2 are enabled, you will be prompted to select the fields and then press Cal (Cal) to complete the calibration. The message line at the bottom of the screen will display "Calibrating Channel..." followed by "Calibration Successful". Press Esc (Esc) to cancel the calibration.

CALIBRATING DO % IN AIR SATURATED WATER: **1-POINT CALIBRATION**

Continuously sparge water with air using an air stone or some type of aerator until the water becomes completely saturated with air. For 500 ml of water at room temperature, it may take 60 minutes or more for the water to become completely saturated. Place the sensor in the air saturated water, be sure to immerse both the ODO and Temperature sensor into the water, and wait for the readings to stabilize (at least 2 minutes).

Press Calibration (Cal). If Probe ID or User ID are enabled in the System GLP menu you will be able to highlight these features and add, select, edit, or delete an ID. When enabled these IDs are stored with each calibration record in the GLP file.

After selecting the Probe ID and/or User ID if appropriate, highlight DO and press enter. Highlight **DO %** and press enter to confirm.

The instrument will use the value from the internal barometer and will display this value in brackets at the top of the display. Highlight the barometer value and press enter to adjust it if needed. If the barometer reading is incorrect, it is recommended that you calibrate your barometer. Note - the barometer should be reading "true" barometric pressure (see Barometer section for more information on "true" barometric pressure). If the value is acceptable, there is no need to change it or perform a barometer calibration.

Wait for the temperature and DO% values under "Actual Readings" to stabilize, then highlight **Accept Calibration** and press enter to calibrate. If User Field 1 or 2 are enabled, you will be prompted to select the fields and then press Cal (Cal) to complete the calibration. The message line at the bottom of the screen will display "Calibrating Channel..." followed by "Calibration Successful". Press Esc (Esc) to cancel the calibration.

CALIBRATING IN AIR SATURATION PERCENT (DO %): **2-POINT CALIBRATION WITH ZERO SOLUTION**

Place the sensor in a solution of zero DO. Be sure to immerse both the ODO and Temperature sensor into the water.

A zero DO solution can be made by dissolving approximately 8 - 10 grams of sodium sulfite (Na_2SO_3) into 500 mL tap water or DI water. Mix the solution thoroughly. It may take the solution 60 minutes to be oxygen-free.

Press Calibration (Cal). If Probe ID or User ID are enabled in the System GLP menu you will be able to highlight these features and add, select, edit, or delete an ID. When enabled these IDs are stored with each calibration record in the GLP file.

After selecting the Probe ID and/or User ID if appropriate, highlight DO and press enter. Highlight **Zero** and press enter. Wait for the temperature and DO% values under "Actual Readings" to stabilize, then press enter to **Accept Calibration**. If User Field 1 or 2 are enabled, you will be prompted to select the fields and then press Cal (Cal) to complete the calibration. The screen will then prompt for a follow-up second point calibration.

Highlight **DO%** for the second calibration point and press enter to continue with the next point at full saturation. Rinse the sensor of any zero oxygen solution using clean water. Follow the steps under either of the DO % Saturation methods previously discussed to complete the second point.

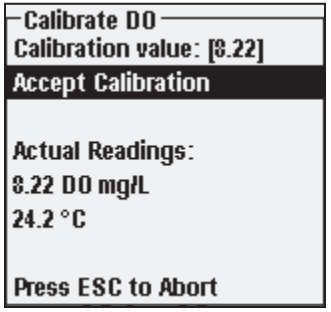
CALIBRATING IN MG/L OR PPM AS A TITRATION: **1-POINT CALIBRATION**

Place the sensor into a water sample that has been titrated by the Winkler method to determine DO concentration. Allow the sensor to stabilize.

Press Calibration (Cal). If Probe ID or User ID are enabled in the System GLP menu you will be able to highlight these features and add, select, edit, or delete

an ID. When enabled these IDs are stored with each calibration record in the GLP file.

After selecting the Probe ID and/or User ID if appropriate, highlight DO and press enter. Highlight **DO mg/L or ppm** and press enter.



Highlight **Calibration value** and press enter to manually input the sample's dissolved oxygen value. Highlight **Accept Calibration** and press enter once the temperature and Dissolved Oxygen readings have stabilized. If User Field 1 or 2 are enabled, you will be prompted to select the fields and then press Cal (Cal) to complete the calibration. After completing the calibration, the message line will display "Calibration Successful". Press Esc (Esc) to cancel the calibration.

CALIBRATING IN MG/L OR PPM AS A TITRATION: **2-POINT CALIBRATION WITH ZERO SOLUTION**

Place the sensor in a solution of zero DO. Be sure to immerse both the ODO and Temperature sensor into the water.

A zero DO solution can be made by dissolving approximately 8 - 10 grams of sodium sulfite (Na_2SO_3) into 500 mL tap water. Mix the solution thoroughly. It may take the solution 60 minutes to be oxygen-free.

Press Calibration (Cal). If Probe ID or User ID are enabled in the System GLP menu you will be able to highlight these features and add, select, edit, or delete an ID. When enabled these IDs are stored with each calibration record in the GLP file.

After selecting the Probe ID and/or User ID if appropriate, highlight DO and press enter. Highlight **Zero** and press enter. Wait for the temperature and DO% values under "Actual Readings" to stabilize, then press enter to **Accept Calibration**. If User Field 1 or 2 are enabled, you will be prompted to select the fields and then Press Cal (Cal) to complete the calibration. The screen will then prompt for a follow-up second point calibration.

Highlight the desired calibration units (mg/L or ppm) and press enter to continue with the next point in a known titrated value. Rinse the sensor of any zero oxygen solution using clean water. Follow the steps under One Point Calibration for mg/L or ppm for the second point.

BAROMETER

All ProODO instruments contain an internal barometer.

DISPLAY - BAROMETER

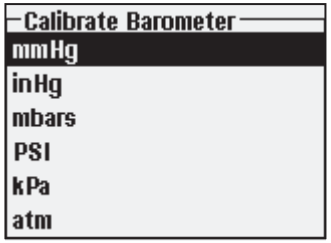
Press Probe (Probe), highlight **Display**, and press enter. Highlight **Barometer**, press enter. The measurement unit options are: mmHg, inHg, mBar, PSI, kPa, or Atm. Only one unit can be displayed at a time. Select **None** if you do not want to display a barometric pressure reading.

Whether or not you choose to display the barometer reading, the barometric pressure will still be used for calibrating DO and for compensating for pressure changes if **Local DO** is enabled.

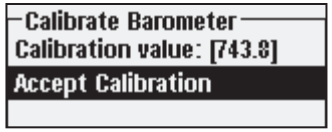
CALIBRATION - BAROMETER

The barometer in the instrument is calibrated at the factory. If the barometer requires calibration, press **Calibrate** (Cal). If Probe ID or User ID are enabled in the System GLP menu you will be able to highlight these features and add, select, edit, or delete an ID. When enabled these IDs are stored with each calibration record in the GLP file.

After selecting the Probe ID and/or User ID if appropriate, highlight barometer and press enter.



Highlight the desired unit and press enter.



Highlight **Calibration Value** and press enter to manually enter the correct "true" barometric pressure. Next, highlight **Accept Calibration**, and press enter. If User Field 1 or 2 are enabled, you will be prompted to select the fields and then press Cal (Cal) to complete the calibration. After completing the calibration, the message line will display "Calibration Successful". Press Esc (Esc) to cancel the calibration.

> *Laboratory barometer readings are usually "true" (uncorrected) values of air pressure and can be used "as is" for barometer calibration. Weather service readings are usually not "true", i.e., they are corrected to sea level, and therefore cannot be used until they are "uncorrected". An approximate formula for this "uncorrection" is below:*

True BP = [Corrected BP] – [2.5 * (Local Altitude in ft. above sea level/100)]

TEMPERATURE

All probe/cable assemblies have built-in temperature. Temperature calibration is not required nor is it available. To set the units, press Probe, and select **Display**. Highlight **Temperature** and press enter. Highlight the desired temperature units of **°F**, **°C**, or **K** and press enter to confirm the selection. Only one temperature unit may be displayed at a time. You may also choose to not display temperature. If you choose not to display temperature, dissolved oxygen readings will still be temperature compensated.

TAKING MEASUREMENTS

1. To take readings, insert the probe into the sample. Move the probe in the sample to release any air bubbles and to provide a fresh sample to the sensor cap. This movement is only necessary when first inserting the probe into the sample. Since the ProODO utilizes optical luminescent technology, continuous sample movement or stirring is not required. The probe will fit into a 300 mL BOD bottle for taking initial and final BOD readings. For best results in a BOD bottle, a stirring device should be used to properly mix the sample and to keep solids from settling at the bottom.

2. Allow the temperature readings to stabilize and wait approximately 25-35 seconds for the DO readings to stabilize.

3. Log One Sample is already highlighted in Run mode. Press Enter to open a submenu. Highlight Sites or Folders and press Enter to select the site or folder to log the sample to.

4. If necessary, use the keypad to create a new Site or Folder name. If Site List and Folder List are disabled in the **System** menu, you will not see these options when logging a sample.

5. Once the Site and/or Folder name is selected, highlight **Log Now** and press Enter. The instrument will confirm that the data point was successfully logged.

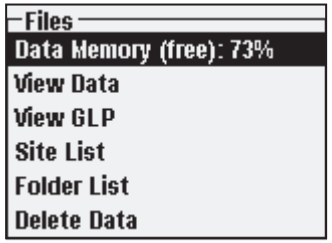
If you would like to log at a specific interval vs. logging one sample at a time or vice versa, press **System**, then highlight **Logging** and press Enter. Select **Continuous Mode** and adjust the time Interval if necessary. On the Run screen, the option to log will change from Log One Sample to Start Logging based on the time interval entered in the Logging Menu. Note – When utilizing the Manual sampling mode, the Continuous Logging Interval must be set to 10 seconds or greater.

During a continuous log, the Start Logging dialog box on the Run screen will change to Stop Logging. Press Enter to stop continuous logging.

Note - There is NO WARM-UP period associated with the ProODO sensor so you may wish to turn off the ProODO instrument between readings to conserve battery power.

FILES AND SITE LISTS

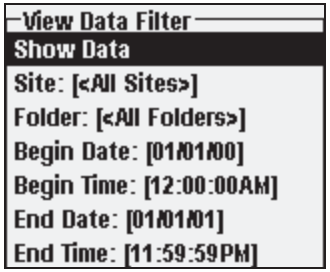
FILE MEMORY



To view the file memory, press **File**.

The **Data Memory** shows a percentage indicating the amount of memory available. If the file memory is near 0%, files should be downloaded to a PC and/or deleted to free up memory.

VIEW DATA

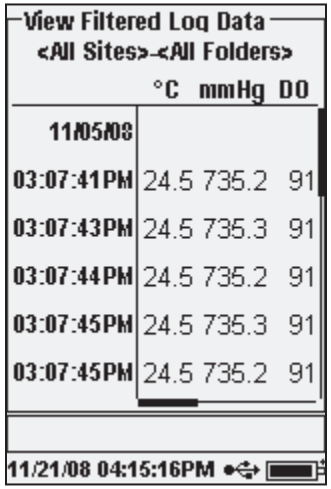


Press **File**, highlight **View Data**, press enter. Configuring your data view:

Site: will allow you to view data from one particular site or all sites. Highlight Site, press enter, and select the site you wish to view data from or select All Sites to view data from all sites.

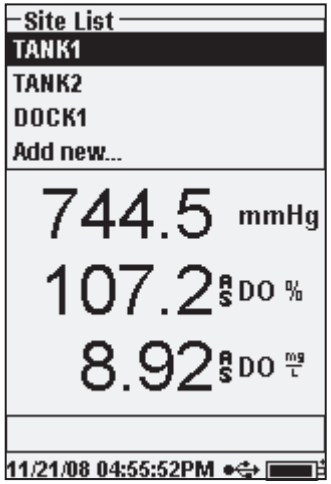
Folder: will allow you to view data from one particular folder or all folders. Highlight **Folder**, press enter, and select the file you wish to view data from or select All Folders to view data from all folders.

Begin and **End** will allow you to view data that was collected between two dates. Highlight Begin and/or End, press enter, and use the numeric entry screen to select the dates you wish to view.



After making your selections in the Data Filter, highlight **Show Data** and press enter. The data will have date and time stamps. You will likely have to scroll up and down and side to side using the arrow keys to completely view the data file.

SITE LIST



To modify the Site List, press **File**, highlight **Site List**, and press enter. Enter new site names or edit existing sites with the alpha/numeric entry screen. Site lists can also be created and edited on your PC with Data Manager and then downloaded to the instrument.

FOLDER

To modify the Folder List, press **File**, highlight **Folder List**, and press enter. Enter new Folder names or edit existing folders with the alpha/numeric entry screen.

DELETE DATA

Press **File**, highlight **Delete Data**, and press enter. Enter the criteria for the data you wish to delete in the Delete Data Filter, then highlight Delete Data and press enter.

DATA MANAGER DESKTOP SOFTWARE

Data Manager is provided with the purchase of a ProODO Instrument. Data Manager is a powerful Windows® based software that will allow you to easily manage logged data, set up instruments, and conduct real time studies.

Data Manager needs to be installed on a PC before use. Once the communications saddle is connected to an instrument and the PC, the Data Manager software will recognize the attached instruments. Data Manager will identify the connected instruments by their Unit ID.

From the 'home' screen of Data Manager, you can select one of the following functions: Retrieve Instrument Data, Real Time Instrument Data, Instrument Configuration, or View Saved File/Data.

USING THE COMMUNICATIONS SADDLE

WARNING: *DO NOT connect the Communications Saddle to your PC before installing Data Manager. The Communication Saddle drivers MUST be installed prior to connecting it to your PC. The drivers will install automatically during the Data Manager installation. The first time the saddle is connected to the PC, you may have to walk through a couple of installation wizards. For detailed instruction, please refer to the Readme file located on the CD that was included with your instrument.*

A PC will recognize the Communications Saddle (saddle) as a YSI water quality instrument with or without the handheld installed in the saddle.

To connect to a ProODO, simply align the saddle to the oval section on top of the instrument and push it down to snap it in place (Figure 7).

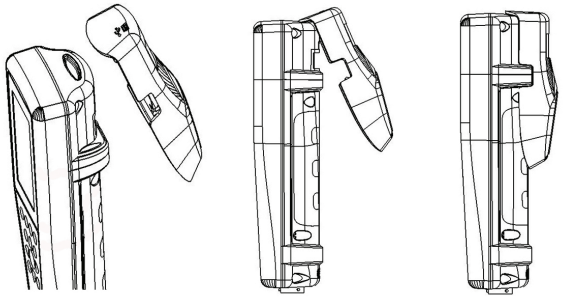


Figure 7. Locate the oval alignment groove at the top of the instrument and inside the saddle. Insert the saddle into this oval groove. Press the saddle towards the back of the instrument until it snaps into place.

Connect the USB cable to the top of the saddle and to a USB port on the PC. Once Data Manager is launched, the program will recognize all saddles with instruments connected to the PC.

The instrument will be powered through the saddle and USB connection when connected to the PC.

MANAGE LOGGED DATA

Data that has been logged to the ProODO can be uploaded to the PC via the provided USB saddle. You can upload sensor data, GLP files, site lists, and instrument configuration files individually or all at once. After connecting the instrument to the PC via the USB saddle and cable and launching Data Manager, click the **Retrieve Instrument Data** tab. Click on the Instrument's Unit ID you would like to retrieve data from, then select the files you would like to retrieve and click Start.

Once the sensor data is uploaded to the PC, you can graph and view tabular data by instrument Unit ID, date/time, site name, and/or folder name. This allows you to configure the report according to your needs. You can select to view all data from all instruments, or select a certain date/time range for only a few specific instruments, there are multiple ways to view the data. Once the report has been defined, you will be able to print the graph and/or export the table.

Data Manager takes information management one step further and allows you to delete specific points instead of entire files. This allows you to clean up data that is no longer needed or that may have been collected erroneously, for example, when the sensor was out of the water. If you can not delete data due to regulation and compliance purposes, Data Manager has the solution. While viewing logged data or real time data, you have the ability to 'tag' individual data points with comments.

In addition to sensor data, you will be able to view GLP files, site lists, and configuration files that have been uploaded from the instrument. These can be printed and exported as well.

REAL TIME DATA COLLECTION

Data Manager allows you to view real time data on the PC.

After selecting your instrument, click the Real Time Instrument Data tab. Next, input your sample interval, site/folder name, select the parameters you wish to view and click OK. You must click Start on the next screen to begin your real time study. Choose to hide the table or graph by unchecking the box next to these options. Click Stop, then Edit Setup to change the Y-scale min/max of the graph, to select different colors, or to name your graph. Add a comment to a data point, by clicking in the comment field of the table next to the data point. You may also Print the graph and Export the data for viewing in another program.

CONFIGURE INSTRUMENTS

Data Manager allows for easy and quick configuration of single or multiple instruments. Once you have uploaded a site list or configuration file, you can edit it as needed, save it, and download it to other instruments. You no longer need to configure each instrument individually. By using the same configuration file for all instruments, you can rest assured that all instruments will have identical settings.

New site lists and configuration files can be created in Data Manager. These lists and files can be downloaded to one or multiple instruments. Save time by creating these files on your PC and downloading them to the instrument as opposed to creating them on the instrument.

Minimum system requirements for Data Manager are a system with Windows® 2000 with SP4 (minimum) or Windows® XP with SP2 (minimum), 300 MHz or higher Pentium®-compatible CPU, 128 MB of RAM or higher, 80 MB or more of free hard-disk space, USB 2.0, and Microsoft® .NET.

MAINTENANCE AND STORAGE

This section describes the proper procedures for care, maintenance and storage of the ProODO. The goal is to maximize their lifetime and minimize down-time associated with improper sensor usage.

UPDATING INSTRUMENT AND PROBE FIRMWARE

The instrument and probe's firmware can be updated via www.ysi.com. There you will find the new firmware files and instructions on how to update the instrument and/or probe. There is no need to send the instrument back to the factory for upgrades.

GENERAL MAINTENANCE - BATTERY COMPARTMENT GASKET

The instrument utilizes a gasket as a seal to prevent water from entering the battery compartment. If the gasket and sealing surfaces are not maintained properly, it is possible that water can enter the battery compartment. This could severely damage the battery terminals causing loss of battery power and corrosion to the battery terminals. Therefore, when the battery compartment lid is removed, the gasket that provides the seal should be carefully inspected for contamination (e.g. debris, grit, etc.) and cleaned if necessary. If contamination is evident, clean the gasket and nearby plastic parts with lens cleaning tissue or equivalent lint-free cloth. Alcohol can be used to clean the plastic parts, but use only water and mild detergent on the o-ring itself. Also, inspect the gasket for nicks and imperfections.

> ⓘ *Using alcohol on a gasket may cause a loss of elasticity and may promote cracking.*

SENSOR MAINTENANCE - DISSOLVED OXYGEN

CLEANING THE SENSOR CAP

The Sensor Cap should be kept clean since some types of fouling may consume oxygen which could affect the dissolved oxygen measurements. To clean the Sensor Cap, gently wipe away any fouling with a lens cleaning tissue that has been moistened with water. Do not use organic solvents to clean the Sensor Cap. Using an organic solvent to clean the Sensor Cap may cause permanent damage to the cap. For example, alcohol will dissolve the outer paint layer and other organic solvents will likely dissolve the dye in the cap

SENSOR CAP REPLACEMENT

The Sensor Cap should be replaced about once per year but may last longer. It should also be replaced if it is cracked or damaged (see Troubleshooting section for instruction on how to inspect the cap for damage). The instruction sheet shipped with the replacement ODO sensor cap includes the calibration coefficients specific to your sensor cap.

> ⓘ *IMPORTANT - Be sure to save the ODO Sensor Cap instruction sheet in case you need to reload the calibration coefficients.*

The replacement ODO Sensor Cap is shipped in a humidified container and the package should not be opened until immediately before sensor cap replacement. Once the sensor cap has been installed on the ODO sensor as described below, it is important to keep the sensor in a 100% humid environment. Therefore, the ODO sensor should be stored either in the grey calibration/storage sleeve with the sponge moistened or immersed in water, see Sensor Storage for more information. If the sensor dries out, refer to the Rehydration procedure in this manual.

Refer to Figure 8 below when following the instructions for replacing the cap.

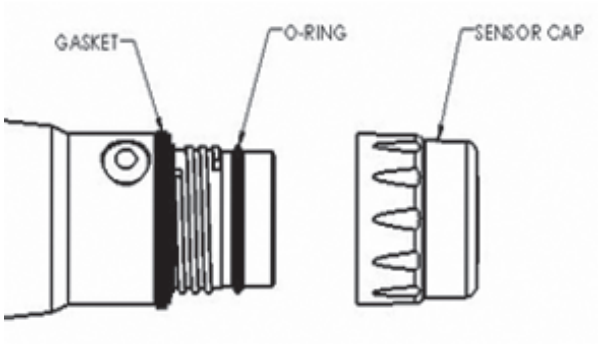


Figure 8

> ⚠ *Caution: Avoid touching the sensing end of the sensor cap during the following maintenance procedures.*

1. Remove the old sensor cap assembly from the sensor by grasping the probe body with one hand and then rotating the sensor cap counterclockwise until it is completely free. Do not use any tools for this procedure.

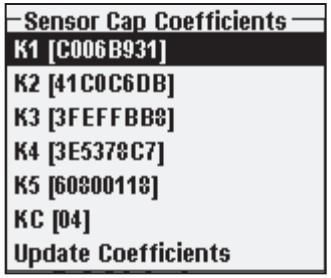
2. Inspect the o-ring on the probe for damage. If there is any indication of damage, carefully remove the o-ring and replace it with the new o-ring included with the replacement sensor cap. Do not use any tools to remove the o-ring.
3. Ensure that the o-ring installed on the probe is clean. If necessary, wipe clean with a lint free cloth or replace the o-ring as described in the previous step.
4. Locate the o-ring lubricant included with the new sensor cap. Apply a thin coat of o-ring lubricant to the installed o-ring. After application, there should be a thin coat of o-ring lubricant on the o-ring only. Remove any excess o-ring lubricant from the o-ring and/or probe with a lens cleaning tissue.
5. Remove the new sensor cap from its hydrated container and dry the inside cavity of the sensor cap with lens cleaning tissue. Make sure that the cavity is completely dry before proceeding with the installation. Next, clean the clear surface of the sensor on the end of the probe with lens cleaning tissue.
6. Using clockwise motion, thread the new sensor cap onto the probe assembly until it is finger-tight. The o-ring should be compressed between the sensor cap and probe. Do not over-tighten the sensor cap and do not use any tools for the installation process.
7. After installing the new sensor cap, store the sensor in either water or in humidified air in the calibration sleeve.
8. Follow the procedures below for configuring the ProODO instrument for the new Sensor Cap.

CONFIGURING PROODO INSTRUMENT FOR NEW SENSOR CAP

After installing a new Sensor Cap, connect the probe/cable assembly to the ProODO instrument and turn the instrument on. Locate the Calibration Code Label at the top of the instruction sheet and note the six numbers which are listed as K1 through K5 and KC. These six numbers contain the calibration code for this particular sensor cap. Follow the instructions below to enter the new calibration coefficients into your existing ODO instrument.

1. Press the **Probe** , highlight DO, and press enter.
2. Highlight **Sensor Cap** and press enter.
3. Highlight **Sensor Cap Coefficients** and press enter.

4. Highlight each coefficient in turn (K1 through KC) and use the numeric entry screen to enter the corresponding new coefficient from the Calibration Code Label. Press Enter after each entry and then proceed to the next K selection.
5. After all the new coefficients have been entered, highlight Update Sensor Cap Coefficients and press the Enter.
6. A message will appear warning that you will be overwriting the current sensor cap coefficients and you should confirm that you wish to carry out this action. Highlight Yes and press enter to confirm the new coefficients.



After updating the Coefficients, the Serial # in the Sensor Cap menu will be updated automatically based on your entries. The Temperature Coefficient listed in the Sensor Cap menu is programmed into the sensor at the factory and should not be modified unless instructed by YSI Technical Support.

If errors are made in entering the Sensor Cap Coefficients, the instrument will block the update and an error message will appear on the display. If you see this error message, re-enter the coefficients and check them carefully for correct transcription from the Calibration Code Label prior to selecting Update Sensor Cap Coefficients. If you continue to get an error message after several entry attempts, contact YSI Technical Support for assistance.

After entering the new Sensor Cap coefficients, perform a 1-point DO calibration.

REHYDRATING THE SENSOR CAP

The Sensor Cap must remain in a moist environment; see Sensor Storage for storage recommendations. If you inadvertently leave your sensor exposed to ambient air for a period of more than approximately 8 hours it may dry out. If the sensor cap is allowed to dry out, it is likely to drift slightly at the beginning of your next study unless it is rehydrated. If the cap dries out, you can rehydrate it by soaking the probe tip with the sensor cap installed in warm tap water for 24 hours. After rehydration is complete, recalibrate and be sure to store the probe in a moist environment.

SENSOR MAINTENANCE - TEMPERATURE

You must keep the temperature portion of the sensor free of build up. Other than that, the sensor requires no maintenance. A soft bristle brush, like a tooth brush can be used to scrub the temperature sensor if needed.

SENSOR STORAGE

SHORT-TERM STORAGE

When the ODO Sensor is not in use, it MUST BE STORED IN A MOIST ENVIRONMENT, i.e., either in water or in water-saturated air. If the sensor cap is allowed to dry out by exposure to ambient air, it is likely to drift slightly at the beginning of your next study unless it is rehydrated.

For short-term storage (<30 days), moisten the sponge in the calibration/storage sleeve with a small amount of clean water and place this over the probe with the sensor cap installed. This will provide a 100% saturated air environment.

LONG-TERM STORAGE

For long-term storage (>30 days), remove the batteries from the instrument. Moisten the sponge in the red protective plastic cap that was provided with the probe and place it over the sensor with the sensor cap installed. Inspect the sponge every 30 days to make sure it is still moist. If you no longer have the red protective cap, then moisten the sponge in the calibration/transport sleeve and place this over the probe.

Alternatively, you can place the probe with sensor cap directly in a beaker or other container of water, making sure that the water does not evaporate over time.

Long-term Storage: -5 to 70°C (23 to 158°F)

TROUBLESHOOTING

DISSOLVED OXYGEN READINGS

Erroneous dissolved oxygen readings typically indicate a need to clean the sensor cap, replace the sensor cap, and/or recalibrate the instrument. First, verify the sensor is properly setup in the Probe menu. Next, clean the sensor cap following the instructions in the Maintenance and Storage section of this manual and then perform a calibration. If erroneous readings persist, follow the steps on the next page to inspect the sensor cap for damage and then attempt to recalibrate the instrument. If the problem continues, try to rehydrate the sensor cap then

recalibrate. If you are still getting erroneous dissolved oxygen readings, try replacing the sensor cap and then recalibrate. If the erroneous readings continue, contact YSI Technical Support to help determine the next step.

INSPECTING THE SENSOR CAP FOR DAMAGE

> ⚠ *Caution: Avoid touching the sensing end of the sensor cap during the following maintenance procedures.*

If readings seem to be in error or are jumpy, remove the sensor cap from the sensor by grasping the probe body with one hand and then rotating the sensor cap counterclockwise until it is completely free. Avoid using tools for the removal of the cap if at all possible.

Inspect the sensor cap assembly for any cracks or damage. If damage has occurred, contact YSI Customer Service to order a replacement sensor cap.

Inspect the o-ring on the probe and the gasket at the top of the threads for damage. If there is any indication of damage, carefully remove these parts and contact YSI Technical Support to obtain a new o-ring and/or gasket. Avoid using tools to remove the o-ring as damage to the sealing surfaces could result.

Before reinstalling the sensor cap, make sure that the cavity is completely dry before proceeding with the installation. If water is found, dry the cavity with lens cleaning tissue. Finally, clean the clear window on the end of the probe with lens cleaning tissue.

After reinstalling the sensor cap, perform a calibration and then reevaluate the quality of the dissolved oxygen readings. If problems persist, try rehydrating or replacing the sensor cap.

HELP

During use of the ProODO instrument press **Question** ? from any screen to view help messages directly on the display.

ERROR/STATUS MESSAGES

If readings for a certain parameter are over range you will see a series of +++++ and if the readings are under range you will see a series of ----- plus the error message along the bottom of the screen. If you see a series of ?????, that will indicate that a certain parameter cannot be calculated. This could be due to a

connection issue between the cable and instrument. The following are some of the potential messages:

Message	*Description and Recommended Action*
Probe Temp over range	Temperature is over 100° C or reading erroneously. Check cable connection and ensure Temp sensor is clean.
Probe Temp under range	Temperature is under -10° C or reading erroneously. Check cable connection and ensure Temp sensor is clean.
DO over range	DO% saturation is over 550%. Check sensor cap and recalibrate.
DO under range	DO% saturation is under -5%. Check sensor cap and recalibrate.
Barometer over range	Barometric pressure is reading over 988 mmHg. Calibrate barometer.
Barometer under range	Barometric pressure is reading under 375 mmHg. Calibrate barometer.
ODO Communications Error	No communication between the instrument and cable. Check cable connection.
Clock Battery Low	Internal battery for real time clock has low voltage. Contact Technical Support.
Measurements Locked!	Measurements are held in Manual Sampling mode. Select Update Measurements or Log Held Data.

Illegal Value may appear during alpha/numeric entry on the message line. This only appears if the values entered do not match the formatting. This will also appear in the GLP security area if the password is incorrect.

RESTORE DEFAULT CALIBRATION VALUES

Occasionally, the instrument may need to have the factory calibration default values restored. In order to accomplish this press Calibrate (Cal), highlight **Restore Default Cal** and press enter. Select the parameter you wish to restore, either DO or Barometer, and press enter. After selecting barometer or DO, you will be asked to confirm the operation. Highlight Yes and press enter.

ACCESSORIES / PART NUMBERS

Part Number	*Description*
626281	ProODO Instrument
626250-1, -4, -10, -20, -30, -40, -50, -60, or -100	1, 4, 10, 20, 30, 40, 50, 60, or 100-meter probe/cable assembly*
626320	Replacement Sensor Cap
605604	Communications saddle kit
605515	Data Manager desktop software
603075	Carrying case, soft-sided
603076 and 603078	Extended length flow cell and single port adapter. Both items are required for use with a ProODO

Part Number	*Description*
603074	Carrying case, hard-sided
603069	Belt clip
063517	Ultra clamp
063507	Tripod clamp

Part Number	*Description*
603062	Cable management kit
605978	Weight, sensor/cable, 4.9 oz.
063019	Weight, sensor/cable, 24 oz., 3”
063020	Weight, sensor/cable, 51 oz., 6”
603070	Shoulder strap

*All cables include a temperature and dissolved oxygen sensor. Special order cables in 10 meter increments from 60 to 100 meters are available.

DECLARATION OF CONFORMITY

The undersigned hereby declares on behalf of the named manufacturer under our sole responsibility that the listed product conforms to the requirements for the listed European Council Directive(s) and carries the CE mark accordingly.

Manufacturer:	YSI Incorporated 1725 Brannum Lane Yellow Springs, OH 45387 USA
Product Name:	Professional ODO Water Quality Instrument
Model Numbers	
Instrument/Accessory:	ProODO (626281) / ProComm (605604)
Probe/Cable Assemblies:	626250
Conforms to the following:	
Directives:	EMC 2004/108/EC RoHS 2002/95/EC WEEE 2002/96/EC
Harmonized Standards:	• EN61326-1:2006, Electrical equipment for measurement, control, and laboratory use – EMC requirements – Part 1: General Requirements • EN61326-2-3:2006, Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 2-3: Particular Requirements – Test configuration, operational conditions, and performance criteria for transducers with integrated or remote signal conditioning. • EN61000-3-2:2006, Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current < 16A per phase). • EN61000-3-3:1995 +A1:2001 +A2:2005, Electromagnetic compatibility (EMC) – Part 3: Limits – Section 3: Limitation of voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current < 16A.

Supplementary Information:	All performance met the continuous unmonitored operation criteria as follows: 1. ESD, EN61000-4-2, Performance Criterion B 2. Radiated Immunity, EN61000-4-3, Performance Criterion A 3. EFT, EN61000-4-4, (EFT) Performance Criterion B 4. Surge, EN61000-4-5, Performance Criterion B 5. Conducted Immunity, EN61000-4-6, Performance Criterion A 6. Voltage Interrupts, EN61000-4-11, Performance Criterion B 7. RF Emissions, EN55011:1998, A1:1999 Class B equipment
Authorized EU Representative	YSI Hydrodata Ltd Unit 8, Business Centre West, Avenue 1 Letchworth, Hertfordshire, SG6 2HB UK

Signed: Lisa M. Abel Date: 26 November 2008
Title: Director of Quality

The undersigned hereby declares on behalf of the named manufacturer under our sole responsibility that the listed product conforms to the requirements for electrical equipment under US FCC Part 15 and ICES-003 for unintentional radiators.

Manufacturer:	YSI Incorporated 1725 Brannum Lane Yellow Springs, OH 45387 USA	
Product Name:	Professional ODO Water Quality Instrument	
Model Numbers		
Instrument/Accessory:	ProODO (626281) / ProComm (605604)	
Probe/Cable Assemblies:	626250	
Conforms to the following:		
Standards:	• FCC 47 CFR Part 15-2008, Subpart B, Class B, Radio Frequency Devices • ICES-003:2004, Digital Apparatus	
Supplementary Information:	Tested using ANSI C63.4-2003 (excluding sections 4.1, 5.2, 5.7, 9, and 14)	

Signed: Lisa M. Abel Date: 26 November 2008
Title: Director of Quality

The undersigned hereby declares on behalf of the named manufacturer under our sole responsibility that the listed product conforms with the Australian and New Zealand Electromagnetic Compatibility (EMC) requirements for generic products to be used in residential, commercial, and light industrial environments.

Manufacturer:	YSI Incorporated 1725 Brannum Lane Yellow Springs, OH 45387 USA
Product Name:	Professional ODO Water Quality Instrument
Model Numbers	
Instrument/Accessory:	ProODO (626281) / ProComm (605604)
Probe/Cable Assemblies:	626250
Conforms to the following:	
Standards:	• AS/NZS 4251.1:1999, Electromagnetic Compatibility (EMC) – Generic emission standard – Part 1: Residential, commercial, and light industry.

Signed: Lisa M. Abel Date: 26 November 2008
Title: Director of Quality

RECYCLING

YSI is committed to reducing the environmental footprint in the course of doing business. Even though materials reduction is the ultimate goal, we know there must be a concerted effort to responsibly deal with materials after they've served a long, productive life-cycle. YSI's recycling program ensures that old equipment is processed in an environmentally friendly way, reducing the amount of materials going to landfills.

- Printed Circuit Boards are sent to facilities that process and reclaim as much material for recycling as possible.
- Plastics enter a material recycling process and are not incinerated or sent to landfills.
- Batteries are removed and sent to battery recyclers for dedicated metals.

When the time comes for you to recycle, follow the easy steps outlined at www.ysi.com.

CONTACT INFORMATION

ORDERING AND TECHNICAL SUPPORT

Telephone: 800 897 4151 (US)
+1 937 767 7241 (Globally)
Monday through Friday, 8:00 AM to 5:00 ET

Fax: +1 937 767 9353 (orders)
+1 937 767 1058 (technical support)

Email: environmental@ysi.com or proseries@ysi.com

Mail: YSI Incorporated
1725 Brannum Lane
Yellow Springs, OH 45387 USA

Internet: www.ysi.com

When placing an order please have the following available:
1.) YSI account number (if available)
2.) Name and phone number
3.) Purchase Order or Credit Card
4.) Model Number or brief description
5.) Billing and shipping addresses
6.) Quantity

SERVICE INFORMATION

YSI has authorized service centers throughout the United States and Internationally. For the nearest service center information, please visit www.ysi.com and click 'Support' or contact YSI Technical Support directly at 800-897-4151.

When returning a product for service, include the Product Return form with cleaning certification. The form must be completely filled out for a YSI Service Center to accept the instrument for service. The form may be downloaded from www.ysi.com by clicking on the 'Support" tab, then the Product Return Form button.

APPENDIX A-DO% CALIBRATION VALUES

Calibration Value	Pressure			
D.O. %	in Hg	mmHg	kPa	mbar
101%	30.22	767.6	102.34	1023.38
100%	29.92	760.0	101.33	1013.25
99%	29.62	752.4	100.31	1003.12
98%	29.32	744.8	99.30	992.99
97%	29.02	737.2	98.29	982.85
96%	28.72	729.6	97.27	972.72
95%	28.43	722.0	96.26	962.59
94%	28.13	714.4	95.25	952.46
93%	27.83	706.8	94.23	942.32
92%	27.53	699.2	93.22	932.19
91%	27.23	691.6	92.21	922.06
90%	26.93	684.0	91.19	911.93
89%	26.63	676.4	90.18	901.79
88%	26.33	668.8	89.17	891.66
87%	26.03	661.2	88.15	881.53
86%	25.73	653.6	87.14	871.40
85%	25.43	646.0	86.13	861.26
84%	25.13	638.4	85.11	851.13
83%	24.83	630.8	84.10	841.00
82%	24.54	623.2	83.09	830.87
81%	24.24	615.6	82.07	820.73
80%	23.94	608.0	81.06	810.60
79%	23.64	600.4	80.05	800.47
78%	23.34	592.8	79.03	790.34
77%	23.04	585.2	78.02	780.20
76%	22.74	577.6	77.01	770.07
75%	22.44	570.0	75.99	759.94
74%	22.14	562.4	74.98	749.81
73%	21.84	554.8	73.97	739.67
72%	21.54	547.2	72.95	729.54

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APPENDIX B-OXYGEN SOLUBILITY TABLE

Solubility of Oxygen in mg/L in Water Exposed to Water-Saturated Air at 760 mm Hg Pressure.
Salinity = Measure of quantity of dissolved salts in water.
Chlorinity = Measure of chloride content, by mass, of water.
S(0/00) = 1.80655 x Chlorinity (0/00)

Temp °C	Chlorinity : 0 Salinity: 0	5.0 ppt 9.0 ppt	10.0 ppt 18.1 ppt	15.0 ppt 27.1 ppt	20.0 ppt 36.1 ppt	25.0 ppt 45.2 ppt
0.0	14.62	13.73	12.89	12.10	11.36	10.66
1.0	14.22	13.36	12.55	11.78	11.07	10.39
2.0	13.83	13.00	12.22	11.48	10.79	10.14
3.0	13.46	12.66	11.91	11.20	10.53	9.90
4.0	13.11	12.34	11.61	10.92	10.27	9.66
5.0	12.77	12.02	11.32	10.66	10.03	9.44
6.0	12.45	11.73	11.05	10.40	9.80	9.23
7.0	12.14	11.44	10.78	10.16	9.58	9.02
8.0	11.84	11.17	10.53	9.93	9.36	8.83
9.0	11.56	10.91	10.29	9.71	9.16	8.64
10.0	11.29	10.66	10.06	9.49	8.96	8.45
11.0	11.03	10.42	9.84	9.29	8.77	8.28
12.0	10.78	10.18	9.62	9.09	8.59	8.11
13.0	10.54	9.96	9.42	8.90	8.41	7.95
14.0	10.31	9.75	9.22	8.72	8.24	7.79
15.0	10.08	9.54	9.03	8.54	8.08	7.64
16.0	9.87	9.34	8.84	8.37	7.92	7.50
17.0	9.67	9.15	8.67	8.21	7.77	7.36
18.0	9.47	8.97	8.50	8.05	7.62	7.22
19.0	9.28	8.79	8.33	7.90	7.48	7.09
20.0	9.09	8.62	8.17	7.75	7.35	6.96
21.0	8.92	8.46	8.02	7.61	7.21	6.84
22.0	8.74	8.30	7.87	7.47	7.09	6.72
23.0	8.58	8.14	7.73	7.34	6.96	6.61
24.0	8.42	7.99	7.59	7.21	6.84	6.50

Temp °C	Chlorinity : 0 Salinity: 0	5.0 ppt 9.0 ppt	10.0 ppt 18.1 ppt	15.0 ppt 27.1 ppt	20.0 ppt 36.1 ppt	25.0 ppt 45.2 ppt
25.0	8.26	7.85	7.46	7.08	6.72	6.39
26.0	8.11	7.71	7.33	6.96	6.62	6.28
27.0	7.97	7.58	7.20	6.85	6.51	6.18
28.0	7.83	7.44	7.08	6.73	6.40	6.09
29.0	7.69	7.32	6.93	6.62	6.30	5.99
30.0	7.56	7.19	6.85	6.51	6.20	5.90
31.0	7.43	7.07	6.73	6.41	6.10	5.81
32.0	7.31	6.96	6.62	6.31	6.01	5.72
33.0	7.18	6.84	6.52	6.21	5.91	5.63
34.0	7.07	6.73	6.42	6.11	5.82	5.55
35.0	6.95	6.62	6.31	6.02	5.73	5.46
36.0	6.84	6.52	6.22	5.93	5.65	5.38
37.0	6.73	6.42	6.12	5.84	5.56	5.31
38.0	6.62	6.32	6.03	5.75	5.48	5.23
39.0	6.52	6.22	5.98	5.66	5.40	5.15
40.0	6.41	6.12	5.84	5.58	5.32	5.08
41.0	6.31	6.03	5.75	5.49	5.24	5.01
42.0	6.21	5.93	5.67	5.41	5.17	4.93
43.0	6.12	5.84	5.58	5.33	5.09	4.86
44.0	6.02	5.75	5.50	5.25	5.02	4.79
45.0	5.93	5.67	5.41	5.17	4.94	4.72

Item # 626279
Rev C
Drawing # A626279
March 2009

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Notes

Write down the name and information of your OAKTON distributor here.

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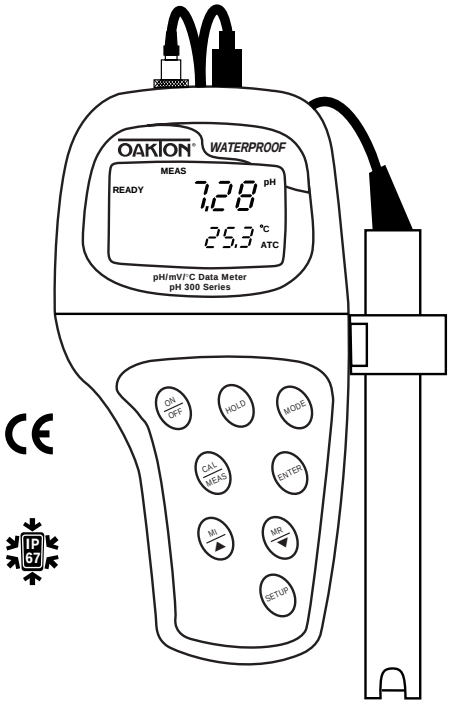
68X248903

OAKTON®

OPERATING INSTRUCTIONS

OAKTON® 35618-Series

pH 300 and 310 Portable Waterproof pH/mV/°C Meter



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OAKTON®

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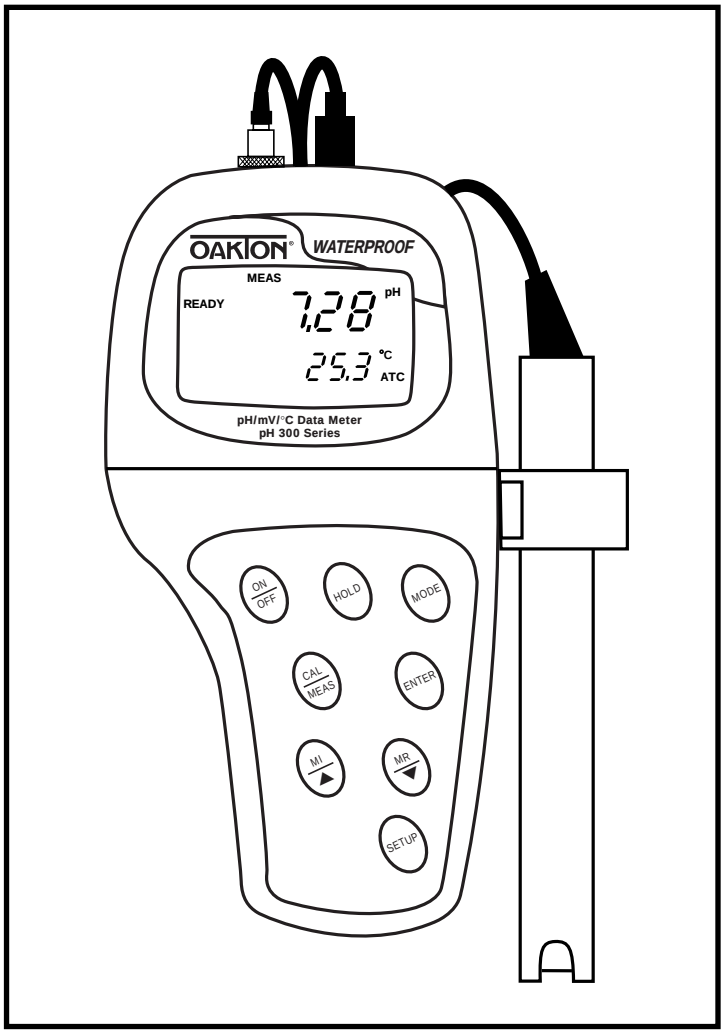
1. Introduction

Thank you for selecting an OAKTON meter. This OAKTON portable meter is a microprocessor-based instrument that measures pH, mV, and temperature. It's completely waterproof—and it floats! Your meter has many user-friendly features, all of which are accessible through the membrane keypad.

This meter includes two electrode holders and batteries.

Please read this manual thoroughly before operating your meter.



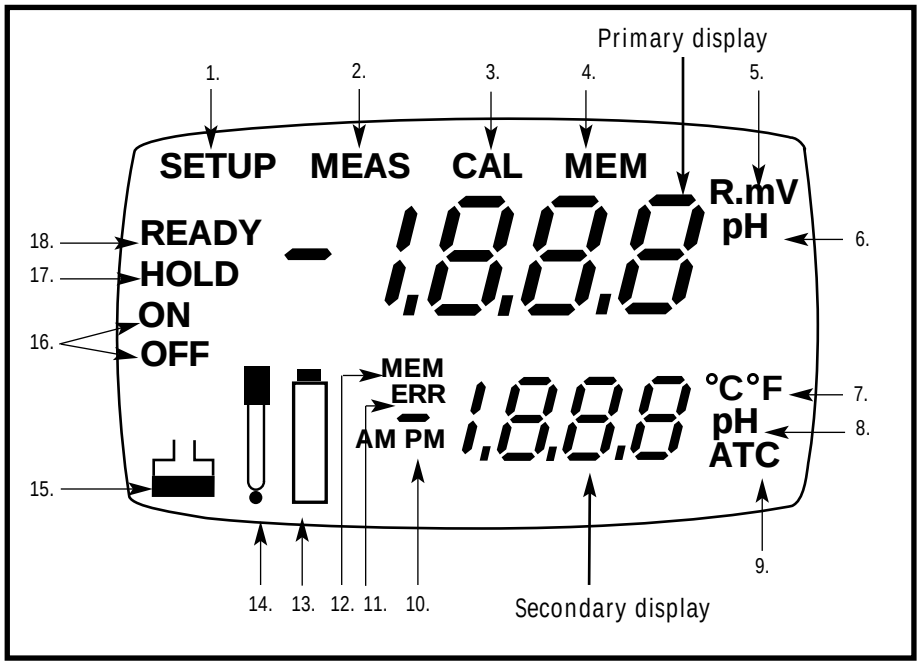
2. Display and Keypad Functions

2.1 Display

The LCD has a primary and secondary display.

- The primary display shows the measured pH, mV or Relative mV reading.
- The secondary display shows the temperature.

The display also shows error messages, keypad functions and program functions.



1. SETup mode indicator
2. MEASurement mode indicator
3. CALibration indicator
4. MEMory recall mode indicator
5. mV or relative mV indicator
6. pH indicator
7. Temperature indicator *(°F available on pH 310 meter only)*
8. pH buffer selection indicator
9. Automatic Temperature Compensation indicator
10. Clock indicator *(pH 310 meter only)*
11. ERRor indicator
12. MEMory location indicator
13. Low battery indicator
14. Probe indicator
15. Buffer indicator
16. Function ON / OFF indicator
17. HOLD indicator
18. READY indicator

2.2 Keypad

The large membrane keypad makes the instrument easy to use. Each button, when pressed, has a corresponding graphic indicator on the LCD.

ON/OFF.....Powers and shuts off the meter.

HOLD .....Freezes the measured reading. To activate, press **HOLD** while in measurement mode. To release, press **HOLD** again.
pH 310 model only: When auto endpoint feature is switched on, it automatically holds reading after 5 seconds of stability. The HOLD indicator appears on the display. Press HOLD to release auto end-point feature.

MODE.....Selects the measurement parameter. Press MODE to toggle between pH; mV (or relative mV); and date / time *(date/time available on pH 310 model only)*. In pH calibration mode, press MODE to access temperature calibration.

CAL/MEAS.....Toggles user between Calibration and Measurement mode.
- If you were in pH measurement mode, press **CAL/MEAS** to enter pH calibration mode.
- If you were in mV measurement mode, press **CAL/MEAS** to enter mV calibration mode.

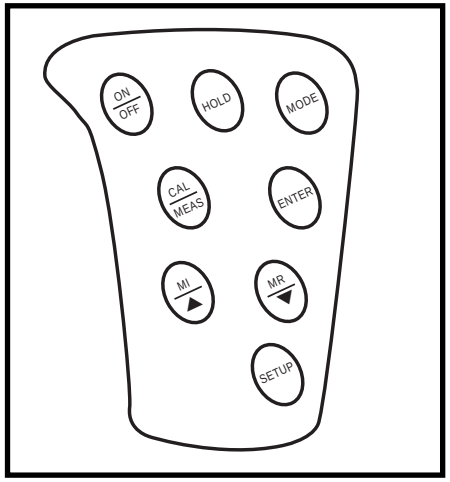
NOTE: Temperature calibration is available from pH calibration mode; see page 17 for directions.
In advanced set-up mode: Press **CAL/MEAS** to return to main menu from sub menus. Press **CAL/MEAS** again to return to measurement mode from main menu.

ENTER .....Press to confirm values in Calibration mode and to confirm selections in Setup mode.

MI ▲ / **MR** ▼ .....Press ▲/▼ in setup mode to scroll through subgroups. Also press ▲/▼ in mV calibration mode to adjust the calibration value.

MI/MR work in the measurement mode. **MI** (memory input) stores the measured value into memory. **MR** (memory recall) recalls the sets of values stored in the memory.

SET.....Press to enter SETUP mode. SETUP mode lets you customize meter preferences and defaults, and view calibration and electrode offset data.

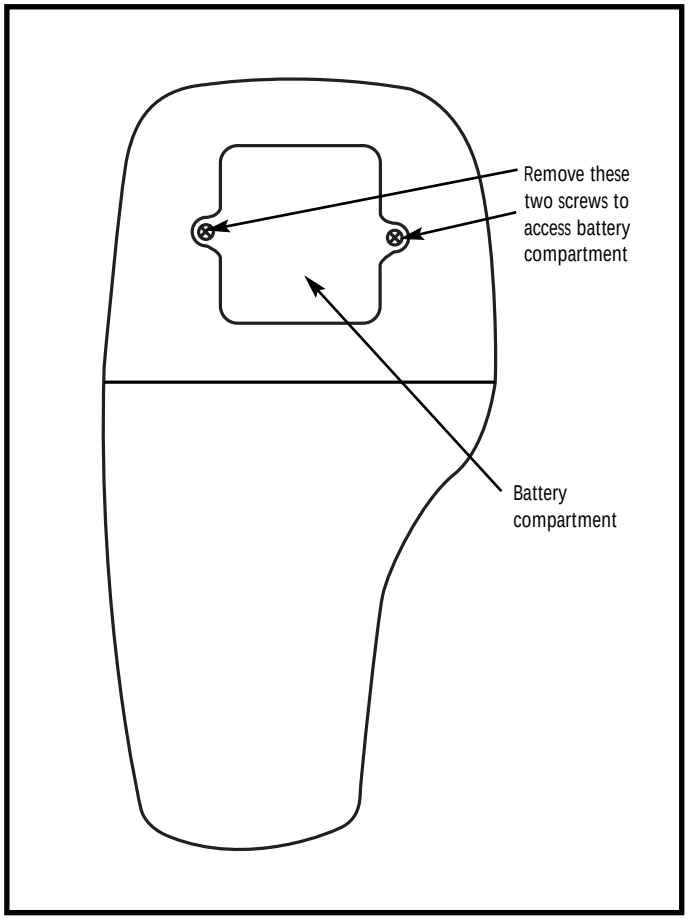


3. Preparation

3.1 Inserting the Batteries

Four AAA batteries are included with your meter.

1. Use a Phillips screwdriver to remove the two screws holding the battery cover. See figure below.
2. Lift off battery cover to expose batteries.
3. Insert batteries. Follow the diagram inside the cover for correct polarity.
4. Replace the battery cover into its original position. Screw cover back into place.



3.2 Connecting the Electrode and Temperature Probe

The OAKTON pH/mV meter can use any standard pH, ORP, or ISE electrode with a BNC connector. For automatic temperature compensation (ATC), this meter requires a temperature probe with a specialty 6-pin connector.

Use either:

- any electrode with a BNC connector and a separate temperature probe with 6-pin connector (part number 35618-05)
- an "All-in-One" combination pH electrode/temperature probe designed specifically for the pH 300 and pH 310 waterproof meters

NOTE: Keep connectors clean. Do not touch connector with soiled hands.

See the "Accessories" section on page 45 for a temperature probe and "All in One" electrodes for use with the pH 300 and pH 310 meters.

To connect the pH, ORP or ISE electrode:

1. Slide the BNC connector of the probe over the BNC connector socket on the meter. Make sure the slots of the connector are in line with the posts of the socket. Rotate and push the connector clockwise until it locks.

See figure below.

2. To remove probe, push and rotate the connector counterclockwise. While holding onto the metal part of the connector, pull probe away from the meter.

CAUTION: Do not pull on the probe cord or the probe wires might disconnect.

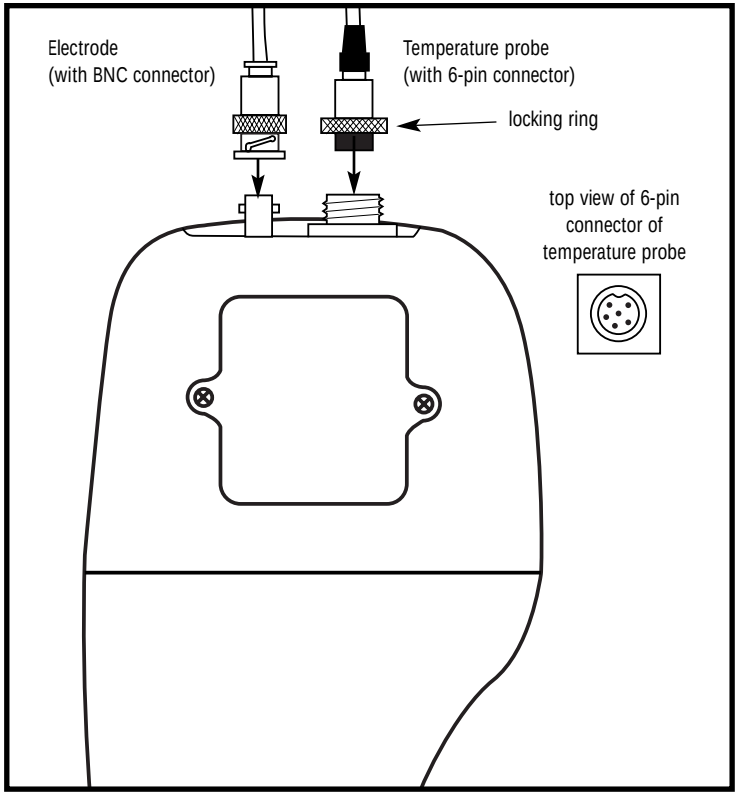
To connect the temperature probe:

1. Line up the notch and 6 pins on the meter with the holes in the 6-pin connector. Push down and turn the locking ring clockwise to lock into place.

See figure below.

2. To remove probe, turn the locking ring counterclockwise on the probe connector. Pull probe away from the meter.

CAUTION: Do not pull on the probe cord or the probe wires might disconnect.



3.3 Attaching the Electrode Holder to the Meter

Attaching the electrode holder to the meter facilitates one-hand operation. Attach two electrode holders if you have a separate electrode and temperature probe.

1. Locate the slot on the left hand side of the meter.
2. Gently slide the flange of the holder into the slot on the meter. Make sure the holder is secured properly into the slot.

See figure A

You can attach the electrode holder in different positions.

See figure B

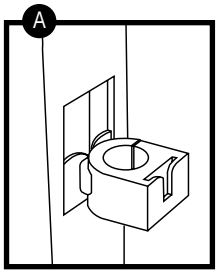
To attach a second electrode holder:

3. Align the flange of the second electrode holder with the slot of the first holder.

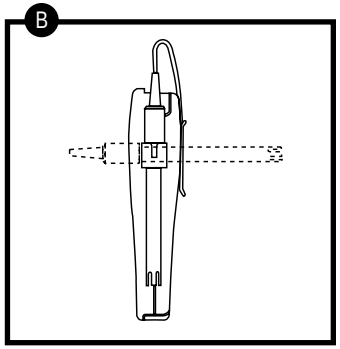
See figure C

4. Slide the flange of the second holder into the slot of the first holder until the tops of the holders are aligned and secure.

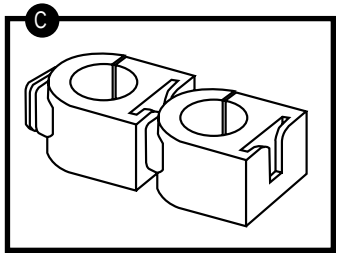
A



B



C



3.4 Inserting the Electrode into the Electrode Holder

Do not use excessive force when inserting electrodes into the holders.

1. Insert the pH electrode into the opening of the first holder until the top housing of the electrode touches the top of the holder.
2. If you are using a separate temperature probe, insert the probe into the opening of the second holder until the ridge on the housing touches the top of the holder.

NOTE: The holder is designed for probes 12 mm in diameter. Electrodes larger than 12 mm may not fit in the holder. Forcing the electrode into the opening may damage the holder or your electrode.

4. Calibration

4.1 Important Information on Meter Calibration

When you recalibrate your meter, old pH, Rel mV and mV calibration points are replaced on a point by point basis. For example, if you previously calibrated your meter at pH 4.01, 7.00, and 10.01, and you recalibrate at pH 7.00, the meter retains the old calibration data at pH 4.01 and pH 10.01. To view current calibration points, see Program P2.0 in the SETUP section, page 29.

To completely recalibrate your meter, or when you use a replacement probe, it is best to set the meter to its factory defaults and recalibrate the meter at all points. To reset the meter to its factory defaults, see the SETUP section Program P5.0, page 36 (for pH 300 meter) or Program P6.0, page 39 (for pH 310 meter).

For information on how to calibrate your meter:

- See section 4.3 on pages 14-15 for pH calibration
- See section 4.4 on page 16 for Relative mV calibration
- See section 4.5 on pages 17 for Temperature Calibration of replacement temperature probes or replacement “All-in-One” electrodes

4.2 Preparing the Meter for Calibration

Before starting calibration, make sure you are in the correct measurement mode. When you switch on the meter, the meter starts up in the units last used. For example, if you shut the meter off in "mV" units, the meter will read "mV" units when you switch the meter on.

Be sure to remove the protective electrode storage bottle or rubber cap of the probe before calibration or measurement. If the electrode has been stored dry, wet the probe in tap water for 10 minutes before calibrating or taking readings to saturate the pH electrode surface and minimize drift.

Wash your probe in deionized water after use, and store in electrode storage solution. If storage solution is not available, use pH 4.0 or 7.0 buffer.

Do not reuse buffer solutions after calibration. Contaminants in the solution can affect the calibration, and eventually the accuracy of the measurements. See page 41 for information on our high-quality OAKTON pH buffers.

pH 300 meter calibration

The pH 300 meter is capable of up to 5-point pH calibration to ensure accuracy across the entire pH range of the meter. Select from the following buffer options:

pH 1.68, 4.01, 7.00, 10.01, and 12.45.

The meter automatically recognizes and calibrates to these standard buffer values, which makes pH calibration faster and easier.

pH 310 meter calibration

The pH 310 meter features three separate buffer sets. Select the buffer set you require in Set Up mode Program 4.0 (see page 34 for more information). The pH 310 meter is capable of up to 6-point pH calibration, depending on the buffer set. Select from the following buffer options:

USA buffers (pH 1.68, 4.01, 7.00, 10.01, 12.45)
NIST buffers (pH 1.68, 4.01, 6.86, 9.18, 12.45)
DIN buffers (pH 1.09, 3.06, 4.65, 6.79, 9.23, 12.75)

The meter automatically recognizes and calibrates to these standard buffer values, which makes pH calibration faster and easier.

4.3 pH calibration

NOTE: We recommend that you perform at least a 2-point calibration using standard buffers that bracket (one above and one below) the expected sample range. You can perform a 1-point calibration, but make sure that the buffer value is close to the sample value you are measuring.

1. **If necessary, press the MODE key to select pH mode**. The pH indicator appears in the upper right hand corner of the display.

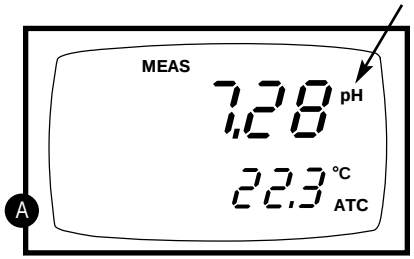
See figure A

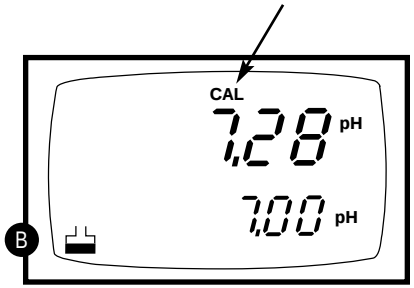
2. **Rinse the probe thoroughly with de-ionized water or a rinse solution.** Do not wipe the probe; this causes a build-up of electrostatic charge on the glass surface.
3. **Dip the probe into the calibration buffer.** The end of the probe must be completely immersed into the sample. Stir the probe gently to create a homogeneous sample.
4. **Press CAL/MEAS** to enter pH calibration mode. The CAL indicator lights. The primary display will show the measured reading while the smaller secondary display will indicate the pH standard buffer solution.

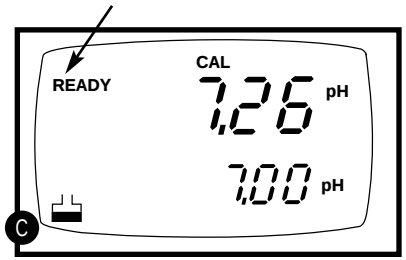
See figure B

5. **Wait for the measured pH value to stabilize.**

See figure C







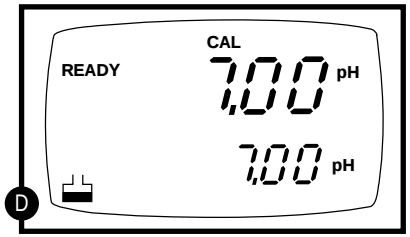
If the READY indicator has been activiated (set up program P4.1—see page 32), the READY annunciator lights when the reading is stable.

6. **Press ENTER to confirm calibration**. The meter is now calibrated to the current buffer.

See figure D

- If you are performing multipoint calibration, go to step 7.
- If you are performing one-point calibration, go to step 9.

7. **Rinse the probe with de-ionized water or a rinse solution, and place it in the next pH buffer.**
8. Follow steps 5 to 8 for additional calibration points.
9. When calibration is complete, **press CAL/MEAS to return to pH measurement mode**.



Notes

To exit from pH Calibration mode without confirming calibration, DO NOT press **ENTER** in step 6. Press **CAL/MEAS** instead.

If the selected buffer value is not within ±1.0 pH from the measured pH value: the electrode and buffer icon blink and the ERR annunciator appears in the lower left corner of the display.

To limit the number of pH buffer values available during calibration, see section P4.2 on page 33.

4.4 Relative mV Calibration

1. **While in the measurement function, press MODE** to enter the mV mode. The mV indicator appears in the upper right hand corner.

See figure A

2. **Press the CAL/MEAS key.** The **CAL** indicator appears above the primary display. The primary display shows the relative mV reading and the secondary display shows the absolute mV value.

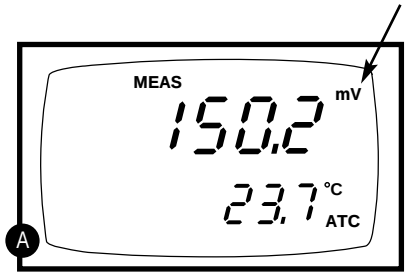
   NOTE: If you have never calibrated relative mV or if the meter has been reset, the value shown in the primary display is the same as the absolute mV value.

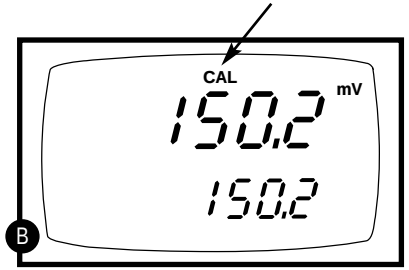
See figure B

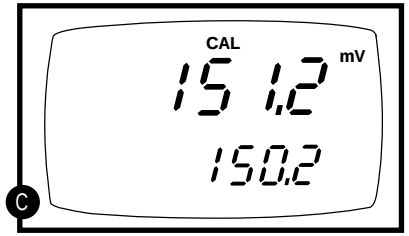
3. **Press the ▲ or ▼ keys** to enter the relative mV value that matches your desired reading.

See figure C

4. **Press the ENTER key** to confirm the reading and to return to the measurement mode. The primary display now shows the relative mV reading. The RmV indicator appears in the upper right hand corner.







Notes

To view the mV offset value, use the **SETUP** mode Program P3.1. See page 30 for instructions.

The relative mV (RmV) indicator appears whenever the mV offset is not zero.

To reset the all calibration and offset values in memory to the factory default settings, use:

- *pH 300 meter:* SETUP Program P 5.0. See page 36.
- *pH 310 meter:* SETUP Program P6.0. See page 39.

4.5 Temperature Calibration

The temperature sensor is factory calibrated. Calibrate your sensor only if you suspect temperature errors that may have occurred over a long period of time or if you have a replacement probe.

Temperature calibration

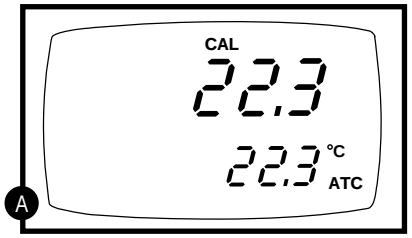
1. Make sure the ATC probe (or temperature connector of the "All-in-One" electrode) is attached to the 6-pin connector. The ATC annunciator will appear at the right-hand side of the LCD.
2. Switch the meter on. **Press the MODE key** to select pH mode.
3. **Press the CAL/MEAS key** to enter pH calibration mode. The CAL indicator will appear above the primary display.
4. While in pH calibration mode, **press the MODE key** to enter temperature calibration mode. The primary display shows the temperature value with the last set offset and the secondary display shows the factory default temperature value.

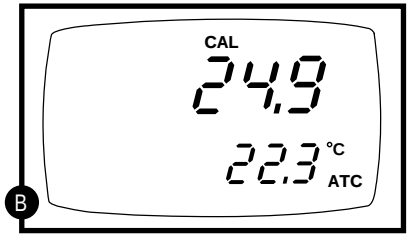
See figure A

5. **Dip the ATC probe** (or "All-in-One" electrode) **into a solution of known temperature** (i.e. a temperature bath). Allow time for the temperature probe to stabilize.
6. **Scroll with the ▼ and ▲ keys** to set the correct temperature value (i.e. the temperature of the temperature bath). You can adjust the reading in increments of 0.1°C.

See figure B

7. Once you have selected the correct temperature, **press the ENTER key.** The meter automatically returns to pH measurement mode.





Notes

- You can offset the temperature reading up to ±5°C from the original reading.
- To exit this program without confirming the temperature calibration value, DO NOT press **ENTER** in step 7. Press **CAL/MEAS** instead.

5. Measurement

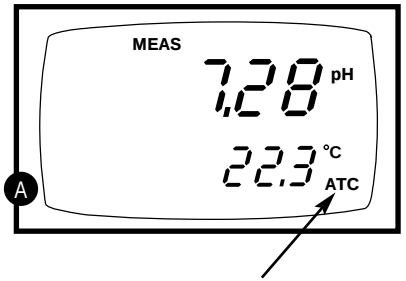
This meter is capable of taking measurements with automatic or manual temperature compensation. Automatic temperature compensation only occurs when a temperature sensor is plugged into the meter. If there is no temperature sensor plugged into the meter, the default manual temperature setting is automatically 25°C. You can manually set the temperature to match your working conditions using a separate thermometer.

5.1 Automatic Temperature Compensation

For automatic temperature compensation (ATC) simply plug the temperature probe into the meter (see page 9 for directions). The ATC indicator will light on the LCD.

See figure A

NOTE: If you are using a temperature probe, the probe must be submersed in the liquid you are measuring.



5.2 Manual Temperature Compensation

IMPORTANT: For manual compensation, you must disconnect the temperature probe (see page 9).

1. Switch the meter on. **Press the MODE key** to select pH mode.
2. **Press the CAL/MEAS key** to enter pH calibration mode. The CAL indicator will appear above the primary display.
3. While in pH calibration mode, **press the MODE key** to enter temperature calibration mode. The primary display and secondary display show the last set value.

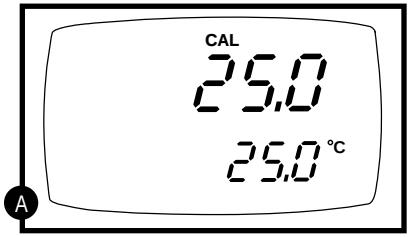
See figure A

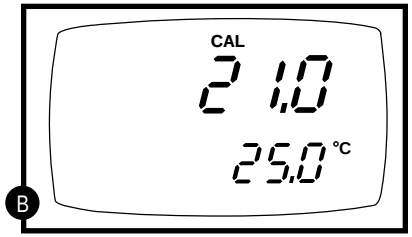
4. **Check the temperature of your sample** using an accurate thermometer.
5. **Press the ▲ or ▼ keys** to offset the temperature to the measured value from step 4.

See figure B

6. **Press ENTER** to confirm the selected temperature and to return to the pH measurement mode.

The meter will now compensate pH readings for the manually set temperature.





Notes

To exit this program without confirming the manual temperature compensation value, DO NOT press **ENTER** in step 6. Press **CAL/MEAS** instead.

5.3 Taking Measurements

Be sure to remove the electrode soaker bottle or protective rubber cap on the electrode before measurement.

To take readings:

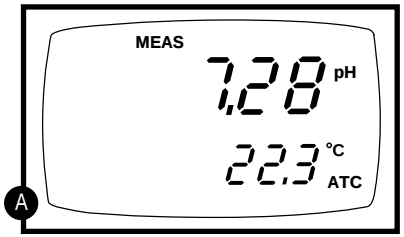
1. **Rinse the probe with deionized or distilled water before use** to remove any impurities adhering to the probe body. If the pH electrode has dehydrated, soak it for 30 minutes in OAKTON electrode storage solution or a 2M–4M KCl solution.
2. **Press ON to switch on meter.** The **MEAS** annunciator appears on the top center of the LCD. The ATC indicator appears in the lower right hand corner to indicate Automatic Temperature Compensation (See page 19 to set Manual Temperature Compensation).

See figure A

3. **Dip the probe into the sample.**

When dipping the probe into the sample, the sensor or the glass bulb of the electrode must be completely immersed into the sample. Stir the probe gently in the sample to create a homogenous sample.

4. **Allow time for the reading to stabilize.** Note the reading on the display.
5. To toggle between pH and mV (or Rel mV) readings, **press the MODE key.**



Taking measurements with READY indicator selected on

If the READY indicator has been activated, the **READY** annunciator lights when the reading is stable*. Switch the READY indicator on or off in Set up program P4.1—see page 32 for directions.

*The READY indicator appears and the reading holds until the measured value exceeds the tolerance (± 0.02 pH; ± 0.8 mV <400; ±1.2 mV >400). Then, the **READY** annunciator turns off.

Taking measurements with the auto endpoint feature selected on

NOTE: this feature is available on model pH 310 only.

When a reading is stable for more than 5 seconds, the auto endpoint feature will automatically “hold” the reading. The “hold” indicator appears on the left side of the display. Press the HOLD key to release the reading. Switch the Auto endpoint feature on or off in Set up program P4.1—see page 32 for directions.

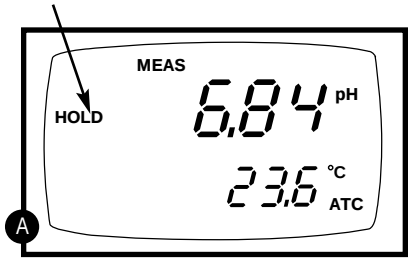
6. HOLD function

This feature lets you freeze the value of the pH, mV (or Relative mV) and temperature readings for a delayed observation. **HOLD** can be used any time when in **MEAS** mode.

1. To hold a measurement, press the **HOLD** key while in measurement mode. "**HOLD**" will appear on the display.

See figure A

2. To release the held value, press **HOLD** again. Continue to take measurements.



NOTE: This meter shuts off automatically after 30 minutes of nonuse. If the meter is shut off either automatically or manually, the HOLD value will be lost. For longer storage, use the memory functions (see pages 23-24).

NOTE: *For pH 310 model only:* The pH 310 meter has an auto endpoint feature. When this feature is switched on, the display will automatically "hold" a reading that has been stable for more than 5 seconds. The "hold" indicator appears. Press the HOLD key to release the reading. To switch on or off the auto endpoint feature, see Set up program P4.1 on page 32.

7. Memory functions

7.1 Memory Input

Your meter stores data in sets:

- pH and temperature
- mV (or relative mV) and temperature.

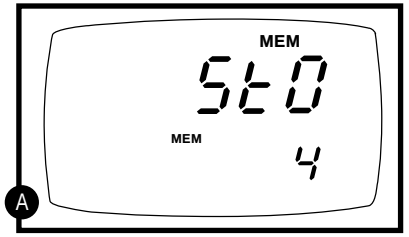
pH 300 meter: The pH 300 meter can store up to 16 sets of data in any combination of values. For example, you can store 7 pH and 9 mV values.

pH 310 meter: The pH 310 meter can store up to 50 sets of data in any combination of values. In addition to the standard data set, the pH 310 meter also stores the date and time the reading was stored.

To store a reading:

1. **During any measurement function (MEAS),** press the **MI** key to input any data into the memory
2. **MEM, "Sto" and memory number will flash.** The meter then returns to measurement mode.

See figure A



NOTE: If the memory is full, the first value stored will be erased to create space for the new value.

7.2 Memory Recall

This function recalls the previous readings stored in the memory. You can only access **MR** from the **MEAS**urement mode. Memory recall is in "Last In First Out" order.

To recall readings:

1. **Press the MR key once** to retrieve the last reading stored. The memory location screen—**MEM, "Loc" and the memory number**—will flash on the display.

See figure B

2. **Press the ENTER key** to recall the reading stored under that memory number.

See figure C

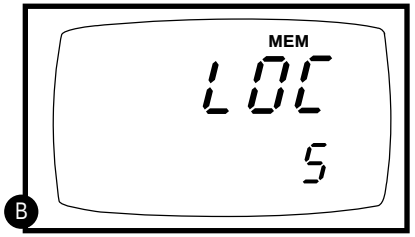
3. *pH 300 meter only:* **Press the ENTER key** again to return to the "memory location" screen.
   pH 310 meter only: **Press the ENTER key** again to view the date and time the reading was taken. **Press the ENTER key** again to return to the "memory location" screen.

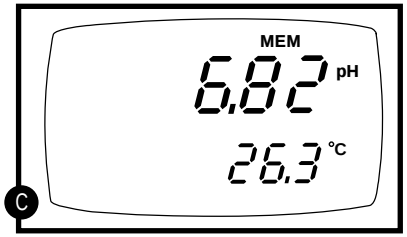
See figure D

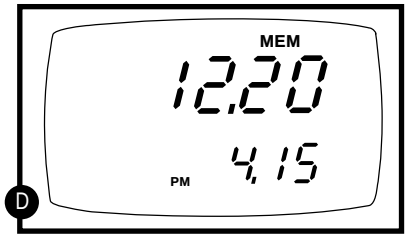
4. The display automatically moves to the next memory location screen.

See figure E

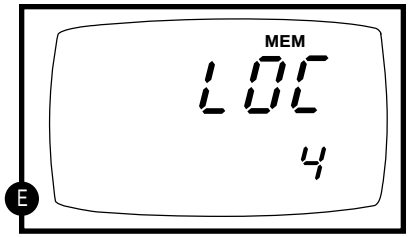
5. **If necessary, press the ▲ key** to select the next "memory location" screen; **press the ▼ key** to select the previous "memory location" screen.
6. Repeat steps 2-5 to review additional stored data sets.
7. To exit Memory Recall, **press the MEAS key** to return to the Measurement mode.







Time/date appears on pH 310 meter display only



Notes

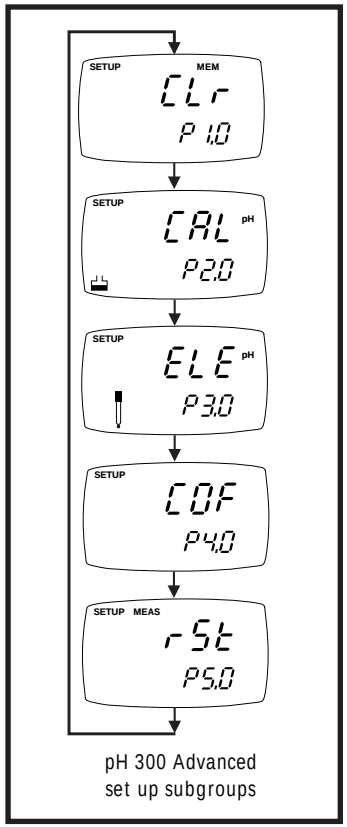
Readings stored in memory are retained even if the unit is turned off. To erase all readings stored in memory, use the **SETUP** mode P1.0 on page 28.

8. Advanced set up functions

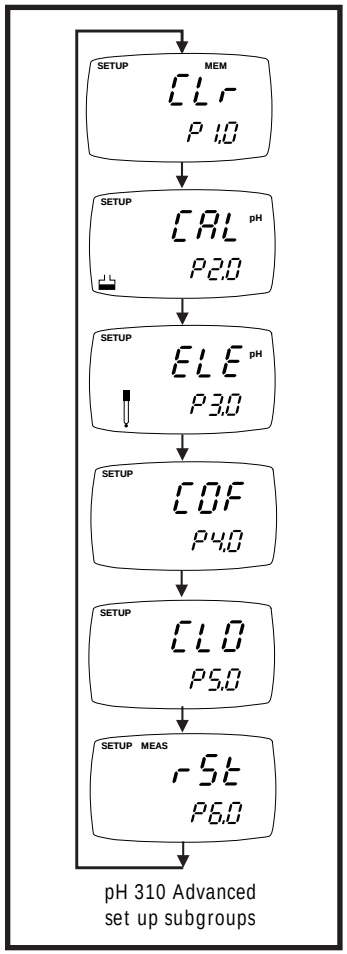
The advanced set up mode lets you customize your meter's preferences and defaults. Your OAKTON waterproof meter features different sub groups that organize all set-up parameters.

The sub groups are:

1. P1.0: Memory clear (CLR)
2. P2.0: Viewing calibration data (CAL)
3. P3.0: Viewing electrode data (ELE)
4. P4.0: Unit configuration (COF)
5. *pH 300 only:* P5.0: Reset to factory default settings (rSt)
   pH 310 only: P5.0: Setting clock (CLO)
6. *pH 310 only:* P6.0: Reset to factory default settings (rSt)



pH 300 Advanced set up subgroups

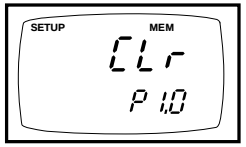


pH 310 Advanced set up subgroups

8.1 Advanced set-up mode overview

Press the SETUP key to enter Set up mode.
Press the ▲ and ▼ keys to scroll through sub groups.

pH 300 meter set up mode



Instructions on page 28

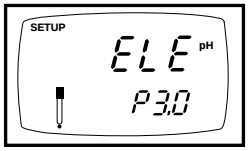
P1.0: Memory clear

- P1.0 Clear all stored readings

Instructions on page 29

P2.0: Viewing previous calibration data

- P2.1: First calibration point
- P2.2: Second calibration point
- P2.3: Third calibration point
- P2.4: Fourth calibration point
- P2.5: Fifth calibration point

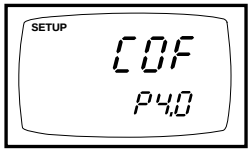


Instructions on page 30-31

P3.0: Viewing electrode data

In pH measurement mode:
- P3.1: pH electrode offset
- P3.2: pH electrode slope

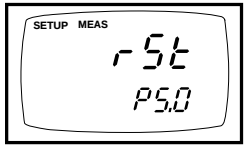
In mV (or relative mV) measurement mode:
- P3.1: relative mV offset



Instructions on pages 32-33

P4.0: Unit configuration

- P4.1: Ready indicator on or off
- P4.2: # of calibration points: 2, 3, 4, 5, or 5



Instructions on page 36

P5.0: Reset to factory default

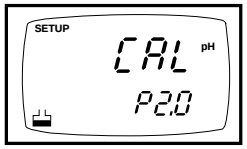
- P5.0: Reset to factory default settings

pH 310 meter set up mode

Instructions on page 28

P1.0: Memory clear

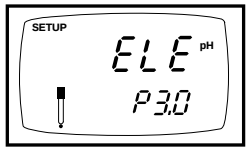
- P1.0 Clear all stored readings



Instructions on page 29

P2.0: Viewing previous calibration data

- P2.1: First calibration point (plus time / date)
- P2.2: Second calibration point (plus time / date)
- P2.3: Third calibration point (plus time / date)
- P2.4: Fourth calibration point (plus time / date)
- P2.5: Fifth calibration point (plus time / date)
- P2.6: Sixth calibration point (plus time / date)-only available when DIN buffer set is selected in P4.3

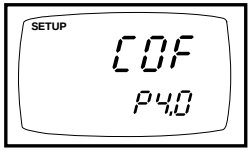


Instructions on page 30-31

P3.0: Viewing electrode data

In pH measurement mode:
- P3.1: pH electrode offset
- P3.2: pH electrode slope

In mV (or relative mV) measurement mode:
- P3.1: relative mV offset



Instructions on pages 32-35

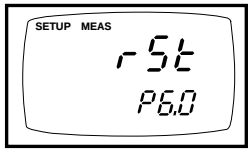
P4.0: Unit configuration

- P4.1: Ready indicator on or off
- P4.2: # of calibration points: 2, 3, 4, 5, or 6 (6th point available for DIN buffer set only)
- P4.3: Select calibration buffer set: USA, DIN, or NIST
- P4.4: Select °C or °F

Instructions on pages 37-38

P5.0: Setting Clock

- Setting year
- Setting date (month / day)
- Setting time (hour / minute / second)



Instructions on page 39

P6.0: Reset to factory default

- P6.0: Reset to factory default settings

8.2 P1.0: Memory Clear

Use this parameter to clear all memory values when you need to store a new series of values. This lets you avoid confusing the old values with the new ones. NO is the default setting.

NOTE: Selecting YES will wipe out all memory.

From measurement mode:

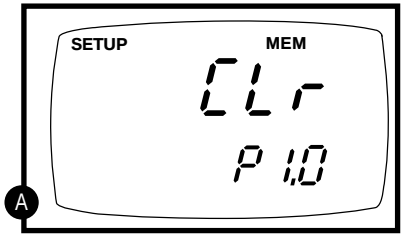
1. **Press the Set up key** to enter Set Up mode.
2. **Press the ▲ and ▼ keys** to scroll through subgroups until you view parameter P1.0.

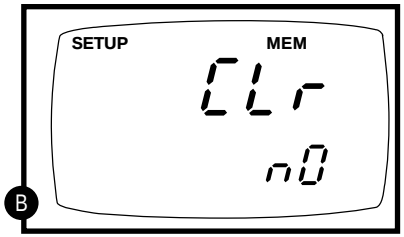
See figure A

3. **Press the ENTER key** to enter parameter P1.0.
4. **Press the ▲ and ▼ keys** to toggle between NO and YES.
   - NO retains current memory
   - YES clears all memory

See figure B

5. **Press the ENTER key** to confirm selection and return to the subgroup menu. Press the CAL/MEAS key to return to measurement mode.





8.3 P2.0: Viewing previous calibration data

This mode lets you recall previous calibration data, which helps you know when to recalibrate your meter. This is a "view only" mode.

From measurement mode:

1. **Press the Set up key** to enter Set Up mode.

See figure A

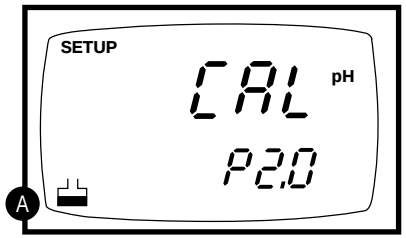
2. **Press the ▲ and ▼ keys** to scroll through subgroups until you view parameter P2.0.
3. *pH 300 meter only:* **Press the ENTER key repeatedly** to view previous calibration data.

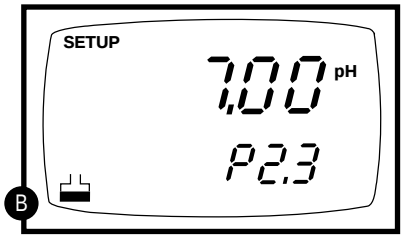
See figure B

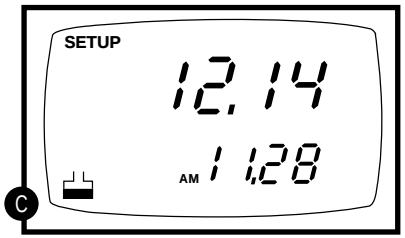
pH 310 meter only: **Press the ENTER key repeatedly** to view previous calibration data. The meter will first display the calibration point, and then display the date and time of calibration.

See figures B *and* C

4. When you have scrolled through all calibration data, you will automatically return to the subgroup menu. Press the CAL/MEAS key to return to measurement mode.







Time/date appears on pH 310 meter display only

Notes

If there is no previous calibration data at a particular point, the primary display will show "----".

8.4 P3.0: Viewing electrode data

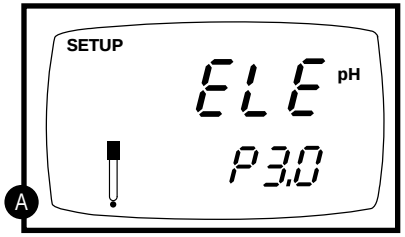
Program 3 has two “view only”options that lets you check the electrode parameters for diagnostic purposes.

P3.1: Electrode offset

From measurement mode

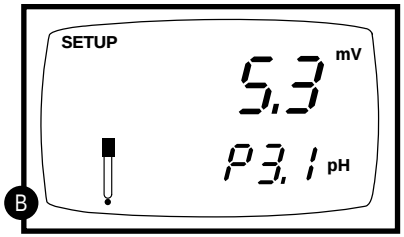
1. **Press the Setup key** to enter Set Up mode.
2. **Press the ▲ and ▼ keys** to scroll through subgroups until you view parameter P3.0.

See figure A



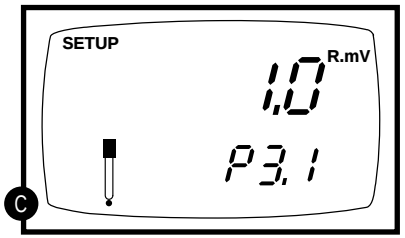
3. **Press the ENTER key** to select parameter 3.1.
4. **The display shows the electrode offset value.**
   - *If you are in pH measurement mode,* the display shows the mV offset at pH 7.00. If you have not calibrated at any buffer, the primary display shows 0.0 mV.

See figure B



   - *If you are in mV measurement mode,* the display shows the relative mV offset. You can adjust the relative mV offset in relative mV calibration mode—see page 16 for instructions.

See figure C



5. **Press the ENTER key** to to proceed to step 4 of P3.2. Or, press the CAL/MEAS key to return to measurement mode.

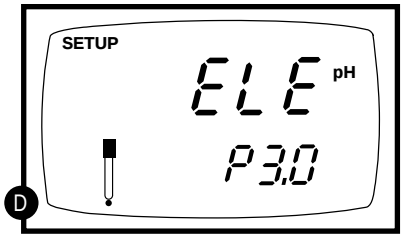
P3.2: Electrode slope

NOTE: this parameter is available in pH measurement mode only.

From measurement mode

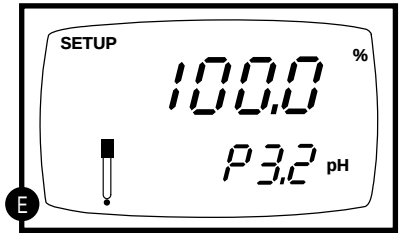
1. If necessary, **press the MODE key** to select pH measurement mode. **Press the Setup key** to enter Set Up mode.
2. **Press the ▲ and ▼ keys** to scroll through subgroups until you view parameter P3.0.

See figure D



3. **Press the ENTER key** twice to select parameter 3.2.
4. The display shows electrode slope in percentage. Slope displayed is the average slope based on the pH calibrations. Default setting is 100.0.

See figure E



5. **Press the ENTER key** to return to the subgroup menu. Press the CAL/MEAS key to return to measurement mode.

8.5 P4.0: Unit configuration

P4.1: READY indicator and auto endpoint function

Program P4.1 lets you select “READY indicator on” to indicate when the reading is stable*, or select “READY indicator off” for faster meter response.

pH 310 meter only: Program P4.1 also lets you switch the Auto endpoint function on or off. Select auto endpoint on to “hold” the reading when it is stable for more than 5 seconds. The display automatically freezes, and the HOLD indicator appears on the left side of the display. Press the HOLD key to release the display and access other functions. Select auto endpoint off to deactivate this feature.

From measurement mode

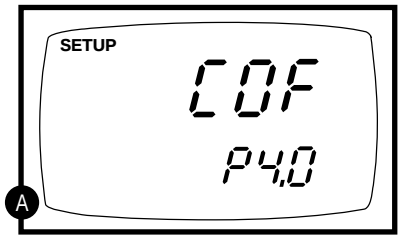
1. **Press Setup key** to enter Set Up mode.
2. **Press the ▲ and ▼ keys** to scroll through subgroups until you view parameter P4.0.

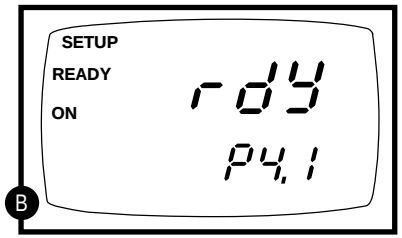
See figure A

3. **Press the ENTER key** to select parameter 4.1.

See figure B

4. **Press the ▲ and ▼ keys** to select the configuration you require.
   - OFF switches the READY indicator off.
   - ON switches the READY indicator on.
   - *pH 310 meter only:* ON and HOLD together switches the auto endpoint feature on.
5. **Press the ENTER key** to confirm selection and to proceed to step 4 of P.4.2. Press the CAL/MEAS key to return to measurement mode.





Notes

Meter default is set for Ready indicator on, and auto endpoint function off.

*The READY indicator appears and the reading holds until the measured value exceeds the tolerance (± 0.02 pH; ± 0.8 mV <400; ±1.2 mV >400). Then, the **READY** annunciator turns off.

P4.2: Selecting number of pH calibration points

Program P4.2 lets you select the number of calibration points that appear in pH calibration mode: 2, 3, 4, or 5. This lets the meter scroll through the calibration points more quickly if you regularly calibrate at less than 5 points.

From measurement mode

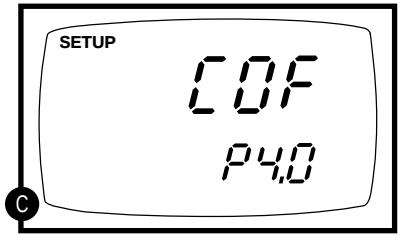
1. **Press Setup key** to enter Set Up mode.
2. **Press the ▲ and ▼ keys** to scroll through subgroups until you view parameter P4.0.

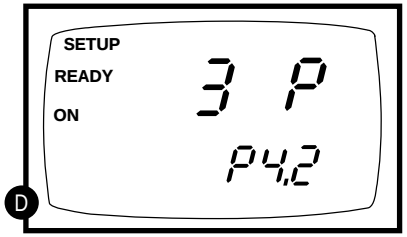
See figure C

3. **Press the ENTER key** twice to select parameter 4.2.

See figure D

4. **Press the ▲ and ▼ keys** to select 2, 3, 4, or 5 point pH calibration.
5. **Press the ENTER key** to confirm selection and to return to the subgroup menu. Press the CAL/MEAS key to return to measurement mode.





P4.3 Calibration buffer selection sets

Available in pH 310 meter only

The pH 310 meter lets you select between three standard calibration buffer sets, depending on your requirements. The available sets are USA, NIST, and DIN standard calibration buffers.

From measurement mode

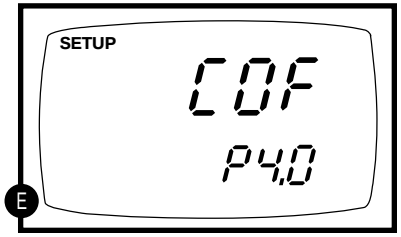
1. **Press Setup key** to enter Set Up mode.
2. **Press the ▲ and ▼ keys** to scroll through subgroups until you view parameter P4.0.

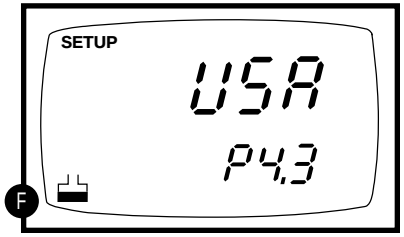
See figure E

3. **Press the ENTER key** three times to select parameter 4.3.

See figure F

4. **Press the ▲ and ▼ keys** to select the buffer set you require:
   - USA buffers (pH 1.68, 4.01, 7.00, 10.01, 12.45)
   - NIST buffers (pH 1.68, 4.01, 6.86, 9.18, 12.45)
   - DIN buffers (pH 1.09, 3.06, 4.65, 6.79, 9.23, 12.75)
5. **Press the ENTER key** to confirm selection and to return to the subgroup menu. Press the CAL / MEAS key to return to measurement mode.





P4.4 Selecting °C or °F

Available in pH 310 meter only

The pH 310 meter lets you select between °C and °F units for temperature readings.

From measurement mode

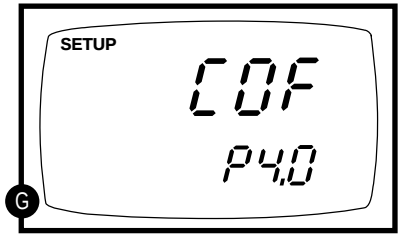
1. **Press Setup key** to enter Set Up mode.
2. **Press the ▲ and ▼ keys** to scroll through subgroups until you view parameter P4.0.

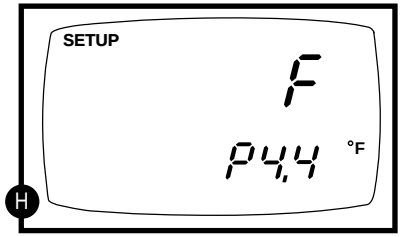
See figure G

3. **Press the ENTER key** four times to select parameter 4.4.

See figure H

4. **Press the ▲ and ▼ keys** to toggle between °C and °F.
5. **Press the ENTER key** to confirm selection and to return to the subgroup menu. Press the CAL / MEAS key to return to measurement mode.





8.6 P5.0: Resetting to factory default settings

Available in pH 300 meter only

In the pH 300 meter, Program 5 lets you reset all parameters to factory default settings. This clears all calibration data, memory, and any other setup functions you might have changed.

From measurement mode

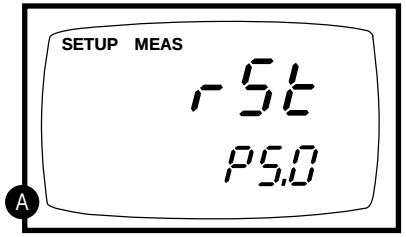
1. **Press Setup key** to enter Set Up mode.
2. **Press the ▲ and ▼ keys** to scroll through subgroups until you view parameter P5.0.

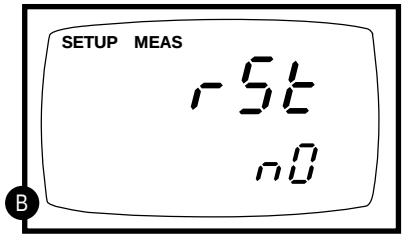
See figure A

3. **Press the ENTER key** to enter parameter P5.0.

See figure B

4. **Press the ▲ and ▼ keys** to toggle between NO and YES.
   - NO retains current settings
   - YES resets to factory default settings
5. **Press the ENTER key** to confirm selection and to return to the subgroup menu. Press the CAL / MEAS key to return to measurement mode.





8.7 P5.0: Setting the real-time clock

Available in pH 310 meter only

The pH 310 meter features a real-time calendar and clock. This helps you meet GLP (Good Laboratory Practice) standards.

From measurement mode

1. **Press Setup key** to enter Set Up mode.
2. **Press the ▲ and ▼ keys** to scroll through subgroups until you view parameter P5.0.

See figure A

3. **Press the ENTER key** to enter parameter P5.0. The meter lets you select the century: “19-” or “20-”. The century digits will flash.

See figure B

4. **Press the ▲ and ▼ keys** to toggle to the correct century.
5. **Press the ENTER key** to confirm the century and move to “year” selection. The “year” digits will flash.

See figure C

6. **Press the ▲ and ▼ keys** to toggle to the correct year.
7. **Press the ENTER key** to confirm the year and move to “month” selection. The “month” digits will flash.

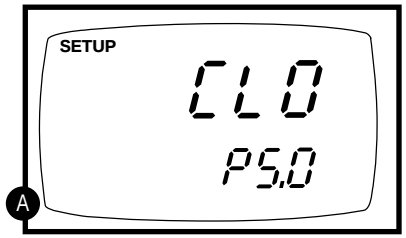
See figure D

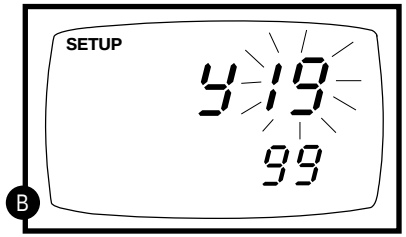
8. **Press the ▲ and ▼ keys** to toggle to the correct month.
9. **Press the ENTER key** to confirm the month and move to “date” selection. The “date” digits will flash.

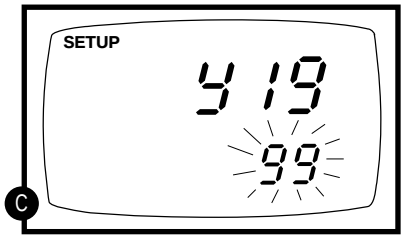
See figure E

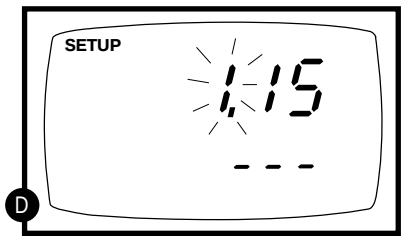
10. **Press the ▲ and ▼ keys** to toggle to the correct date.

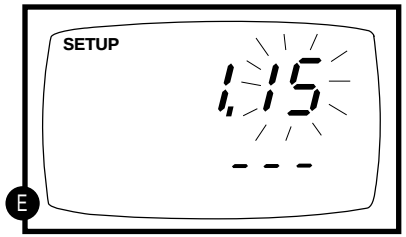
continued on next page











11. **Press the ENTER key** to confirm the date and move to “hour” selection. The “hour” digits will flash.

See figure F

12. **Press the ▲ and ▼ keys** to toggle to the correct hour. Note the “AM” and “PM” indicator on the lower portion of the display.

13. **Press the ENTER key** to confirm the hour and move to “minute” selection. The “minute” digits will flash.

See figure G

14. **Press the ▲ and ▼ keys** to toggle to the correct minutes.

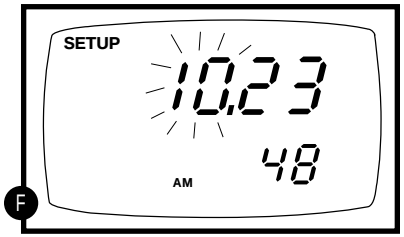
15. **Press the ENTER key** to confirm the minutes and move to “second” selection. The “second” digits will flash.

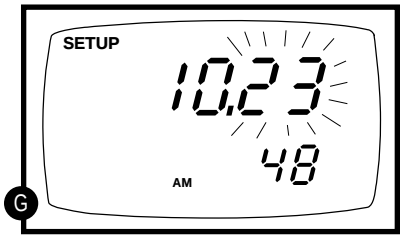
See figure H

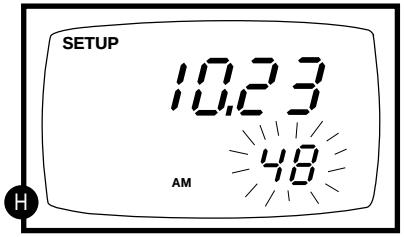
16. **Press the ▲ and ▼ keys** to toggle to the correct seconds.

17. **Press the ENTER key** to confirm the seconds and return to “century” selection.

18. **Press the CAL/MEAS key** to return to the subgroup menu. Press the CAL / MEAS key again to return to measurement mode.







Notes

Press the CAL / MEAS key at any point while setting the time to return to the subgroup menu.

8.8 P6.0: Resetting to factory default settings

Available in pH 310 meter only

In the pH 310 meter, Program 6 lets you reset all parameters to factory default settings. This clears all calibration data, memory, and any other setup functions you might have changed.

From measurement mode

1. **Press Setup key** to enter Set Up mode.

2. **Press the ▲ and ▼ keys** to scroll through subgroups until you view parameter P6.0.

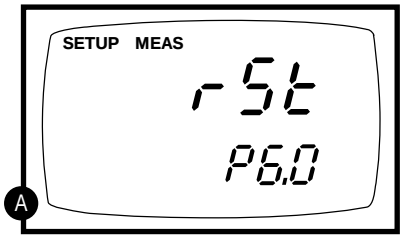
See figure A

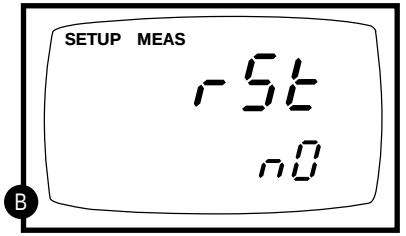
3. **Press the ENTER key** to enter parameter P6.0.

See figure B

4. **Press the ▲ and ▼ keys** to toggle between NO and YES.
   - NO retains current settings
   - YES resets to factory default settings

5. **Press the ENTER key** to confirm selection and to return to the subgroup menu. Press the CAL / MEAS key to return to measurement mode.





9. Probe Care and Maintenance

Since your pH electrode is susceptible to dirt and contamination, clean it every one to three months depending on the extent and condition of use.

NOTE: for specialty electrode care, consult the instruction manual included with your electrode.

pH electrode storage

For best results, always keep the pH bulb wet. Use the protective electrode storage bottle or rubber cap filled with OAKTON electrode storage solution to store your electrode (see page 45 for ordering information). Also, you can store in a pH 4 buffer with 1/100 part of saturated KCl. Other pH buffers are OK for storage, but NEVER use distilled water for storage.

After measuring

1. Rinse the pH electrode and reference junction in de-ionized water.
2. **Store the electrode as recommended above in "pH electrode storage," or as recommended by the manufacturer.**
3. Prior to next use, rinse the liquid junction with de-ionized water and tap dry—**never wipe electrode.**

NOTE: If this does not restore electrode to normal response, see "Reactivating the pH electrode" section below.

pH electrode cleaning

Salt deposits: dissolve the deposits by immersing the electrode in tap water for ten to fifteen minutes. Ten thoroughly rinse with distilled water.

Oil/grease film: wash electrode pH bulb gently in some detergent and water. Rinse electrode tip with distilled water or use a general purpose electrode cleaner (see page 40 for ordering information).

Clogged reference junction: heat a diluted KCl solution to 60 to 80°C. Place the sensing part of the electrode into the heated solution for about 10 minutes. Allow the electrode to cool in some unheated KCl solution.

Protein deposits: prepare a 1% pepsin solution in 0.1 M of HCl. Set the electrode in the solution for five to ten minutes. Rinse the electrode with distilled water.

Reactivating the pH electrode

If stored and cleaned properly, your pH electrode should be ready for immediate use. However, a dehydrated bulb may cause sluggish response. To rehydrate the bulb, immerse the electrode in a pH 4 buffer solution for 10 to 30 minutes. If this fails, the electrode requires activation. **Never touch or rub glass bulb. Contact builds up an electrostatic charge.**

pH electrode activation (for glass bodied electrodes only)

WARNING: Only qualified persons proficient with the safe handling of dangerous chemicals should perform the procedure below. Provide proper containers, fume hoods, ventilation, and waste disposal. Safety goggles and protective clothing must be worn while performing this procedure. If possible, replace with another electrode instead of performing this reactivation procedure.

1. **Dip or stir the pH electrode** in alcohol for 5 minutes.
2. **Leave the electrode in tap water** for 15 minutes.
3. **Dip and stir the electrode** in concentrate acid (such as HCl or H_2SO_4) for five minutes.
4. **Repeat step 2.**
5. **Dip and stir in strong base** (NaOH) for five minutes.
6. **Leave for 15 minutes** in distilled or deionized water.
7. **Now test with standard calibration buffer solutions** to see if the electrode yields acceptable results. You may repeat step 3 through 6 up to three times for better response. If the response does not improve, then your electrode is no longer functioning. Replace with a new electrode—call your OAKTON Distributor for more information.

10. Troubleshooting

Problem	Cause	Solution
Power on but no display	a) Batteries not in place.	a) Check that batteries are in place and making good contact.
	b) Batteries not in correct polarity (+ and –).	b) Reinsert batteries with correct polarity.
	c) Weak batteries.	c) Replace batteries or attach optional AC adapter.
Unstable readings	a) Air bubbles in probe.	a) Tap probe to remove bubbles.
	b) Dirty probe.	b) Clean the probe and recalibrate.
	c) Probe not deep enough in sample.	c) Make sure sample entirely covers the probe sensors.
	d) External noise pickup or induction caused by nearby electric motor.	d) Move or switch off interfering motor.
	e) Broken probe.	e) Replace probe. See page 45.
Slow response	a) Dirty / Oily probe.	a) Clean probe. See "Probe Care & Maintenance", page 40.

11. Error Messages

LCD Display	Indicates	Cause	Solution
Err annunciator	Unrecognized input from keypad	Wrong input in selected mode.	Release key. Select valid operations depending on mode.
CAL & Err annunciators on/ Buffer and electrode indicators blink	Calibration error	Wrong buffer value input at calibration. Dirty probe.	Check your buffer input value, clean probe. See Calibration sections or Probe Maintenance section.
Battery indicator blinks	Low battery level	Need new batteries or battery connection is bad	Clean battery contacts. Replace batteries with fresh ones, noting polarity

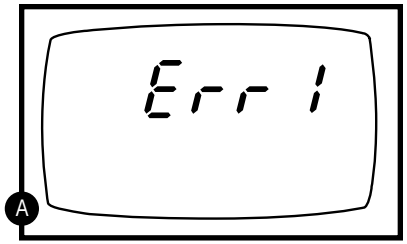
* See "Warranty" and "Return of Items" on page 47

If an error message appears in the primary display (the upper row of larger digits), switching off the meter and switching it on again may eliminate the error message.

See figure A

If error persists, or the meter shows incorrect values, return the meter.

For a complete diagram of the display, see page 5.



ERR 1 in primary display

12. Specifications

Mode	pH	Temperature	mV
Range	-2.00 to 16.00 pH	–10.0 to 110.0˚C (also 14.0 to 230.0°F for pH 310 meter)	-2000 to 2000 mV (same for Rel mV)
Resolution	0.01 pH	0.1˚C (also 0.1°F for pH 310 meter)	0.1 mV between ±199.9 mV 1 mV beyond ±199.9 mV
Accuracy	±0.01 pH	±0.5˚C (also ±0.5˚F for pH 310 meter)	±0.2 mV between ±199.9 mV ±2 mV beyond ±199.9 mV
Input	BNC connector	6-pin plug	BNC connector

Calibration
pH 300 meter: Up to five points (pH1.68, 4.01, 7.00, 10.01, 12.45)
pH 310 meter: Up to six points—select from three different buffer sets:
USA buffers (pH 1.68, 4.01, 7.00, 10.01, 12.45)
NIST buffers (pH 1.68, 4.01, 6.86, 9.18, 12.45)
DIN buffers (pH 1.09, 3.06, 4.65, 6.79, 9.23, 12.75)
Temperature: Offset in 0.1°C increments
mV: Offset up to ±150 mV

Memory:
pH 300 meter: up to 16 data sets (pH or mV plus temperature)
pH 310 meter: up to 50 data sets (pH or mV plus temperature, date, and time)

pH slope range: 80% to 110%

Temperature compensation: automatic (ATC) or manual from 0 to 100°C

Operating temperature: 0 to 50°C

Power: four 1.5 V AAA batteries (included)

Battery life: > 100 hours

Housing: meets IP67 standards for waterproof and dustproof housing

Dimensions:
Meter: 7.5"L x 3.5"W x 1.75"H
(19.1 cm x 8.9 cm x 4.5 cm)
Boxed: 9.2"L x 8.5"W x 2.75"H
(23.3 cm x 21.6 cm x 7 cm)

Shipping weight: 1.3 lbs (0.6 kg)

13. Accessories

Replacement meters

35618-02 Replacement waterproof pH 300 meter

35618-70 Waterproof pH 300 meter kit. Includes “All-in-One” probe, five each of pH “Singles” buffer pouches pH 4.01; 7.00; 10.01; and rinse water, one squeeze bottle for deionized rinse water, batteries, instructions and two electrode brackets, all in a hard shell carrying case

35618-12 Replacement pH 310 meter

35618-72 Waterproof pH 310 meter kit. Includes “All-in-One” probe, five each of pH “Singles” buffer pouches pH 4.01; 7.00; 10.01; and rinse water, one squeeze bottle for deionized rinse water, batteries, instructions and two electrode brackets, all in a hard shell carrying case

Electrodes and probes

35618-05 Temperature probe. For pH 300 and pH 310 meters

35808-71 Replacement “All-in-One” combination pH/temperature probe, single junction, sealed, 145 mm L x 12 mm diameter (0.5 lb)

35801-00 pH electrode, epoxy body, single-junction, 145 mm L x 12 mm diameter (0.5 lb)

35805-13 ORP electrode, epoxy body, single-junction, 145 mm L x 12 mm diameter (0.5 lb)

00653-04 Electrode storage solution, 1 pint bottle. Keeps electrode bulb moist for faster, more accurate readings. (1.1 lbs)

00653-06 Electrode cleaning solution, 1 pint bottle. Removes buildup from electrodes and maintains electrode sensitivity. (1.1 lbs)

NOTE: Remember to check the temperature calibration when replacing the ATC probe or when using with an OAKTON® "All-in-One" combined pH and temperature probe. See section 4.5, "Temperature calibration" (page 17).

Continued on next page

OAKTON calibration solutions

pH solutions have ±0.01 pH accuracy at 25°C. Shpg wt 1.1 lb (510 g).

00654-01 pH 1.68 calibration buffer, 1 pint.

00654-00 pH 4.01 calibration buffer, 1 pint.

00654-04 pH 7.01 calibration buffer, 1 pint.

00654-08 pH 10.01 calibration buffer, 1 pint.

00654-12 pH 12.45 calibration buffer, 1 pint.

OAKTON "Singles" calibration solution pouches

pH solutions have ±0.01 pH accuracy at 25°C. Shpg wt 1.1 lb (510 g) per box.

35653-00 Deionized rinse water solution pouches, 20/box.

35653-01 pH 4.01 calibration buffer solution pouches, 20/box.

35653-02 pH 7.00 Calibration buffer solution pouches, 20/box.

35653-03 pH 10.00 Calibration buffer solution pouches, 20/box.

35653-04 Assortment pack, 5 each deionized water, pH 4.01, pH 7.00, and pH 10.00 solution pouches.

To order OAKTON accessories, contact your OAKTON distributor.

14. Warranty

OAKTON warrants this meter to be free from significant deviations in material and workmanship for a period of three years from date of purchase. OAKTON warrants this probe to be free from significant deviations in material and workmanship for a period of six months from date of purchase. If repair or adjustment is necessary and has not been the result of abuse or misuse within the warrantied time period, please return—freight prepaid—and correction will be made without charge. OAKTON alone will determine if the product problem is due to deviations or customer misuse.

Out-of-warranty products will be repaired on a charge basis.

15. Return of items

Authorization must be obtained from our Customer Service Department before returning items for any reason. When applying for authorization, please include data regarding the reason the items are to be returned. For your protection, items must be carefully packed to prevent damage in shipment and insured against possible damage or loss. We will not be responsible for damage resulting from careless or insufficient packing. A restocking charge will be made on all unauthorized returns.

NOTE: We reserve the right to make improvements in design, construction, and appearance of products without notice.

150 & 450 Series Waterproof Handheld Meter

pH/mV Operation Instructions

EUTECH INSTRUMENTS *Technology Made Easy ...*

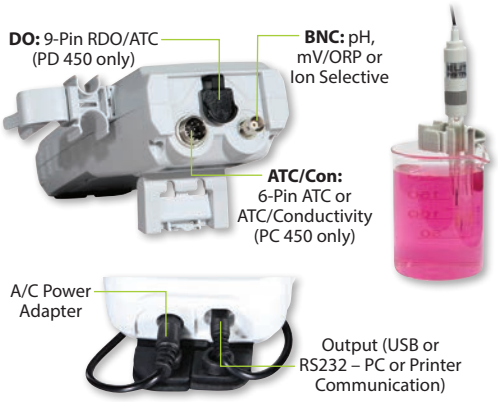
OAKTON®

Models:

pH 150	**pH 450**	**PC 450**	**PD 450**
pH/mV	pH/mV/ISE	pH/mV/Con	pH/mV/DO

Getting Started/Connections

After installing (2) AA batteries and/or connecting the optional 110/220 VAC power supply, connect the desired sensors to the corresponding ports.



12 mm and 16 mm probes can utilize the **Grip-Clip™** to attach one or more sensors to a beaker and to the instrument as needed. The stand can be extended as shown above or used for wall-mounting.

Keypad Functions

⏻	Press once to power ON in the mode that was previously used. Press again to turn backlight on for one minute or off (450 series only). Hold for 3 seconds to power OFF.
CAL MEAS BACK	Toggle between measurement and calibration modes. In SETUP mode, BACK serves to return to the previous menu option or setting.
ENTER HOLD	Confirm calibration values in CAL mode. Confirm selections in SETUP mode. Freeze or release the measured reading.
SETUP	Customize instrument settings and preferences. (See also **Setup Programs**)
MODE	Toggle between available measurement types.
▲ SAVE	Save measurement into memory. Increase value or scroll up in SETUP or manual calibration.
VIEW ▼	Recall saved values from memory. Decrease value or scroll down in SETUP or manual calibration.
🖶	Send output data to printer or computer. (450 series only).

Setup Programs

To access the settings below, press **SETUP**. Up/down arrows will display the available options. Press **ENTER** to accept the desired setting, or **BACK** to return to the previous option and/or exit.

Configuration Options

- Ready indicator **ON** / **OFF** / or Automatic **HOLD** when stable
- Choose **°C**elsius or **°F**ahrenheit

pH Buffer Options

- Select the desired pH Buffer Calibration Group:
  USA (1.68, 4.01, 7.00, 10.01, 12.45) or
  NIST (1.68, 4.01, 6.86, 9.18, 12.45) or
  DIN (1.09, 3.06, 4.65, 6.79, 9.23, 12.75) or
  MAN (manual adjustment of any custom pH values that are ≥1 pH unit apart. 450 series only)
- Select number of calibration points

Select Calibration Due Reminder

- Set number of days from **0-60** for desired parameter

View Calibration Data

- Press **ENTER** to view each point that is calibrated.

View Electrode Data

- Press **ENTER** to view mV **Offset** and **Slope %** of the measured reading.

System Settings

- Data Logging:
  MANUAL upon key press only
  TIMED interval. Choose (**SEC** / **MIN** / **HOUR**) interval.
- Automatic shut off after 10 minutes. Choose **ON** or **OFF**.
- Clock Settings:
  Date: Choose **USA** (MM/DD/YYYY) or **Euro** (DD/MM/YYYY).
  Time: Choose (**24HR or 12HR**). If 12HR, choose **AM** or **PM**.
- Set Printer Type:
  CSV (Comma Separated Values) – best format for computer
  Printer (Text) – best format for printer.
  Choose Manual (**MAN**) upon key press or **TIMED** interval.
  If timed, choose (**SEC** / **MIN** / **HOUR**).

Reset

- **NO**. Exits from reset menu options without action.
- **FACTORY RESET**. Returns all settings except date/time and ATC calibration to factory default values after **ENTER** is pressed then restarts meter.
- **DATA RESET**. Erases data stored in memory while retaining other settings after **ENTER** is pressed.
- **CALIBRATION RESET**. Erases non-ATC calibration data while retaining other settings after **ENTER** is pressed.

pH Calibration

For best results, periodic calibration with known, accurate standards is recommended. Calibrate with standards that bracket your intended measuring range while including a neutral standard (pH 7.00 or 6.86). For example, if you expect to measure samples from pH 6.2 to pH 9.5, calibration with 4.01, 7.00, and 10.01 standards will work well. Provide stirring for best results. After calibration with two or more points, the active slope segment of the measurement will be visible on the bottom display during measurement. 100 % slope will be shown if only one calibration point is performed and "- - -" if no calibration is performed. The meter will automatically return to measurement mode upon successful completion of the number of specified calibration points. To specify a different number of pH calibration points, see **pH Buffer Options**.

Using Automatic Buffer Recognition

1. While in pH measurement mode, dip the pH and ATC sensor(s) into your first standard, then press **CAL**. The primary display will search for the nearest standard value, while the secondary display will show the un-adjusted value.
2. When the "**READY**" indicator appears, press **ENTER** to accept. The primary reading will flash "**DONE**".
3. Rinse your electrode(s) then dip into the next pH standard. The primary display will search for the nearest standard value that has not yet been calibrated, while the secondary display will show the unadjusted value. When the "**READY**" indicator appears, press **ENTER** to accept.
4. To calibrate another pH standard repeat Step 3 or press **MEAS** to return to pH measurement mode.

Using Manual Recognition / Custom Buffers (450 Series Only)

1. While in pH measurement mode, dip the pH and ATC sensor(s) into your first standard then press **CAL**.
2. When the **READY** indicator appears, use up/down arrows to adjust the primary reading to match the standard value at the measured temperature, then press **ENTER**.
3. Rinse your electrode(s) then repeat Step 2 with a standard that is ≥1 pH unit from the previous standard value.
4. To calibrate another pH standard, repeat Step 3 or press **MEAS** to return to pH measurement mode.

mV Offset Adjustment

1. While in mV measurement mode, dip the ORP and ATC sensors into a solution with a known mV value (i.e. Zobel, Light's, quinhydrone, or iodide/triiodide) and stir.
2. When the "**READY**" indicator appears, use up/down arrows to adjust the primary reading to match the mV value at the measured temperature, then press **ENTER**. The meter allows an adjustable maximum value of ±200 mV from the factory default mV value. When an offset has been stored successfully, R.mV replaces mV.

Temperature Calibration/Manual ATC

1. Press **CAL** from any measurement, then press **MODE**.
2. Skip to step 3 for manual ATC, otherwise, dip the temperature sensor into a solution with a known accurate temperature. The upper display shows the active temperature while the lower display shows the factory default temperature without adjustment.
3. Use up/down arrows to adjust the upper display. Press **ENTER** to accept the calibration temperature. The maximum adjustable value is ±10 °C (or ±18 °F) from factory default.

Error Messages

ERR "ERR" will appear when an error condition exists or the incorrect key is pressed. Common examples include:

- Pressing **ENTER** during calibration before the "**READY**" indicator appears. Wait for the "**READY**" indicator before pressing **ENTER**.
- **UR** (Under Range) • **OR** (Over Range)

Intended Use, Maintenance & Precautions

These handheld meters use sensors to detect various parameters for water-based measurements. For routine maintenance disconnect the power cord or battery, then dust or wipe the display using a damp cloth. If necessary, warm water or a mild water based detergent can be used. Immediately remove any spilled substance from contact with the meter using the proper cleaning procedure for the type of spill.

- Do not use this equipment in potentially explosive atmospheres.
- Refer to the electrode instructions for use, storage and cleaning.
- Ensure that no liquid enters the instrument.
- Do not use any aggressive cleaning chemicals (solvents or similar agents).
- There are no user serviceable parts inside. Attempts to service internal parts may void the warranty.
- **WARNING:** No modification of this equipment is allowed.

Instrument Operating Conditions	
Operating Ambient Temp.	5 to 45 °C
Operating Relative Humidity	5 to 85 %, non-condensing
Storage Temp.	-20 to +60 °C
Storage Relative Humidity	5 to 85 %, non-condensing
Pollution	Degree 2
Overvoltage	Category II
Weight	500 g
Size (L x W x H)	21.15 x 9.87 x 5.85 cm
Regulatory & Safety	CE, TUV 3-1, FCC Class A
Power Rating	DC Input: 9 VDC 1 A
Battery Requirement	2 x AA (LR6) 1.5 V batteries (replace batteries when battery sign blinks)
Vibration	Shipping/handling per ISTA #1A
Shock	Drop test in packaging per ISTA #1A
Enclosure (Designed To Meet)	IP67 (using rubber covers)
Universal Power Adapter Operating Conditions	
Operating Ambient Temp.	0 to 50 °C
Operating Relative Humidity	0 to 90 %, non-condensing
Storage Temp.	-20 to +75 °C
Storage Relative Humidity	0 to 90 %, non-condensing
Pollution	Degree 2
Overvoltage	Category II
Power Rating	I/P: 100 - 240 V, 50/60 Hz, 0.3A O/P: 9 VDC 1 A

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68X651901 08/14 Rev0

150 & 450 Series Medidor de manoresistente al agua

pH/mV Instrucciones de funcionamiento

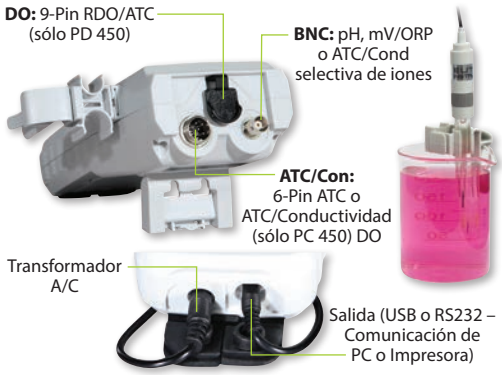
EUTECH INSTRUMENTS Technology Made Easy ... OAKTON®

Modelos:

pH 150	pH 450	PC 450	PD 450
pH/mV	pH/mV/ISE	pH/mV/Con	pH/mV/DO

Primeros pasos/Conexiones

Luego de insertar (2) baterías AA y/o conectar el suministro de energía opcional de 110/220 VAC conecte los sensores deseados a los puertos correspondientes.



Sondas de 12 mm y 16 mm pueden utilizar **Grip-Clip™** para sujetar uno o más sensores a un vaso y si es necesario al instrumento. El pie puede ser extendido como se muestra arriba o puede ser montado a la pared.

Funciones del teclado

⏻	Presione una vez, para encender en el modo usado previamente. Presione otra vez, para encender la retroiluminación por un minuto o apagar (sólo serie 450). Mantenga apretado por 3 segundos.
CAL MEAS BACK	Alterne ente los modos medición y calibración. En el modo CONFIGURACIÓN la tecla VOLVER sirve para volver a la opción previa del menú o ajuste.
ENTER HOLD	Confirmar los valores de calibración en el modo CAL. Confirmar selecciones en el modo CONFIGURACIÓN. Congelar o liberar el valor medido.
SETUP	Personalizar los ajustes del instrumento y las preferencias. (Vea también los **programas de configuración**)
MODE	Alterne entre los tipos de medición disponibles.
SAVE	Guardar la medición en la memoria. Aumente el valor o desplace hacia arriba en CONFIGURACIÓN o calibración manual.
VIEW	Volver a mostrar valores guardados en la memoria. Reduzca el valor o desplace hacia abajo en CONFIGURACIÓN o calibración manual.
🖶	Envíe los datos de salida a una impresora o computadora. (Sólo serie 450)

Programmes de configuration

Para acceder a los ajustes abajo presione **CONFIGURACIÓN**, Las flechas arriba/abajo van a hacer aparecer las opciones disponibles. Presione **ENTER** para aceptar el ajuste deseado o **BACK** (Volver) para volver a la opción anterior y/o salir.

Opciones de Configuración

- Indicador listo **ON** / **OFF** / o **HOLD** (Mantenimiento) automático si estable
- Elija **ºC**elsius o **ºF**ahrenheit

Opciones de buffer de pH

- Seleccione el grupo de calibración del buffer de pH deseado:
  USA (1.68, 4.01, 7.00, 10.01, 12.45) or
  NIST (1.68, 4.01, 6.86, 9.18, 12.45) or
  DIN (1.09, 3.06, 4.65, 6.79, 9.23, 12.75) o
  MAN (ajuste manual de valores de ph personalizados que están a ≥1 unidad de pH. Sóloserie 450)
- Seleccione la cantidad de puntos de calibración

Seleccione Notificación de Calibración Pendiente

- Fije la cantidad de días entre **0 y 60** para el parámetro deseado

Ver Datos de Calibración

- Presione **ENTER** para ver cada punto que va a ser calibrado.

Ver Datos de Electrodos

- Presione **ENTER** para ver el **offset** de mV y **el % de pendiente** (Slope) del valor medido.

Ajustes del Sistema

- Registro de datos:
  MANUAL al apretar un botónsólo intervalo **TIMED** (Cronometrado). Elija (**SEG** / **MIN** / **HORA**) intervalo.
- Apagado automático después de 10 minutos. Elija **ON** oder **OFF**.
- Ajustes del reloj:
  Fecha: Elija **USA** (MM/DD/AAAA) o **Euro** (DD/MM/AAAA).
  Tiempo: Elija (**24HR o 12HR**). Si 12HR elija **AM** o **PM**.
- Ajustartipo de impresora:
  CSV (Valores Separados por Coma) – mejor formato para la computadora.
  Impresora (texto) – mejor formato para impresora.
  Elija Manual (**MAN**) al apretar un botón o intervalo **TIMED** (Cronometrado).
  Si cronometrado, elija (**SEG** / **MIN** / **HORA**).

Resetear

- **NO** (NRO). de salidas de las opciones del menú de reseteo sin acción.
- **FACTORY RESET** (RESETEO DE FÁBRICA). Retorna todos los ajustes von excepción de fecha/tiempo y calibración ATC a los valores estándares de fábrica luego de oprimir **ENTER** y el medidor es reseteado.
- **DATA RESET** (RESETEO DE DATOS). Elimina datos guardados en la memoria mientras otros ajustes se conservan luego de oprimir **ENTER**.
- **CALIBRATION RESET** (RESETEO DE CALIBRACIÓN). Elimina datos de calibración no-ATC mientras otros ajustes se conservan luego de oprimir **ENTER**.

Calibración de pH

Para mejores resultados se recomienda una calibración periódica con estándares conocidos y precisos. Calibre con estándares que encuadren su rango de medición deseado mientras incluye un estándar neutro (pH 7,00 o 6,86). Por ejemplo si usted espera medir muestras con un pH de entre 6,2 y 9,5 la calibración con los estándares 4,01, 7,00 y 10,01 van a funcionar bien. Revuelva para los mejores resultados. Luego de la calibración con dos o más puntos el segmento de pendiente activo de la medición va a ser visible en la visualización inferior durante la medición. Una pendiente de 100 % va a aparecer si solamente se utiliza un punto de calibración y "- - -" si no se lleva a cabo ninguna calibración. El medidor va volver automáticamente al modo de medición luego de una finalización exitosa de la cantidad de puntos de calibración especificada. Para especificar una cantidad distinta de puntos de calibración de pH vea Opciones de **Buffer de pH**.

Utilizando Reconocimiento Automático de Buffer

1. Mientras esté en el modo de medición pH sumerja los sensores de pH y ATC en su primer estándar, luego presione **CAL**. La visualización primaria va a buscar al valor estándar más cercano mientras que la pantalla secundaria va a mostrar el valor no ajustado.
2. Cuando aparece el indicador "**READY**" (Listo) presione **ENTER** para aceptar. En la medición primaria va a brillar "**READY**" (Listo).
3. Lave sus electrodos y sumérjalos en el siguiente estándar de pH. La visualización primaria va a buscar al valor estándar más cercano, que no ha sido calibrado aún, mientras que la visualización secundaria va a mostrar el valor no ajustado. Cuando aparece el indicador "**READY**" (Listo) presione **ENTER** para aceptar.
4. Para calibrar otro estándar de pH, repita el paso 3 o presione **MEAS**, para regresar al modo de medición de pH.

Utilizar Reconocimiento Manual / Buffers Personalizados (Sólo Serie 450)

1. Mientras esté en el modo de medición pH sumerja los sensores de pH y ATC en su primer estándar, luego presione **CAL**.
2. Cuando aparezca el indicador "**READY**" (Listo) utilize las flechas arriba/abajo para ajustar la medición primaria para que sea igual que el valor estándar a la temperatura medida, luego presione **ENTER**.
3. Lave sus electrodos y luego repita el paso 2 con un estándar que sea ≥1 unidad de pH a partir del valor estándar anterior.
4. Para calibrar otro estándar de pH, repita el paso 3 o presione **MEAS**, para regresar al modo de medición de pH.

Ajuste del offset de mV

1. En el modo de medición mV sumerja los sensores ORP y ATZ en una solución con un valor mV conocido (z. B. Zobel, Light, quinhydrona o ioduro/triioduro) y revuelva.
2. Cuando aparezca el indicador "**READY**" (Listo) use las flechas arriba/abajo para ajustar la lectura primaria para ajustar el valor mV a la temperatura medida, luego oprima **ENTER**. El medidor permite un valor máximo ajustable de ±200 mV a partir del valor mV estándar de fábrica. Cuando un offset se haya guardado exitosamente, mV es reeplazado por R.mV.

Calibración de temperatura/ATC Manuel

1. Oprima **CAL** de cualquier medición, luego oprima **MODE** (Modo).
2. Siga con el paso 3 por una ATC manual, de otra manera sumerja el sensor de temperatura en una solución con una temperatura determinada conocida. La visualización superior muestra la temperatura activa mientras que la visualización inferior muestra la temperatura estándar de fábrica sin ajuste.
3. Use las flechas arriba/abajo para ajustar la visualización superior. Oprima **ENTER** para aceptar la temperatura de calibración. El valor ajustable máximo es ±10 ºC (o ±18 ºF) desde el valor de fábrica.

Mensajes de error

ERR "ERR" va a aparecer si existe una condición de error o si se presionada la tecla equivocada. Ejemplos comunes son entre otros:

- Apretar **ENTER** durante la calibración antes de que aparezca la indicación "**READY**" (Listo). Espere a que aparezca la indicación "**READY**" (Listo) antes de apretar **ENTER**.
- **RI** (Rango inferior) • **RS** (Rango superior)

Uso intencionado, mantenimiento y precauciones

Estos medidores portables utilizan sensores para detectar varios parámetros para mediciones basadas en agua. Para el mantenimiento de rutina disconecte el cable de alimentación o la batería y luego pase un trapo húmedo por la pantalla. Si es necesario puede utilizarse agua tibia o un detergente suave basado en agua. Remueve inmediatamente cualquier substancia derramada sobre el medidor con el procedimiento de limpieza correcto para el tipo de substancia derramada.

- No utilice este equipo en atmósferas potencialmente peligrosas.
- Vea las instrucciones del electrodo para su uso, almacenamiento y limpieza.
- Asegúrese de que ningún liquido ingrese al instrumento.
- No use químicos de limpieza agresivos (solventes o substancias similares).
- No hay partes en el interior que pueden ser mantenidos por el usuario. El intento de mantener partes internas puede anular la garantía.
- **ADVERTENCIA:** No está permitido ninguna modificación de este equipo.

Condiciones de funcionamiento del instrumento	
Temperatura de ambiente de funcionamiento	5 a 45 ºC
Humedad relativa de funcionamiento	5 a 85 %, no condensada
Temperatura de almacenamiento	-20 a +60 ºC
Humedad relativa de almacenamiento	5 a 85 %, no condensada
Contaminación	Grado de 2
Sobretensión	Categoría de II
Peso	500 g
Tamaño (L x A x A)	21,15 x 9,87 x 5,85 cm
Ordenanzas y Seguridad	CE, TUV 3-1, FCC Class A
Potencia Nominal	Entrada de CC: 9 VDC 1 A
Requerimientos de batería	2 x AA (LR6) 1,5 V batterías (reemplazar batterías cuando parpadea el cartel de la batería)
Vibración	Envío/Manejo conforme a ISTA #1A
Shock	Test de caída en envase conforme a ISTA #1A
Carcasa (diseñado para cumplir)	IP67 (utilizando cubiertas de goma)
Transformador universal Condiciones de funcionamiento	
Temperatura de Ambiente de funcionamiento	5 a 50 ºC
Humedad relativa de funcionamiento	0 a 90 %, no condensada
Temperatura de almacenamiento	-20 a +75 ºC
Humedad relativa de almacenamiento	0 a 90 %, no condensada
Contaminación	Grado de 2
Sobretensión	Categoría de II
Potencia Nominal	I/P: 100 - 240 V, 50/60 Hz, 0.3A O/P: 9 VDC 1 A

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68X651901 08/14 Rev0

Série 150 et 450 Instrument de mesure de poche étanche

pH/mV Mode d'emploi

EUTECH INSTRUMENTS
Technology Made Easy ...

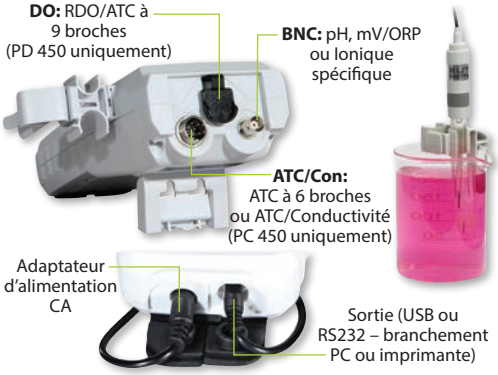
OAKTON®

Modèles proposés:

pH 150	pH 450	PC 450	PD 450
pH/mV	pH/mV/ISE	pH/mV/Con	pH/mV/DO

Mise en route/branchements

Après avoir installé (2) piles AA et/ou raccordé l'alimentation électrique en option de 110/220 VCA, connecter les capteurs souhaités aux ports correspondants.



Les sondes de 12 mm et 16 mm peuvent utiliser le **Grip-Clip™** pour fixer un ou plusieurs capteurs à un bécher et à l'instrument, selon les besoins. Le support peut être étendu comme indiqué ci-dessus ou utilisé pour le montage mural.

Fonctions du clavier

	Appuyer une fois sur le bouton ON (Marche) dans le mode qui a été précédemment utilisé. Appuyer à nouveau pour activer le rétroéclairage pendant une minute ou pour le désactiver (série 450 uniquement). Maintenir enfoncé pendant trois secondes pour éteindre (OFF).
CAL MEAS BACK	Permet de basculer entre les modes de mesure et d'étalonnage. En mode SETUP (Configuration), BACK (Retour) permet de revenir à l'option de menu ou au réglage précédent.
ENTER HOLD	Confirmer les valeurs d'étalonnage en mode CAL (Étalonnage). Confirmer les sélections en mode SETUP (Configuration). Bloquer ou libérer la valeur mesurée.
SETUP	Permet de personnaliser les paramètres et les préférences de l'instrument. (Voir aussi **Programmes de configuration**)
MODE	Permet de basculer entre les différents types de mesure disponibles.
SAVE	Permet d'enregistrer la mesure dans la mémoire. Permet d'accroître la valeur ou de défiler vers le haut en mode SETUP (Configuration) ou étalonnage manuel.
VIEW	Permet de rappeler les valeurs enregistrées dans la mémoire. Permet de réduire la valeur ou de défiler vers le bas en mode SETUP (Configuration) ou étalonnage manuel.
	Permet d'envoyer les données de sortie à l'imprimante ou à l'ordinateur. (série 450 uniquement).

Programmes de configuration

Pour accéder aux paramètres ci-dessous, appuyez sur **SETUP** (Configuration). Les flèches haut/bas affichent les options disponibles. Appuyer sur **ENTER** (Entrée) pour valider le réglage désiré, ou sur **BACK** (Retour) pour revenir à l'option précédente et/ou quitter.

Options de configuration

- Indicateur de préparation **ON** / **OFF** / ou automatiquement figé (**HOLD**) si stable
- Sélectionner le **°C**elsius ou le **°F**ahrenheit

Options de tampon pH

- Sélectionner le tampon pH désiré Groupe d'étalonnage:

  USA (1.68, 4.01, 7.00, 10.01, 12.45) ou

  NIST (1.68, 4.01, 6.86, 9.18, 12.45) ou

  DIN (1.09, 3.06, 4.65, 6.79, 9.23, 12.75) ou

  MAN (réglage manuel de toutes les valeurs de pH personnalisées qui sont à ≥ 1 unité pH l'une de l'autre. série 450 uniquement).
- Choisir le nombre de points d'étalonnage

Choisir le rappel d'étalonnage

- Définir le nombre de jours de **0-60** pour le paramètre désiré

Afficher les données d'étalonnage

- Appuyer sur **ENTER** (Entrée) pour afficher chaque point étalonné.

Afficher les données d'électrode

- Appuyer sur **ENTER** (Entrée) pour afficher le Décalage mV et le **%** de Pente de la valeur mesurée.

Réglages système

- Enregistrement des données:

  MANUAL (Manuel) en appuyant simplement sur le bouton

  TIMED (Chronométré). Choisir l'intervalle (**SEC** / **MIN** / **HOUR**) (Sec./min./heure).
- Arrêt automatique après 10 minutes. Sélectionner **ON** ou **OFF**.
- Réglages de l'horloge:

  Date: Sélectionner le système **USA** américain (MM/JJ/AAAA) ou **Euro** européen (JJ/MM/AAAA).

  Durée: Choisir (**24HR ou 12HR**). Pour 12HR, sélectionner **AM** (du matin) ou **PM** (du soir).
- Régler le type d'imprimante:

  CSV (Comma Separated Values) – meilleur format pour l'ordinateur.

  Imprimante (Texte) – meilleur format pour l'impression.

  Sélectionner MANUEL (**MAN**) en appuyant sur le bouton ou **TIMED** (Chronométré).

  Pour le chronométrage, choisir (**SEC** / **MIN** / **HOUR**) (sec./min./heure).

Réinitialisation

- **NO** (Aucune). Permet de quitter les options du menu de réinitialisation sans aucune modification.
- **FACTORY RESET** (Réinitialisation usine). Permet de remettre tous les réglages, à l'exception du paramètre date/heure et de l'étalonnage ATC, aux valeurs d'usine par défaut lorsque le bouton **ENTER** (Entrée) est enfoncé, puis de redémarrer l'instrument de mesure.
- **DATA RESET** (Réinitialisation données). Permet d'effacer les données stockées dans la mémoire tout en conservant les autres paramètres lorsque vous appuyez sur **ENTER** (Entrée).
- **CALIBRATION RESET** (Réinitialisation étalonnage). Permet d'effacer les données d'étalonnage non ATC tout en conservant les autres paramètres lorsque vous appuyez sur **ENTER** (Entrée).

Étalonnage pH

Pour de meilleurs résultats, l'étalonnage périodique au moyen d'étalons précis est recommandé. Étalonner au moyen d'étalons qui encadrent votre gamme de mesure recherchée tout en incluant un étalon neutre (pH 7,00 ou 6,86). Par exemple, si vous souhaitez mesurer des échantillons compris entre pH 6,2 et pH 9,5, l'étalonnage au moyen d'étalons de 4,01, 7,00 et 10,01 sera adéquat. Remuer pour de meilleurs résultats. Après l'étalonnage avec deux ou plusieurs points, le segment de pente active de la mesure sera visible sur l'écran inférieur pendant la mesure. Une pente de 100 % sera affichée uniquement si un seul point d'étalonnage est utilisé et "- - -" apparaîtra si aucun étalonnage n'est effectué. L'appareil de mesure revient automatiquement au mode de mesure après la réussite du nombre de points d'étalonnage spécifiés. Pour indiquer un autre nombre de points d'étalonnage du pH, voir **Options de tampon pH**.

Utilisation de la reconnaissance automatique de tampon

1. En mode de mesure de pH, tremper le capteur (ou les capteurs) de pH et ATC dans votre premier étalon, puis appuyer sur **CAL** (Étalonner). L'écran principal recherchera la valeur d'étalon la plus proche, tandis que l'écran secondaire indiquera la valeur non ajustée.
2. Lorsque l'indicateur "**READY**" (Prêt) apparaît, appuyer sur **ENTER** (Entrée) pour valider. L'écran principal indique "**DONE**" (Effectué).
3. Rincer l'électrode (ou les électrodes), puis la tremper dans votre prochain étalon pH. L'écran principal recherchera la valeur d'étalon la plus proche qui n'a pas encore été étalonnée, tandis que l'écran secondaire indiquera la valeur non ajustée. Lorsque l'indicateur "**READY**" (Prêt) apparaît, appuyer sur **ENTER** (Entrée) pour valider.
4. Pour étalonner un autre étalon pH, reprendre l'étape 3 ou appuyer sur **MEAS** (Mesure) pour retourner au mode de mesure de pH.

Utilisation de la reconnaissance manuelle / Tampons personnalisés (Série 450 uniquement)

1. En mode de mesure de pH, tremper le capteur (ou les capteurs) de pH et ATC dans votre premier étalon, puis appuyer sur **CAL** (Étalonner).
2. Lorsque l'indicateur **READY** (Prêt) apparaît, utiliser les flèches haut/bas pour ajuster la lecture principale en fonction de la valeur de l'étalon à la température mesurée, puis appuyer sur **ENTER** (Entrée).
3. Rincer votre électrode (ou vos électrodes), puis reprendre l'étape 2 avec un étalon qui est à ≥1 unité pH de la valeur d'étalon précédente.
4. Pour étalonner un autre étalon pH, reprendre l'étape 3 ou appuyer sur **MEAS** (Mesure) pour retourner au mode de mesure de pH.

Ajustement du décalage mV

1. En mode de mesure mV, plonger les capteurs ORP et ATC dans une solution ayant une valeur mV connue (Zobel, Light, quinhydrone, iodure ou triiodure) et remuer.
2. Lorsque l'indicateur "**READY**" (Prêt) apparaît, utiliser les flèches haut/bas pour ajuster la lecture principale en fonction de la valeur mV à la température mesurée, puis appuyer sur **ENTER** (Entrée). L'instrument de mesure accepte une valeur de réglage maximale de ±200 mV par rapport à la valeur mV par défaut. Lorsqu'un décalage est enregistré avec succès, R.mV remplace mV.

Étalonnage de température/ATC manuel

1. Appuyer sur **CAL** (Étalonnage) à partir de n'importe quelle mesure, puis appuyer sur **MODE**.
2. Passer à l'étape 3 pour l'ATC manuel, ou plonger le capteur de température dans une solution ayant une température précise connue. L'écran supérieur indique la température active, tandis que l'écran inférieur indique la température par défaut sans aucun ajustement.
3. Utiliser les flèches haut/bas pour ajuster l'écran supérieur. Appuyer sur **ENTER** (Entrée) pour valider la température d'étalonnage. La valeur de réglage maximale est de ±10 °C (ou ±18 °F) par rapport à la valeur par défaut.

Messages d'erreur

ERR "ERR" s'affiche lorsqu'une condition d'erreur est détectée ou si la mauvaise touche est enfoncée. Exemples courants:

- Appuyer sur **ENTER** (ENTRÉE) pendant l'étalonnage avant que l'indicateur "**READY**" (Prêt) ne s'affiche. Attendre que l'indicateur "**READY**" (Prêt) s'affiche pour appuyer sur **ENTER** (ENTRÉE).
- **UR** (Gamme inférieure) • **OR** (Gamme supérieure)

Utilisation prévue, entretien et précautions

Ces instruments de mesure de poche utilisent des capteurs pour détecter les différents paramètres dans le cadre de mesures à base d'eau. Pour l'entretien de routine, débrancher le cordon d'alimentation ou la batterie, puis épousseter ou nettoyer l'écran à l'aide d'un chiffon humide. Si nécessaire, de l'eau tiède ou un détergent doux à base d'eau peut être utilisé. Enlever immédiatement les substances déversées qui entrent en contact avec l'appareil suivant la procédure de nettoyage appropriée en fonction du type de déversement.

- Ne pas utiliser cet appareil dans des atmosphères potentiellement explosives.
- Consulter les instructions d'utilisation, de stockage et de nettoyage des électrodes.
- Veiller à ce qu'aucun liquide ne pénètre dans l'appareil.
- Ne pas utiliser de produits chimiques de nettoyage agressifs (solvants ou produits similaires).
- L'appareil ne contient aucune pièce réparable par l'utilisateur. Toute tentative de réparation des pièces internes est susceptible d'annuler la garantie.
- **AVERTISSEMENT:** Aucune modification du présent appareil n'est autorisée.

Conditions de fonctionnement de l'instrument	
Temp. de fonctionnement amb.	5 à 45 °C
Humidité de fonctionnement relative	5 à 85 %, sans condensation
Temp. de stockage	-20 à +60 °C
Humidité relative de stockage	5 à 85 %, sans condensation
Pollution	Degré 2
Surtension	Catégorie II
Poids	500 g
Dimensions (L x l x H)	21,15 x 9,87 x 5,85 cm
Réglementation et sécurité	CE, TUV 3-1, FCC Classe A
Puissance nominale	CC Entrée: 9 VCC 1 A
Exigences de piles	2 piles AA 1,5 V (remplacer les piles lorsque l'indicateur de pile clignote)
Vibrations	Expédition/manutention conformément à ISTA N°1A
Chocs	Épreuve de chute dans l'emballage conformément à ISTA N°1A
Enceinte (conçue en conséquence)	IP67 (avec caches en caoutchouc)
Conditions d'utilisation de l'adaptateur universel	
Temp. amb. De fonctionnement	0 à 50 °C
Humidité relative de fonctionnement	0 à 90 %, sans condensation
Temp. de stockage	-20 à +75 °C
Humidité relative de stockage	0 à 90 %, sans condensation
Pollution	Degré 2
Surtension	Catégorie II
Puissance nominale	Entrée: 100 - 240 V, 50/60 Hz, 0.3A Sortie: 9 VCC 1 A

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68X651901 08/14 Rev0

150 & 450 Series Wasserdichtes Handmessgerät

pH/mV Betriebsanleitung

EUTECH INSTRUMENTS *Technology Made Easy ...*

OAKTON®

Modelle:

pH 150	pH 450	PC 450	PD 450
pH/mV	pH/mV/ISE	pH/mV/Con	pH/mV/DO

Erste Schritte/Anschlüsse

Nach Einsetzen (2) der AA-Batterien und/oder Anschließen der optionalen 110/220 VAC Netzspannung, schließen Sie die gewünschten Sensoren an den entsprechenden Anschlüssen an.

12 mm und 16 mm Sonden können den **Grip-Clip™** verwenden, um einen oder mehrere Sensoren an einem Messbecher und wenn erforderlich am Gerät zu befestigen. Der Ständer kann verlängert werden, wie oben gezeigt, oder für die Wandmontage verwendet werden.

Tastenfunktionen

	Einmal drücken, um im vorher verwendeten Modus einzuschalten. Erneut drücken, um die Hintergrundbeleuchtung für eine Minute ein oder auszuschalten (nur 450-Serie). 3 Sekunden lang gedrückt halten, um auszuschalten.
CAL MEAS BACK	Zwischen Mess- und Kalibrierungsmodi schalten. Im SETUP-Modus dient ZURÜCK, um zur vorherigen Menüoption oder Einstellung zurückzukehren.
ENTER HOLD	Kalibrierungswerte im CAL-Modus bestätigen. Auswahlen im SETUP-Modus bestätigen Den gemessenen Wert einfrieren oder freigeben.
SETUP	Instrumenteneinstellungen und Präferenzenanpassen. (Siehe auch **Setupprogramme**)
MODE	Zwischen den verfügbaren Messtypen schalten.
SAVE	MesswertimSpeicherspeichern. Wert erhöhen oder aufwärts scrollen im SETUP oder manuelle Kalibrierung.
VIEW	Gespeicherte Werte aus dem Speicher aufrufen. Wert reduzieren oder nach unten scrollen im SETUP oder manuelle Kalibrierung.
	Ausgangsdaten an Drucker oder Computer senden. (Nur 450-Serie)

Setupprogramme

Um auf die nachstehenden Einstellungen zuzugreifen, drücken Sie **SETUP**. Die Aufwärts-/Abwärtspfeile werden die verfügbaren Optionen anzeigen. Drücken Sie **ENTER**, um die gewünschte Einstellung zu akzeptieren oder **BACK** (Zuruck), um zur vorherigen Option zurückzukehren und/oder zu beenden.

Konfigurationsoptionen

- Bereit-Anzeige **ON** / **OFF** / oder Automatisch **HOLD** (Halten) wenn stabil
- **°C**elsius oder **°F**ahrenheit

pH-Puffer-Optionen

- Wählen Sie die gewünschte pH-Puffer-Kalibrierungsgruppe:
  USA (1.68, 4.01, 7.00, 10.01, 12.45) oder
  NIST (1.68, 4.01, 6.86, 9.18, 12.45) oder
  DIN (1.09, 3.06, 4.65, 6.79, 9.23, 12.75) oder
  MAN (manuelle Anpassung aller benutzerdefinierten pH-Werte, die ≥1 pH-Einheit entfernt sind. Nur 450-Serie)
- Wählen Sie die Anzahl der Kalibrierungspunkte

Wählen Sie Erinnerung an fällige Kalibrierung

- Stellen Sie die Anzahl der Tage zwischen **0-60** für den gewünschten Parameter

Kalibrierungsdaten einsehen

- Drücken Sie **ENTER**, um jeden zu kalibrierenden Punkt zu sehen.

Elektrodendaten einsehen

- Drücken Sie **ENTER**, um mV Offset und Steigung % des Messwertes zu sehen.

Systemeinstellungen

- Messwerterfassung:
  MANUELL bei Betätigen der Taste nur **TIMED** (Zeitlich Festgelegtes) Intervall. Wählen Sie ein Intervall (**SEK** / **MIN** / **STUNDE**).
- Automatisches Ausschalten nach 10 Minuten. Wählen Sie **ON** oder **OFF**.
- Uhreinstellungen:
  Datum: Wählen Sie **USA** (MM/TT/JJJJ) oder **Europa** (TT/MM/JJJJ).
  Uhrzeit: Wählen Sie (**24STD oder 12STD**). Falls 12STD, wählen Sie **AM** oder **PM**.
- Druckertyp einstellen:
  CSV (durch Komma getrennte Werte) – bestes Format für den Computer.
  Drucker (Text) – bestes Format für den Drucker.
  Manuell (**MAN**) wählen bei Betätigen der Taste oder **TIMED** (Zeitlich Festgelegtes) Intervall.
  Wenn zeitlich festgelegt (**SEK** / **MIN** / **STUNDE**) wählen.

Zurückstellen

- **NO** (ANZAHL). Ausgänge aus dem Reset-Menü ohne Handlungen.
- **FACTORY RESET** (WERKSEITIGE RÜCKSTELLUNG). Stellt alle Einstellungen mit Ausnahme von Datum/Uhrzeit und ATC-Kalibrierung auf die werkseitigen Standardwerte zurück, sobald **ENTER** gedrückt und das Messgerät neugestartet wird.
- **DATA RESET** (DATENRÜCKSTELLUNG). Löscht im Speicher gespeicherte Daten, während andere Einstellungen beibehalten werden, nachdem **ENTER** gerückt wurde.
- **CALIBRATION RESET** (KALIBRIERUNGSRÜCKSTELLUNG). Löscht Nicht-ATC-Kalibrierungsdaten, während andere Einstellungen beibehalten werden, nachdem **ENTER** gedrückt wird.

pH-Kalibrierung

Für beste Ergebnisse wird eine regelmäßige Kalibrierung mit bekannten, genauen Standards empfohlen. Kalibrieren Sie mit Standards, die Ihren geplanten Messbereich einbeziehen, während sie einen neutralen Standard (pH 7,00 oder 6,86) einbeziehen. Sollten Sie z. B. davon ausgehen, dass Sie Proben zwischen pH 6,2 und pH 9,5 messen werden, wird eine Kalibrierung mit den Standards 4,01, 7,00 und 10,01 gut funktionieren. Mischen Sie für beste Ergebnisse. Nach der Kalibrierung mit zwei oder mehr Punkten wird das aktive Steigungssegment der Messung während der Messung auf der unteren Anzeige sichtbar sein. 100 % Steigung wird angezeigt, wenn nur ein Kalibrierungspunkt durchgeführt wird, und "- - -", wenn keine Kalibrierung durchgeführt wird. Das Messgerät wird nach einem erfolgreichen Abschluss der Anzahl der festgelegten Kalibrierungspunkte automatisch zum Messmodus zurückkehren. Um eine andere Anzahl von pH-Kalibrierungspunkten anzugeben, siehe **pH-Pufferoptionen**.

Automatische Puffererkennung verwenden

1. Während im pH-Messmodus tauchen Sie die pH- und ATC-Sensoren in den ersten Standard und drücken Sie **CAL**. Das primäre Display wird nach dem nächstgelegenen Standardwert suchen, während die sekundäre Anzeige den unangepassten Wert anzeigen wird.
2. Sobald die Anzeige "**READY**" (Bereit) erscheint, drücken Sie **ENTER**, um zu akzeptieren. Die primäre Anzeige wird "**FERTIG**" anzeigen.
3. Spülen Sie Ihre Elektroden und tauchen Sie in den nächsten pH-Standard. Das primäre Display wird nach dem nächstgelegenen Standardwert, der noch nicht kalibriert wurde, suchen, während die sekundäre Anzeige den unangepassten Wert anzeigen wird, Sobald die Anzeige "**READY**" (Bereit) erscheint, drücken Sie **ENTER**, um zu akzeptieren.
4. Um einen anderen pH-Standard zu kalibrieren, wiederholen Sie Schritt 3 oder drücken Sie **MEAS**, um zum pH-Messmodus zurückzukehren.

Manuelle Erkennung / Benutzerdefinierte Puffer verwenden (Nur 450 Serie)

1. Während im pH-Messmodus tauchen Sie die pH- und ATC-Sensoren in den ersten Standard und drücken Sie **CAL**.
2. Sobald die Anzeige "**READY**" (Bereit) erscheint, passen Sie die primären Messwerte mit den Aufwärts-/Abwärtspfeilen an, damit sie dem Standardwert bei der gemessenen Temperatur entsprechen, und drücken Sie **ENTER**.
3. Spülen Sie Ihre Elektroden und wiederholen Sie Schritt 2 mit einem Standard, der ≥1 pH-Einheit vom vorherigen Standardwert entfernt ist.
4. Um einen anderen pH-Standard zu kalibrieren, wiederholen Sie Schritt 3 oder drücken Sie **MEAS**, um zum pH-Messmodus zurückzukehren.

mV-Messwertanpassung

1. Während im mV-Messmodus tauchen Sie die ORP- und ATC-Sensoren in eine Lösung mit einem bekannten mV-Wert (z. B. Zobel, Quinhydron nach Light oder Iodid/Triiodid) und rühren Sie.
2. Sobald die Anzeige "**READY**" (Bereit) erscheint, verwenden Sie die Aufwärts-/Abwärtspfeile um den primären Messwert anzupassen, sodass er dem mV-Wert bei der gemessenen Temperatur entspricht, und drücken Sie dann **ENTER**. Das Messgerät lässt einen anpassbaren Maximalwert von ±200 mV ab dem werkseitigen Standard-mV-Wert zu. Wenn ein Offset erfolgreich gespeichert wurde, wird mV durch R.mV ersetzt.

Temperaturkalibrierung/Manuelle ATC

1. Drücken Sie **CAL** bei einer beliebigen Messung und drücken Sie dann **MODE** (Modus).
2. Fahren Sie für manuelle ATC mit Schritt 3 fort, ansonsten tauchen Sie den Temperatursensor in eine Lösung mit einer bekannten, genauen Temperatur. Die obere Anzeige zeigt die aktive Temperatur an, während die untere Anzeige die werkseitige Standardtemperatur ohne Anpassung anzeigt.
3. Verwenden Sie die Pfeile oben/unten, um die obere Anzeige anzupassen. Drücken Sie **ENTER**, um die Kalibrierungstemperatur anzunehmen. Der maximale anpassbare Wert beträgt ±10 °C (oder ±18 °F) ab dem werkseitigen Standardwert.

Fehlermeldungen

ERR "ERR" wird erscheinen, wenn ein Fehlerzustand auftritt oder die falsche Taste betätigt wird. Übliche Beispiele sind:

- Während der Kalibrierung **ENTER** zu drücken, bevor die Anzeige "**READY**" (Bereit) erscheint. Warten Sie auf die Anzeige "**READY**" (Bereit), bevor Sie **ENTER** drücken.
- **UB** (Unterer Bereich) • **OB** (Oberer Bereich)

Anwendungszweck, Wartung und Vorsichtsmaßnahmen

Diese tragbaren Messgeräte verwenden Sensoren, um verschiedene Parameter für wasserbasierte Messungen zu erkennen. Trennen Sie für die Routinewartung das Netzkabel oder die Batterie und wischen Sie die Anzeige mit einem feuchten Tuch ab, Bei Bedarf kann warmes Wasser oder mildes, wasserhaltiges Spülmittel verwendet werden. Entfernen Sie umgehend jegliche verschüttete Substanz vom Kontakt mit dem Messgerät, indem Sie entsprechende Reinigungsverfahren für die Art der Verschüttung verwenden.

- Verwenden Sie dieses Gerät nicht in potentiell explosiven Atmosphären.
- Siehe Anweisungen zu Elektroden für deren Gebrauch, Lagerung und Reinigung.
- Vergewissern Sie sich, dass keine Flüssigkeit in das Gerät eindringt.
- Verwenden Sie keine aggressiven Reinigungschemikalien (Lösungsmittel oder ähnliche Substanzen).
- Das Gerät enthält keine vom Benutzer zu wartende Teile. Versuche, die Innenteile zu warten, könnte die Garantie ungültig machen.
- **WARNUNG:** Keine Modifizierung dieses Gerätes erlaubt.

Betriebsbedingungen des Instrumentes	
Umgebungstemperatur bei Betrieb	5 bis 45 °C
Relative Feuchtigkeit bei Betrieb	5 bis 85 %, nicht kondensierend
Lagertemperatur	-20 bis +60 °C
Lagerung Relative Luftfeuchtigkeit	5 bis 85 %, nicht kondensierend
Belastungs	Grad 2
Überspannungs	kategorie II
Gewicht	500 g
Abmessungen (L x B x H)	21,15 x 9,87 x 5,85 cm
Behördliche Vorschriften und Sicherheit	CE, TUV 3-1, FCC Klasse A
Nennleistung Gleichstromeingang	9 VDC 1 A
Batterianforderungen	2 x AA (LR6) 1,5 V Batterien (Batterien wechseln wenn Batteriezeichen blinkt)
Vibrationen	Versand/Handhabung gemäß ISTA #1A
Stöße	Falltest in Verpackung gemäß ISTA #1A
Gehäuse (Auf die Bedürfnisse ausgerichtet)	IP67 (mit Gummiabdeckungen)
Universeller Stromadapter Betriebsbedingungen	
Betriebsumgebungstemperatur	0 bis 50 °C
Relative Feuchtigkeit bei Betrieb	0 bis 90 %, nicht kondensierend
Lagertemperatur	-20 bis +75 °C
Lagerung Relative Luftfeuchtigkeit	0 bis 90 %, nicht kondensierend
Belastungs	Grad 2
Überspannungs	kategorie II
Nennleistung	I/P: 100 - 240 V, 50/60 Hz, 0,3A O/P: 9 VDC 1 A

Eutech Instruments Pte Ltd
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68X651901 08/14 Rev0

APPENDIX B – Standard Operating Procedures

B-6. Management of Investigation-Derived Waste

STANDARD OPERATING PROCEDURE
MANAGEMENT OF INVESTIGATION-DERIVED WASTE

Introduction

Investigation derived wastes (IDW) generated during the Pre-Remedial Design Investigations at the Portland Harbor Superfund Site may include:

- Soils/sediments
- Surface water
- Other materials:
    - Personal protective equipment
    - Disposable sampling equipment
    - Spent decontamination liquids
    - Plastic sheeting, containers, etc.

The management of these wastes will be conducted to limit exposure of Site personnel to hazardous materials, and to prevent introduction of contaminated materials to uncontaminated environmental media at the Site (soils, sediment). The following Standard Operating Procedures (SOPs) establish protocols for testing, storage, and disposal of these materials.

Disposal of laboratory test equipment and supplies will be handled in accordance with the laboratory Quality Assurance Project Plan (QAPP).

General

IDW management will follow guidance described in the Office of Solid Waste and Emergency Response (OSWER) document, Guide to Management of Investigation-Derived Wastes (United States Environmental Protection Agency [EPA] 1992). This guidance discusses factors to consider as part of an IDW management program. These factors include protectiveness of human health and the environment, compliance with applicable and relevant or appropriate requirement (ARAR)-based cleanup levels, land disposal restrictions, storage requirements, recordkeeping and manifesting, and handling of non- Resource Conservation and Recovery Act (RCRA) hazardous wastes. The IDW management program described in this section incorporates these factors in the program.

All IDW identified as potentially contaminated with hazardous materials will be stored in a designated and clearly marked IDW management area located at the AECOM Technical Services (AECOM) Field Laboratory. All vessels will also be clearly labeled to indicate the source of the IDW. The IDW storage area will be inspected daily to ensure that storage procedures (as outlined below) are being followed. Any violations of these procedures will be

documented and remedied as quickly as possible. Potentially contaminated IDW will be identified based on its origin, olfactory evidence, and visual evidence. Laboratory testing will be required to determine the proper disposition of these IDW.

Media Specific IDW Management

Sediment/Soils

Waste soils and sediments will be generated as excess sample material. The required testing and handling of this IDW will depend on its origin and characteristics. Olfactory and visual observations will be used to determine if the soils contain potentially elevated levels of hazardous materials. The amount of sediment generated will be minimized to the volume necessary for sampling and analysis, if possible. During field operations, leftover sediment material will be returned to the location it was generated from unless a significant sheen or non-aqueous phase liquid (NAPL) is observed. If significant sheen or NAPL is observed, sediment on the vessel or laboratory processing area will be temporally stored in 5-gallon buckets with lids, then transferred to 55-gallon drums. Each drum will be labeled using a grease pencil or paint pen to indicate the date sealed, location, and contents. Each of the sealed drums will then be staged at a designated solid waste management unit location for later disposal characterization.

Surface Water

Sampling activities may result in the creation of surface water sheens. Sorbent booms will be deployed if significant sheen is encountered on the water surface during coring/grab sampling. A small support boat may be used to manage the boom so the sampling vessel can operate without interruption. AECOM will coordinate with the Office of Spill Prevention Section on additional mitigation measures and agency notifications for releases. Surface water generated during sediment collection will be returned to the lake unless a significant sheen is observed. If a sheen is observed, water will be contained in 55-gallon drums or plastic containers and managed accordingly.

Personal Protective Equipment (PPE)

Investigation-derived PPE consists of gloves, chemically protective clothing, respirator canisters, and other one-time use equipment used during the field investigation. All used PPE will be containerized in plastic garbage bags and disposed of on-site for subsequent transport to the municipal landfill.

Decontamination Fluids

Decontamination fluids will be drummed up in either 55-gallon drums or disposed of in sanitary sewers if no significant sheen is observed. Alconox used on the boat will be discarded overboard if no significant sheen is observed. The decontamination containers will be kept on-site until the water has been analyzed for hazardous materials, at which time the water will be discarded appropriately.

Chemical Liquid Wastes

Chemical liquid wastes will include the spent solvents and acids and other residual chemicals generated during the decontamination process.

Waste acids and solvents will be collected in (dedicated) satellite containers as follows:

- Waste acids (e.g., hydrogen chloride, nitric acid) will be collected in a plastic storage carboy (20-L) SEPARATE FROM WASTE SOLVENTS, labeled with a Class 8 Corrosive Liquid label and containing a tag that indicates acid name, concentration, and volume along with users' initials and date/time.
- Waste solvents (e.g., acetone, methanol, and hexane) will be collected in Type I or II UL-approved galvanized steel disposal can, SEPARATE FROM WASTE ACIDS, labeled with a Class 3 Flammable Liquid label and containing a tag that indicates solvent name, concentration, and volume along with users' initials and date/time.

Solvent Waste (Acetone, Methanol, Hexane)

- Assign a unique identification number to the Type I or II UL-approved steel disposal can (clearly marked on the top and sides).
- Prepare a log for the drum, listing the volume and concentration of each solvent transferred to the drum along with date/time.
- Place a label indicating that the drum contains IDW pending characterization and a Class 3 Flammable Liquid label on the drum.
- Close the drum after each transfer.
- Store the drum in a secure area at the field facility until pickup by an authorized waste handler at the end of the field phase. Drums containing hazardous waste will be removed from the facility within the time mandated for the governing hazardous waste generator status (large quantity generator, small quantity generator, or conditionally except generator).

Other Materials

All plastic sheeting, sampling containers, and other disposable equipment that is free from hazardous materials will be containerized in plastic garbage bags and disposed of on-site for subsequent transport to the municipal landfill. Materials that have visible NAPL will also be drummed and shipped off-site for disposal at an approved facility. Non-disposable or bulky materials may be decontaminated and re-used or disposed as solid waste (see SOP for decontamination). Other disposable materials used on-site (tarps covering non-contaminated soils, caution tape, potable water containers) that have not contacted contaminated media will be disposed as solid waste.

Testing and Disposal

All drummed materials will be tested to determine the proper disposal method. Composite samples will be collected from each drum for analysis. Composite samples will be collected such that reasonable likelihood exists that the entire volume of material in a drum is represented in the sample.

Composite samples will be tested for the parameters identified in the QAPP. Modifications of this analyte list may be made based on specific knowledge of the origin and likely contaminants in the materials.

Soils contaminated above hazardous waste criteria will be shipped to a licensed disposal facility following any further required waste characterization or stabilization.

References

United States Environmental Protection Agency (EPA). 1992. Guide to Management of Investigation-Derived Wastes. Office of Solid Waste and Emergency Response. 9345-03FS.

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APPENDIX D

Record of Change Requests

- Change Request 6 - QAPP Consistency Revisions
- Change Request 7 - Laboratory Change Surface Sediments
- Change Request 9 - Laboratory Change Subsurface Sediments
- Change Request 16 - Laboratory Change Surface Water PCP

APPENDIX D

Record of Change Requests

- Change Request 6 - QAPP Consistency Revisions
- Change Request 7 - Laboratory Change Surface Sediments
- Change Request 9 - Laboratory Change Subsurface Sediments
- Change Request 16 - Laboratory Change Surface Water PCP

CHANGE REQUEST FORM
Portland Harbor PDI Studies, 2018

Page: 1 of 1 Change No: 6

CHANGE REQUEST

The changes noted under 'Description of Change' are proposed to the QAPP. The majority of these changes are intended to correct and/or clarify portions of the QAPP to align with the associated WP, ROD, and FSPs. In addition, edits are requested to correct inconsistencies within the QAPP document and to clarify information important for data reviewers and persons interpreting the data. These changes would be implemented immediately and will be incorporated with the final QAPP submittal following completion of the approval process for response to EPA's comments on the QAPP.

Applicable Reference:

Quality Assurance Project Plan, Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling, Portland Harbor Superfund Site, Agency Approval Draft dated March 23, 2018

Description of Change:

The following line item changes are requested for the QAPP for the purposes noted under 'Change Request'.

1. Section 2.4 indicates the selected laboratories are NELAP accredited for their assigned analyses. Test America is not currently NELAP accredited for the updated grain size method ASTM D7928 (change made based on EPA comment 13, 2-9-2018). Test America is not accredited for Atterberg Limits (ASTM D4318).
2. There are some inconsistencies in the text in Sections 2.4.1 and 2.4.3 compared to Tables 2a, 2b, and 2e. The text will be corrected to match the tables.
3. Table 2a – this table was omitted in the 3-23-2018 QAPP submittal but was present in the RLSO version submitted to EPA. We will insert in the next version of the QAPP to EPA, but also will remove the following compounds from the analytical list for the SMA surface sediments and for the subsurface sediments because they are not required for these media per Table 6 of the Work Plan – BEHP, Aldrin, chlordanes, dieldrin, and lindane.
4. Table 2a - Atterberg Limits will be included under subsurface sediments and removed from surface sediments.
5. Table 2b - Atterberg Limits will be included on this table as this test may be conducted for selected upriver sediment samples.
6. Tables 2a and 2b – Criteria is shown for MS/MSDs for PCB congeners. MS/MSDs are not required by EPA Method 1668A. We propose to remove MS/MSDs from the remaining sediment program for 1668A analysis.
7. Table 2c – the PAH compound list on this table currently includes PAHs not shown for surface water in Table 17 of the ROD or Table 6 of the Work Plan. The following compounds will be removed from the PAH analytical list on Table 2c - acenapthene, acenapthylene, anthracene, benzo(g,h,i)pyrene, fluoranthene, fluorene, 2-methylnapthalene, phenanthrene, and pyrene.
8. Table 2c – TOC will be added to the surface water analysis. This will match the associated FSP.
9. Tables 2a-2c, 2e – The footnotes associated with reporting limits and/or referencing EDLs, SDLs, MDLs, and PQLs will be refined so that it is clear how data are reported by the laboratories for data reviewers as well as to provide a reference for data users.
10. Table 5 – This table will be revised to correct archival requirements for metals digestates; TOC will be added to the surface water list; rinsate blank bottle requirements will be added; and a footnote identifying test methods that can be consolidated into the same containers for submittal to the laboratory will be added.

Impact on Present and Completed Work:

The changes requested will not have an adverse impact on data quality or use for sample analysis completed thus far and will not adversely impact data quality or use in samples pending or planned for analysis.

Requested By: Ken Tyrrell (AECOM Project Coordinator) Date: 5/24/2018

Acknowledged By: _____ (EPA Project Manager) Date: _____

APPROVAL

Senior Technical Advisor Karen Mixon Date: 5/24/2018

Client Project Coordinator: Ken Tyrrell Date: 5/24/2018

EPA Project Manager: _____ Date: _____

Tyrrell, Ken

From: Zhen, Davis <Zhen.Davis@epa.gov>
Sent: Friday, June 15, 2018 3:25 PM
To: Tyrrell, Ken; Scott Coffey; younghs@cdmsmith.com
Cc: Pretare, Jennifer; Ruffle, Betsy; Mixon, Karen
Subject: RE: Re-Sending --- RE: Change Request 06 - QAPP Items

Ken,

This slip through the cracks. EPA has reviewed you request and did not find any issues. As such EPA is approving your changes except:

#1 Section 2.4 indicates the selected laboratories are NELAP accredited for their assigned analyses. Test America is not currently NELAP accredited for the updated grain size method ASTM D7928 (change made based on EPA comment 13, 2-9-2018). Test America is not accredited for Atterberg Limits (ASTM D4318).

While EPA agrees with the change, but due to a lack of DQOs described for these geotechnical parameters and the fact that the labs will not have accreditation for running these tests, the data use for these geotechnical parameters (both immediate and future) is limited to qualitative informational purposes only and not design.

Thanks,

****
Davis Zhen, Manager
Site Cleanup Unit 2
Office of Environmental Cleanup
1200 Sixth Avenue Suite 155
M/S ECL – 122, Seattle, WA 98101
Tel: (206) 553-7660
Cell: (206) 437-5826
****

From: Tyrrell, Ken [mailto:ken.tyrrell@aecom.com]
Sent: Friday, June 15, 2018 2:16 PM
To: Zhen, Davis <Zhen.Davis@epa.gov>; Scott Coffey <coffeyse@cdmsmith.com>; younghs@cdmsmith.com
Cc: Pretare, Jennifer <jennifer.pretare@aecom.com>; Ruffle, Betsy <betsy.ruffle@aecom.com>; Mixon, Karen <karen.mixon@aecom.com>
Subject: Re-Sending --- RE: Change Request 06 - QAPP Items

Davis,

We are requesting an update on this Change Request 06. Could you pls let us know the status of your review?

This is becoming an important item on our schedule.

Thanks,

Ken Tyrrell
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From: Tyrrell, Ken
Sent: Thursday, May 24, 2018 3:07 PM
To: Zhen, Davis <Zhen.Davis@epa.gov>; Coffey, Scott <CoffeySE@cdmsmith.com>; Young, Howard S. <younghs@cdmsmith.com>
Cc: Pretare, Jennifer <jennifer.pretare@aecom.com>; Ruffle, Betsy <betsy.ruffle@aecom.com>; Mixon, Karen <karen.mixon@aecom.com>
Subject: Change Request 06 - QAPP Items

Davis,

Please accept the attached change request that pertains to the QAPP. These are the items briefly discussed during our conference call on May 17.

It is our intent to implement these changes immediately and then to incorporate these into the final QAPP submittal following completion of the approval process for response to EPA's comments on the QAPP.

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CHANGE REQUEST FORM
Portland Harbor PDI Studies, 2018

Page: 1 of 1 Change No: 7

CHANGE REQUEST

The surface sediment samples collected from/after June 13 for polynuclear aromatic hydrocarbons (PAHs), bis(2-ethylhexyl) phthalate (BEHP), and tributyltin (TBT) will be moved from ALS Kelso to TestAmerica Seattle (TA Seattle).

Applicable Reference:

Quality Assurance Project Plan, Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling, Portland Harbor Superfund Site, Agency Approval Draft dated March 23, 2018, as amended by Change Request 06.

Description of Change:

All surface sediment samples for PAHs, BEHP, and TBT analyses collected from/after June 13 will be sent to TA Seattle rather than ALS Kelso. Quantitation and detection limits and control limits provided by TA Seattle are incorporated into this change request by reference (Table 1, attached) and achieve the ROD Table 17 cleanup levels for these compounds. The attached Table 1 and EPA approved Change Request form would be appended to the QAPP.

Method Summary:

Analyte Group	QAPP (ALS Kelso)	Alternate Laboratory		
		Laboratory	Method	SOP ID/Revision/Date
PAHs	8270D-SIM	TA Seattle	8270D-SIM	TA-MS-0315, Rev. 4, 4/25/18 (Analytical) TA-OP-0367, Rev. 7, 12/29/17 (Prep)
BEHP	8270D-LL	TA Seattle	8270D-LL	TA-MS-0315, Rev. 4, 4/25/18 (Analytical) TA-OP-0302, Rev. 18.1, 4/17/18 (Prep)
TBT	Krone by GC-FPD	TA Seattle	Krone by GC/MS	TA-MS-0346, Rev. 14, 10/17/2017

Reason for Change:

Due to a staffing shortage and instrument capacity, ALS-Kelso has been unable to keep up with the work load of this project. In order to keep on schedule and since TA Seattle has the capacity to take on the work, we will redirect these analyses as necessary in order to meet the project deadlines.

Impact on Present and Completed Work:

There will be no difference in the results reported for PAH and BEHP analysis as both labs use the same analytical methods. There is a minor difference between the instrumentation used by each lab for TBT; however, the preparation and derivatization is the same and results will be comparable. The redistribution of the analytical work will reduce schedule delays.

Requested By: Ken Tyrrell (AECOM Project Coordinator) Date: 6/26/2018

Acknowledged By: _____ (EPA Project Manager) Date: _____

APPROVAL

Senior Technical Advisor Karen Mixon Date: 6/26/2018

Client Project Coordinator: Ken Tyrrell Date: 6/26/2018

EPA Project Manager: _____ Date: _____

Table 1. Comparison of Limits for Surface Sediment Parameters to be Redirected from ALS Kelso to TestAmerica Seattle - Portland Harbor Pre-Design Investigation

					QAPP (ALS Kelso)									Additional Laboratory									
Parameter	Applicable Media	CAS Number	Units	ROD Cleanup Levels	Method	PQL	MDL	LCS - Low	LCS - High	LCS - RPD %	MS - Low	MS - High	MS - RPD %	Laboratory	Method	PQL	MDL	LCS - Low	LCS - High	LCS - RPD %	MS - Low	MS - High	MS - RPD %
Semivolatile Organic Compounds																							
Bis(2-ethylhexyl) phthalate	1	117-81-7	ug/Kg	135	8270D-LL	100	8.9	39	113	40	23	123	40	TA Seattle	8270D-LL	30	6.8	59	123	13	59	123	13
PAHs	2		ug/Kg	23000	8270D-SIM									TA Seattle	8270D-SIM								
cPAHs	2		ug/Kg	12	8270D-SIM									TA Seattle	8270D-SIM								
2-Methylnaphthalene	2	91-57-6	ug/Kg	NA	8270D-SIM	0.5	0.047	70	130	40	52	85	40	TA Seattle	8270D-SIM	1	0.09	68	120	12	68	120	12
Acenaphthene	2	83-32-9	ug/Kg	NA	8270D-SIM	0.5	0.032	70	130	40	51	82	40	TA Seattle	8270D-SIM	1	0.12	68	120	12	68	120	12
Acenaphthylene	2	208-96-8	ug/Kg	NA	8270D-SIM	0.5	0.029	70	130	40	51	80	40	TA Seattle	8270D-SIM	1	0.1	68	120	12	68	120	12
Anthracene	2	120-12-7	ug/Kg	NA	8270D-SIM	0.5	0.026	70	130	40	56	87	40	TA Seattle	8270D-SIM	1	0.12	73	125	12	73	125	12
Benzo[a]anthracene	2	56-55-3	ug/Kg	NA	8270D-SIM	0.5	0.033	70	130	40	65	97	40	TA Seattle	8270D-SIM	1	0.152	66	120	14	66	120	14
Benzo[a]pyrene	2	50-32-8	ug/Kg	NA	8270D-SIM	0.5	0.036	70	130	40	64	103	40	TA Seattle	8270D-SIM	1	0.08	72	124	12	72	124	12
Benzo[b]fluoranthene	2	205-99-2	ug/Kg	NA	8270D-SIM	0.5	0.057	70	130	40	63	99	40	TA Seattle	8270D-SIM	1	0.118	63	121	10	63	121	10
Benzo[g,h,i]perylene	2	191-24-2	ug/Kg	NA	8270D-SIM	0.5	0.059	70	130	40	56	101	40	TA Seattle	8270D-SIM	1	0.1	63	120	14	63	120	14
Benzo[k]fluoranthene	2	207-08-9	ug/Kg	NA	8270D-SIM	0.5	0.045	70	130	40	62	99	40	TA Seattle	8270D-SIM	1	0.12	63	123	15	63	123	15
Chrysene	2	218-01-9	ug/Kg	NA	8270D-SIM	0.5	0.027	70	130	40	63	100	40	TA Seattle	8270D-SIM	1	0.3	69	120	10	69	120	10
Dibenz(a,h)anthracene	2	53-70-3	ug/Kg	NA	8270D-SIM	0.5	0.058	70	130	40	56	104	40	TA Seattle	8270D-SIM	1	0.144	70	125	13	70	125	13
Fluoranthene	2	206-44-0	ug/Kg	NA	8270D-SIM	0.5	0.032	70	130	40	45	96	40	TA Seattle	8270D-SIM	1	0.28	74	125	13	74	125	13
Fluorene	2	86-73-7	ug/Kg	NA	8270D-SIM	0.5	0.039	70	130	40	52	83	40	TA Seattle	8270D-SIM	1	0.1	73	120	13	73	120	13
Indeno[1,2,3-cd]pyrene	2	193-39-5	ug/Kg	NA	8270D-SIM	0.5	0.064	70	130	40	61	105	40	TA Seattle	8270D-SIM	1	0.12	65	121	15	65	121	15
Naphthalene	2	91-20-3	ug/Kg	NA	8270D-SIM	0.5	0.089	70	130	40	48	77	40	TA Seattle	8270D-SIM	1	0.16	70	120	12	70	120	12
Phenanthrene	2	85-01-8	ug/Kg	NA	8270D-SIM	0.5	0.033	70	130	40	48	85	40	TA Seattle	8270D-SIM	1	0.138	73	120	11	73	120	11
Pyrene	2	129-00-0	ug/Kg	NA	8270D-SIM	0.5	0.032	70	130	40	59	98	40	TA Seattle	8270D-SIM	1	0.194	70	120	12	70	120	12
Tributyltin																							
Tributyltin	1	688-73-3	ug/Kg	3080	GC-FPD [3]	1	0.43	10	122	40	10	115	40	TA Seattle	GC/MS [3]	15.0	3.91	14	150	20	14	150	20

1 = Stratified Random Site and Downtown/Upriver Reach surface sediment samples only
2 = All sediment samples
3 = Krone, et al., Marine Environmental Research, Volume 27, Issue 1, 1989, Page 1-18.

CAS = chemical abstract number
cPAH = carcinogenic polycyclic aromatic hydrocarbons
LCS = laboratory control sample
LL = low-level, full scan
MDL = method detection limit
MS = matrix spike
NA = not applicable
PAH = polycyclic aromatic hydrocarbon
PQL = practical quantitation limi
QAPP = Quality Assurance Project Plan, dated March 23, 2018
ROD = record of decision
RPD = relative percent difference
SIM = selected ion monitoring
ug/kg = microgram per kilogram

Mixon, Karen

From: Tyrrell, Ken
Sent: Monday, June 25, 2018 3:20 PM
To: Anderson, Kimberly; Christine L. Hein; Christy Marquez; David Weber; Debbie Silva; Denise Fellers; Drew Gilpin; Eileen Tierney; Frederick Wolf; Gerald George; Greg Christianson; Hans P. Feige; Howard Cumberland; Jeff Ring; Jim Dragna; Karen Traeger; Kelmar, Laura; Kirsten L. Nathanson; Kline, Danni; Linda Baker; Loren Dunn; Mark Strandberg; Mat Cusma; Nathan F Blomgren; Norm DuPont; Peter Saba; PH.Admin.Record; Scott Rowlands
Cc: Pretare, Jennifer; Anne Fitzpatrick (afitzpatrick@geosyntec.com); Ruffle, Betsy; Keith Kroeger; Mixon, Karen; Dahl, Amy; Julia Klens Caprio
Subject: FYI....approval from EPA and request for SOP's --- FW: Change Request 07 - Lab Switch

PRIVILEGED AND CONFIDENTIAL / JOINT DEFENSE COMMUNICATION / ATTORNEY CLIENT WORK PRODUCT

For your information (and request for SOP's from Test America)

See the EPA approval for Change Request CR-07 for lab swith, plus their request for SOP's from TA.

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From: Zhen, Davis [mailto:Zhen.Davis@epa.gov]
Sent: Monday, June 25, 2018 3:15 PM
To: Tyrrell, Ken <ken.tyrrell@aecom.com>
Cc: Scott Coffey <coffeyse@cdmsmith.com>; younghs@cdmsmith.com; vickstromke@cdmsmith.com
Subject: Re: Change Request 07 - Lab Switch

Ken,

EPA has reviewed and approves of Change Request 07. In addition to the CR-07 form and CR-07 Table 1, EPA expects that the additional laboratory SOPs for these analyses from Test Amereica will be provided in an appendix to the QAPP. Let me know if you have any questions.

Thanks,

Sent from my iPhone, please excuse typos
****
Davis Zhen, Manager
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M/S ECL – 122, Seattle, WA 98101
Tel: (206) 553-7660
Cell: (206) 437-5826
****

On Jun 22, 2018, at 2:12 PM, Tyrrell, Ken <ken.tyrrell@aecom.com> wrote:

Davis,

Attached is Change Request 07 regarding the assigned laboratories analyzing surface sediment samples.

The surface sediment samples collected from/after June 13 for polynuclear aromatic hydrocarbons (PAHs), bis(2-ethylhexyl) phthalate (BEHP), and tributyltin (TBT) will be moved from ALS Kelso to TestAmerica Seattle (TA Seattle).

There is additional detail provided on the attached change request. The change request is provided in the native file format and please note there are two tabs.

We are providing notification of this change which is necessary to maintain the project schedule. We plan to implement this change beginning next week, the week of June 25.

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<CR07 - Lab switch.xlsx>

CHANGE REQUEST FORM
Portland Harbor PDI Studies, 2018

Page: 1 of 1 Change No: 9

CHANGE REQUEST

The subsurface sediment samples to be collected for chlorinated pesticides (specifically DDx isomers) and polynuclear aromatic hydrocarbons (PAHs) will be moved from ALS Kelso to the alternate laboratories presented in the table below.

Applicable Reference:

Quality Assurance Project Plan, Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling, Portland Harbor Superfund Site, Agency Approval Draft dated March 23, 2018, as amended by Change Requests 06 and 07.

Description of Change:

Subsurface sediment samples collected for chlorinated pesticides (only DDx isomers will be reported) and PAH analyses will be sent to the alternate laboratories listed below rather than ALS Kelso. Quantitation and detection limits and control limits provided by the alternate laboratories are incorporated into this change request by reference (Table 1, attached) and achieve the ROD Table 17 cleanup levels for these compounds. The attached Table 1 and EPA approved Change Request form would be appended to the QAPP.

Method Summary:

Analyte Group	QAPP (ALS Kelso)	Alternate Laboratory		
		Laboratory	Method	SOP ID/Revision/Date
Pesticides (DDx only)	1699M GC/MS/MS	ALS Burlington	1699 HR-GC/MS	BU-TM-1103, Rev. 7, 2/2/2017
PAHs	8270D-SIM	TA Seattle	8270D-SIM	TA-MS-0315, Rev. 4, 4/25/18 (Analytical) TA-OP-0367, Rev. 7, 12/29/17 (Prep)

Reason for Change:

Due to a staffing shortage and instrument capacity, ALS has been unable to keep up with the work load of this project. In order to keep on schedule and since the alternate laboratories have the capacity to take on the work, we will redirect these analyses as necessary in order to meet the project deadlines.

Impact on Present and Completed Work:

There will be no difference in the results reported for PAH analyses as both labs use the same analytical methods. The instrumentation used by each lab for pesticides is different and could yield data that is not completely comparable but the high resolution method performed by ALS Burlington will yield more sensitive data than the method performed by ALS Kelso and so the differences are acceptable to maintain schedule. The redistribution of the analytical work will reduce schedule delays.

Requested By: Ken Tyrrell (AECOM Project Coordinator) Date: 6/27/2018

Acknowledged By: _____ (EPA Project Manager) Date: _____

APPROVAL

Senior Technical Advisor Karen Mixon Date: 6/27/2018

Client Project Coordinator: Ken Tyrrell Date: 6/27/2018

EPA Project Manager: _____ Date: _____

Table 1. Comparison of Limits for Subsurface Sediment Parameters to be Redirected from ALS Kelso to Alternate Laboratories - Portland Harbor Pre-Design Investigation

					QAPP (ALS Kelso)									Additional Laboratory									
Parameter	**Applicable Media**	**CAS Number**	**Units**	**ROD Cleanup Levels**	**Method**	**PQL**	**MDL**	**LCS - Low**	**LCS - High**	**LCS - RPD %**	**MS - Low**	**MS - High**	**MS - RPD %**	**Laboratory**	**Method**	**PQL**	**MDL**	**LCS - Low**	**LCS - High**	**LCS - RPD %**	**MS - Low**	**MS - High**	**MS - RPD %**
Semivolatile Organic Compounds																							
PAHs	1		ug/kg	23000	8270D-SIM									TA Seattle	8270D-SIM								
cPAHs	1		ug/kg	12	8270D-SIM									TA Seattle	8270D-SIM								
2-Methylnaphthalene	1	91-57-6	ug/kg	NA	8270D-SIM	0.5	0.047	70	130	40	52	85	40	TA Seattle	8270D-SIM	1	0.09	68	120	12	68	120	12
Acenaphthene	1	83-32-9	ug/kg	NA	8270D-SIM	0.5	0.032	70	130	40	51	82	40	TA Seattle	8270D-SIM	1	0.12	68	120	12	68	120	12
Acenaphthylene	1	208-96-8	ug/kg	NA	8270D-SIM	0.5	0.029	70	130	40	51	80	40	TA Seattle	8270D-SIM	1	0.1	68	120	12	68	120	12
Anthracene	1	120-12-7	ug/kg	NA	8270D-SIM	0.5	0.026	70	130	40	56	87	40	TA Seattle	8270D-SIM	1	0.12	73	125	12	73	125	12
Benzo[a]anthracene	1	56-55-3	ug/kg	NA	8270D-SIM	0.5	0.033	70	130	40	65	97	40	TA Seattle	8270D-SIM	1	0.152	66	120	14	66	120	14
Benzo[a]pyrene	1	50-32-8	ug/kg	NA	8270D-SIM	0.5	0.036	70	130	40	64	103	40	TA Seattle	8270D-SIM	1	0.08	72	124	12	72	124	12
Benzo[b]fluoranthene	1	205-99-2	ug/kg	NA	8270D-SIM	0.5	0.057	70	130	40	63	99	40	TA Seattle	8270D-SIM	1	0.118	63	121	10	63	121	10
Benzo[g,h,i]perylene	1	191-24-2	ug/kg	NA	8270D-SIM	0.5	0.059	70	130	40	56	101	40	TA Seattle	8270D-SIM	1	0.1	63	120	14	63	120	14
Benzo[k]fluoranthene	1	207-08-9	ug/kg	NA	8270D-SIM	0.5	0.045	70	130	40	62	99	40	TA Seattle	8270D-SIM	1	0.12	63	123	15	63	123	15
Chrysene	1	218-01-9	ug/kg	NA	8270D-SIM	0.5	0.027	70	130	40	63	100	40	TA Seattle	8270D-SIM	1	0.3	69	120	10	69	120	10
Dibenz(a,h)anthracene	1	53-70-3	ug/kg	NA	8270D-SIM	0.5	0.058	70	130	40	56	104	40	TA Seattle	8270D-SIM	1	0.144	70	125	13	70	125	13
Fluoranthene	1	206-44-0	ug/kg	NA	8270D-SIM	0.5	0.032	70	130	40	45	96	40	TA Seattle	8270D-SIM	1	0.28	74	125	13	74	125	13
Fluorene	1	86-73-7	ug/kg	NA	8270D-SIM	0.5	0.039	70	130	40	52	83	40	TA Seattle	8270D-SIM	1	0.1	73	120	13	73	120	13
Indeno[1,2,3-cd]pyrene	1	193-39-5	ug/kg	NA	8270D-SIM	0.5	0.064	70	130	40	61	105	40	TA Seattle	8270D-SIM	1	0.12	65	121	15	65	121	15
Naphthalene	1	91-20-3	ug/kg	NA	8270D-SIM	0.5	0.089	70	130	40	48	77	40	TA Seattle	8270D-SIM	1	0.16	70	120	12	70	120	12
Phenanthrene	1	85-01-8	ug/kg	NA	8270D-SIM	0.5	0.033	70	130	40	48	85	40	TA Seattle	8270D-SIM	1	0.138	73	120	11	73	120	11
Pyrene	1	129-00-0	ug/kg	NA	8270D-SIM	0.5	0.032	70	130	40	59	98	40	TA Seattle	8270D-SIM	1	0.194	70	120	12	70	120	12
Parameter	**Applicable Media**	**CAS Number**	**Units**	**ROD Cleanup Levels**	**Method**	**PQL**	**MDL**	**LCS - Low**	**LCS - High**	**LCS - RPD %**	**MS - Low**	**MS - High**	**MS - RPD %**	**Laboratory**	**Method**	**MDL**	**EDL**	**LCS - Low**	**LCS - High**	**LCS - RPD %**	**MS - Low**	**MS - High**	**MS - RPD %**
Chlorinated Pesticides																							
DDx	1	--	ug/kg	6.1	GC/MS/MS 1699M	0.1	-	--	--	30	--	--	30	ALS Burlington	HR-GC/MS 1699			-	-	-	-	-	-
DDD [2]	1	--	ug/kg	114	GC/MS/MS 1699M	0.1	0.06	74	117	30	10	190	30	ALS Burlington	HR-GC/MS 1699	0.07	0.019	42	120	30	-	-	-
DDE [2]	1	--	ug/kg	226	GC/MS/MS 1699M	0.1	0.07	54	145	30	43	155	30	ALS Burlington	HR-GC/MS 1699	0.032	0.025	50	120	30	-	-	-
DDT [2]	1	--	ug/kg	246	GC/MS/MS 1699M	0.1	0.09	78	116	30	24	183	30	ALS Burlington	HR-GC/MS 1699	0.085	0.042	50	120	30	-	-	-

1 = All subsurface sediment samples
2 = The laboratory will analyze for both the 2,4 and 4,4 DDE, DDE, and DDT isomers.

CAS = chemical abstract number
cPAH = carcinogenic polycyclic aromatic hydrocarbons
EDL = estimated detection limit
GC/MS/MS = gas chromatography tandem mass spectrometry
HR-GC/MS = high resolution gas chromatography high resolution mass spectrometry
LCS = laboratory control sample
LL = low-level, full scan
MDL = method detection limit
MS = matrix spike
NA = not applicable
PAH = polycyclic aromatic hydrocarbon
PQL = practical quantitation limi
QAPP = Quality Assurance Project Plan, dated March 23, 2018
ROD = record of decision
RPD = relative percent difference
SIM = selected ion monitoring
ug/kg = microgram per kilogram

STATE OF LOUISIANA
DEPARTMENT OF ENVIRONMENTAL QUALITY

Is hereby granting a Louisiana Environmental Laboratory Accreditation to

ALS Environmental - Burlington
1435 Norjohn Ct Unit 1
Burlington, Ontario, Canada L7L 0E6

Agency Interest No. 199920
Activity No. ACC20180001

According to the Louisiana Administrative Code, Title 33, Part I, Subpart 3, LABORATORY ACCREDITATION, the State of Louisiana formally recognizes that this laboratory is technically competent to perform the environmental analyses listed on the scope of accreditation detailed in the attachment.

The laboratory agrees to perform all analyses listed on this scope of accreditation according to the Part I, Subpart 3 requirements and agrees to adapt to any changes in the requirements. It also acknowledges that continued accreditation is dependent on successful ongoing compliance with the applicable requirements of Part I and the 2009 TNI standards by which the laboratory was assessed. Please contact the Department of Environmental Quality, Louisiana Environmental Laboratory Accreditation Program (LELAP) to verify the laboratory's scope of accreditation and accreditation status.

Accreditation by the State of Louisiana is not an endorsement or a guarantee of validity of the data generated by the laboratory. Accreditation of the environmental laboratory does not imply that a product, process, system, or person is approved by LELAP. To be accredited initially and maintain accreditation, the laboratory agrees to participate in two single-blind, single-concentration PT studies, where available, per year for each field of testing for which it seeks accreditation or maintains accreditation as required in LAC 33:I.4711.

Cheryl Sonnier Nolan
Administrator
Public Participation and Permit Support Services Division

Issued Date: 22 June 2018

Effective Date: July 1, 2018
Expiration Date: June 30, 2019
Certificate Number: 05064

STATE OF LOUISIANA
DEPARTMENT OF ENVIRONMENTAL QUALITY

ALS Environmental - Burlington
AI Number: 199920
Activity No. ACC20180001
Expiration Date: June 30, 2019

Effective Date: July 1, 2018

1435 Norjohn Ct Unit 1, Burlington, Ontario, Canada L7L 0E6

Certificate Number: 05064

Air Emissions

Analyte	Method Name	Method Code	Type	AB
1005 - Antimony	EPA 0060	10003404	NELAP	LA
1010 - Arsenic	EPA 0060	10003404	NELAP	LA
1015 - Barium	EPA 0060	10003404	NELAP	LA
1020 - Beryllium	EPA 0060	10003404	NELAP	LA
1030 - Cadmium	EPA 0060	10003404	NELAP	LA
1050 - Cobalt	EPA 0060	10003404	NELAP	LA
1055 - Copper	EPA 0060	10003404	NELAP	LA
1075 - Lead	EPA 0060	10003404	NELAP	LA
1090 - Manganese	EPA 0060	10003404	NELAP	LA
1095 - Mercury	EPA 0060	10003404	NELAP	LA
1105 - Nickel	EPA 0060	10003404	NELAP	LA
1140 - Selenium	EPA 0060	10003404	NELAP	LA
1150 - Silver	EPA 0060	10003404	NELAP	LA
1165 - Thallium	EPA 0060	10003404	NELAP	LA
1910 - Total Phosphorus	EPA 0060	10003404	NELAP	LA
1600 - Total chromium	EPA 0060	10003404	NELAP	LA
1190 - Zinc	EPA 0060	10003404	NELAP	LA
100011 - Extraction of Semivolatile Analytes Collected Using Method 0010 (Modified Method 5 Sampling Train)	EPA 3542	10140600	NELAP	LA
3847 - Modified Method 5 Sampling Train	EPA 3542	10140600	NELAP	LA
5160 - 1,1,1-Trichloroethane	EPA 5041A	10154800	NELAP	LA
5110 - 1,1,2,2-Tetrachloroethane	EPA 5041A	10154800	NELAP	LA
5165 - 1,1,2-Trichloroethane	EPA 5041A	10154800	NELAP	LA
4630 - 1,1-Dichloroethane	EPA 5041A	10154800	NELAP	LA
5180 - 1,2,3-Trichloropropane	EPA 5041A	10154800	NELAP	LA
4635 - 1,2-Dichloroethane (Ethylene dichloride)	EPA 5041A	10154800	NELAP	LA
4655 - 1,2-Dichloropropane	EPA 5041A	10154800	NELAP	LA
4410 - 2-Butanone (Methyl ethyl ketone, MEK)	EPA 5041A	10154800	NELAP	LA
4860 - 2-Hexanone	EPA 5041A	10154800	NELAP	LA
4315 - Acetone	EPA 5041A	10154800	NELAP	LA
4375 - Benzene	EPA 5041A	10154800	NELAP	LA
4395 - Bromodichloromethane	EPA 5041A	10154800	NELAP	LA
4400 - Bromoform	EPA 5041A	10154800	NELAP	LA
4450 - Carbon disulfide	EPA 5041A	10154800	NELAP	LA
4455 - Carbon tetrachloride	EPA 5041A	10154800	NELAP	LA
4475 - Chlorobenzene	EPA 5041A	10154800	NELAP	LA
4575 - Chlorodibromomethane	EPA 5041A	10154800	NELAP	LA
4485 - Chloroethane (Ethyl chloride)	EPA 5041A	10154800	NELAP	LA
4505 - Chloroform	EPA 5041A	10154800	NELAP	LA
4595 - Dibromomethane (Methylene bromide)	EPA 5041A	10154800	NELAP	LA
4765 - Ethylbenzene	EPA 5041A	10154800	NELAP	LA
4950 - Methyl bromide (Bromomethane)	EPA 5041A	10154800	NELAP	LA
4960 - Methyl chloride (Chloromethane)	EPA 5041A	10154800	NELAP	LA
4975 - Methylene chloride (Dichloromethane)	EPA 5041A	10154800	NELAP	LA

Air Emissions

Analyte	Method Name	Method Code	Type	AB
5100 - Styrene	EPA 5041A	10154800	NELAP	LA
5115 - Tetrachloroethylene (Perchloroethylene)	EPA 5041A	10154800	NELAP	LA
5140 - Toluene	EPA 5041A	10154800	NELAP	LA
5170 - Trichloroethene (Trichloroethylene)	EPA 5041A	10154800	NELAP	LA
5175 - Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	EPA 5041A	10154800	NELAP	LA
5235 - Vinyl chloride	EPA 5041A	10154800	NELAP	LA
100719 - Volatile Principle Organic Hazardous Constituents	EPA 5041A	10154800	NELAP	LA
4705 - cis & trans-1,2-Dichloroethene	EPA 5041A	10154800	NELAP	LA
4645 - cis-1,2-Dichloroethylene	EPA 5041A	10154800	NELAP	LA
4680 - cis-1,3-Dichloropropene	EPA 5041A	10154800	NELAP	LA
5240 - m+p-xylene	EPA 5041A	10154800	NELAP	LA
5245 - m-Xylene	EPA 5041A	10154800	NELAP	LA
5250 - o-Xylene	EPA 5041A	10154800	NELAP	LA
5255 - p-Xylene	EPA 5041A	10154800	NELAP	LA
4700 - trans-1,2-Dichloroethylene	EPA 5041A	10154800	NELAP	LA
4685 - trans-1,3-Dichloropropylene	EPA 5041A	10154800	NELAP	LA
1095 - Mercury	EPA 7470	10165603	NELAP	LA
1095 - Mercury	EPA 7470A	10165807	NELAP	LA
5160 - 1,1,1-Trichloroethane	EPA 8260B	10184802	NELAP	LA
5110 - 1,1,2,2-Tetrachloroethane	EPA 8260B	10184802	NELAP	LA
5165 - 1,1,2-Trichloroethane	EPA 8260B	10184802	NELAP	LA
4630 - 1,1-Dichloroethane	EPA 8260B	10184802	NELAP	LA
5180 - 1,2,3-Trichloropropane	EPA 8260B	10184802	NELAP	LA
4635 - 1,2-Dichloroethane (Ethylene dichloride)	EPA 8260B	10184802	NELAP	LA
4655 - 1,2-Dichloropropane	EPA 8260B	10184802	NELAP	LA
4410 - 2-Butanone (Methyl ethyl ketone, MEK)	EPA 8260B	10184802	NELAP	LA
4860 - 2-Hexanone	EPA 8260B	10184802	NELAP	LA
4315 - Acetone	EPA 8260B	10184802	NELAP	LA
4375 - Benzene	EPA 8260B	10184802	NELAP	LA
4395 - Bromodichloromethane	EPA 8260B	10184802	NELAP	LA
4400 - Bromoform	EPA 8260B	10184802	NELAP	LA
4450 - Carbon disulfide	EPA 8260B	10184802	NELAP	LA
4455 - Carbon tetrachloride	EPA 8260B	10184802	NELAP	LA
4475 - Chlorobenzene	EPA 8260B	10184802	NELAP	LA
4575 - Chlorodibromomethane	EPA 8260B	10184802	NELAP	LA
4485 - Chloroethane (Ethyl chloride)	EPA 8260B	10184802	NELAP	LA
4505 - Chloroform	EPA 8260B	10184802	NELAP	LA
4595 - Dibromomethane (Methylene bromide)	EPA 8260B	10184802	NELAP	LA
4765 - Ethylbenzene	EPA 8260B	10184802	NELAP	LA
4950 - Methyl bromide (Bromomethane)	EPA 8260B	10184802	NELAP	LA
4960 - Methyl chloride (Chloromethane)	EPA 8260B	10184802	NELAP	LA
4975 - Methylene chloride (Dichloromethane)	EPA 8260B	10184802	NELAP	LA
5100 - Styrene	EPA 8260B	10184802	NELAP	LA
5115 - Tetrachloroethylene (Perchloroethylene)	EPA 8260B	10184802	NELAP	LA
5140 - Toluene	EPA 8260B	10184802	NELAP	LA
5170 - Trichloroethene (Trichloroethylene)	EPA 8260B	10184802	NELAP	LA
5175 - Trichlorofluoromethane	EPA 8260B	10184802	NELAP	LA

Air Emissions

Analyte	Method Name	Method Code	Type	AB
(Fluorotrichloromethane, Freon 11)				
5235 - Vinyl chloride	EPA 8260B	10184802	NELAP	LA
4705 - cis & trans-1,2-Dichloroethene	EPA 8260B	10184802	NELAP	LA
4645 - cis-1,2-Dichloroethylene	EPA 8260B	10184802	NELAP	LA
4680 - cis-1,3-Dichloropropene	EPA 8260B	10184802	NELAP	LA
5240 - m+p-xylene	EPA 8260B	10184802	NELAP	LA
5245 - m-Xylene	EPA 8260B	10184802	NELAP	LA
5250 - o-Xylene	EPA 8260B	10184802	NELAP	LA
5255 - p-Xylene	EPA 8260B	10184802	NELAP	LA
4700 - trans-1,2-Dichloroethylene	EPA 8260B	10184802	NELAP	LA
4685 - trans-1,3-Dichloropropylene	EPA 8260B	10184802	NELAP	LA
6715 - 1,2,4,5-Tetrachlorobenzene	EPA 8270	10185203	NELAP	LA
5155 - 1,2,4-Trichlorobenzene	EPA 8270	10185203	NELAP	LA
4610 - 1,2-Dichlorobenzene	EPA 8270	10185203	NELAP	LA
6885 - 1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8270	10185203	NELAP	LA
4615 - 1,3-Dichlorobenzene	EPA 8270	10185203	NELAP	LA
6160 - 1,3-Dinitrobenzene (1,3-DNB)	EPA 8270	10185203	NELAP	LA
4835 - 1,3-Hexachlorobutadiene	EPA 8270	10185203	NELAP	LA
4620 - 1,4-Dichlorobenzene	EPA 8270	10185203	NELAP	LA
5790 - 1-Chloronaphthalene	EPA 8270	10185203	NELAP	LA
6425 - 1-Naphthylamine	EPA 8270	10185203	NELAP	LA
6735 - 2,3,4,6-Tetrachlorophenol	EPA 8270	10185203	NELAP	LA
6835 - 2,4,5-Trichlorophenol	EPA 8270	10185203	NELAP	LA
6840 - 2,4,6-Trichlorophenol	EPA 8270	10185203	NELAP	LA
6000 - 2,4-Dichlorophenol	EPA 8270	10185203	NELAP	LA
6130 - 2,4-Dimethylphenol	EPA 8270	10185203	NELAP	LA
6175 - 2,4-Dinitrophenol	EPA 8270	10185203	NELAP	LA
6185 - 2,4-Dinitrotoluene (2,4-DNT)	EPA 8270	10185203	NELAP	LA
6005 - 2,6-Dichlorophenol	EPA 8270	10185203	NELAP	LA
6190 - 2,6-Dinitrotoluene (2,6-DNT)	EPA 8270	10185203	NELAP	LA
5515 - 2-Acetylaminofluorene	EPA 8270	10185203	NELAP	LA
5795 - 2-Chloronaphthalene	EPA 8270	10185203	NELAP	LA
5800 - 2-Chlorophenol	EPA 8270	10185203	NELAP	LA
6360 - 2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	EPA 8270	10185203	NELAP	LA
5145 - 2-Methylaniline (o-Toluidine)	EPA 8270	10185203	NELAP	LA
6385 - 2-Methylnaphthalene	EPA 8270	10185203	NELAP	LA
6400 - 2-Methylphenol (o-Cresol)	EPA 8270	10185203	NELAP	LA
6430 - 2-Naphthylamine	EPA 8270	10185203	NELAP	LA
6460 - 2-Nitroaniline	EPA 8270	10185203	NELAP	LA
6490 - 2-Nitrophenol	EPA 8270	10185203	NELAP	LA
6355 - 3-Methylcholanthrene	EPA 8270	10185203	NELAP	LA
6405 - 3-Methylphenol (m-Cresol)	EPA 8270	10185203	NELAP	LA
6465 - 3-Nitroaniline	EPA 8270	10185203	NELAP	LA
5540 - 4-Aminobiphenyl	EPA 8270	10185203	NELAP	LA
5660 - 4-Bromophenyl phenyl ether	EPA 8270	10185203	NELAP	LA
5700 - 4-Chloro-3-methylphenol	EPA 8270	10185203	NELAP	LA
5745 - 4-Chloroaniline	EPA 8270	10185203	NELAP	LA
5825 - 4-Chlorophenyl phenylether	EPA 8270	10185203	NELAP	LA
6410 - 4-Methylphenol (p-Cresol)	EPA 8270	10185203	NELAP	LA
6470 - 4-Nitroaniline	EPA 8270	10185203	NELAP	LA
6500 - 4-Nitrophenol	EPA 8270	10185203	NELAP	LA
6115 - 7,12-Dimethylbenz(a) anthracene	EPA 8270	10185203	NELAP	LA
9417 - 7h-Dibenzo(c,g) carbazole	EPA 8270	10185203	NELAP	LA
5500 - Acenaphthene	EPA 8270	10185203	NELAP	LA

Air Emissions

Analyte	Method Name	Method Code	Type	AB
5505 - Acenaphthylene	EPA 8270	10185203	NELAP	LA
5510 - Acetophenone	EPA 8270	10185203	NELAP	LA
5545 - Aniline	EPA 8270	10185203	NELAP	LA
5555 - Anthracene	EPA 8270	10185203	NELAP	LA
5575 - Benz(a)anthracene	EPA 8270	10185203	NELAP	LA
5580 - Benzo(a)pyrene	EPA 8270	10185203	NELAP	LA
5585 - Benzo(b)fluoranthene	EPA 8270	10185203	NELAP	LA
5590 - Benzo(g,h,i)perylene	EPA 8270	10185203	NELAP	LA
5600 - Benzo(k)fluoranthene	EPA 8270	10185203	NELAP	LA
5630 - Benzyl alcohol	EPA 8270	10185203	NELAP	LA
5670 - Butyl benzyl phthalate	EPA 8270	10185203	NELAP	LA
5855 - Chrysene	EPA 8270	10185203	NELAP	LA
6065 - Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate, DEHP)	EPA 8270	10185203	NELAP	LA
5925 - Di-n-butyl phthalate	EPA 8270	10185203	NELAP	LA
6200 - Di-n-octyl phthalate	EPA 8270	10185203	NELAP	LA
9354 - Dibenz(a, h) acridine	EPA 8270	10185203	NELAP	LA
5900 - Dibenz(a, j)acridine	EPA 8270	10185203	NELAP	LA
5895 - Dibenz(a,h)anthracene	EPA 8270	10185203	NELAP	LA
5890 - Dibenzo(a,e)pyrene	EPA 8270	10185203	NELAP	LA
9348 - Dibenzo(a,h) pyrene	EPA 8270	10185203	NELAP	LA
9351 - Dibenzo(a,i) pyrene	EPA 8270	10185203	NELAP	LA
5905 - Dibenzofuran	EPA 8270	10185203	NELAP	LA
6070 - Diethyl phthalate	EPA 8270	10185203	NELAP	LA
6135 - Dimethyl phthalate	EPA 8270	10185203	NELAP	LA
8620 - Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 8270	10185203	NELAP	LA
6205 - Diphenylamine	EPA 8270	10185203	NELAP	LA
6260 - Ethyl methanesulfonate	EPA 8270	10185203	NELAP	LA
6265 - Fluoranthene	EPA 8270	10185203	NELAP	LA
6270 - Fluorene	EPA 8270	10185203	NELAP	LA
6275 - Hexachlorobenzene	EPA 8270	10185203	NELAP	LA
6285 - Hexachlorocyclopentadiene	EPA 8270	10185203	NELAP	LA
4840 - Hexachloroethane	EPA 8270	10185203	NELAP	LA
6295 - Hexachloropropene	EPA 8270	10185203	NELAP	LA
6315 - Indeno(1,2,3-cd)pyrene	EPA 8270	10185203	NELAP	LA
6320 - Isophorone	EPA 8270	10185203	NELAP	LA
6325 - Isosafrole	EPA 8270	10185203	NELAP	LA
6375 - Methyl methanesulfonate	EPA 8270	10185203	NELAP	LA
5005 - Naphthalene	EPA 8270	10185203	NELAP	LA
6590 - Pentachlorobenzene	EPA 8270	10185203	NELAP	LA
5035 - Pentachloroethane	EPA 8270	10185203	NELAP	LA
6600 - Pentachloronitrobenzene	EPA 8270	10185203	NELAP	LA
6605 - Pentachlorophenol	EPA 8270	10185203	NELAP	LA
6610 - Phenacetin	EPA 8270	10185203	NELAP	LA
6615 - Phenanthrene	EPA 8270	10185203	NELAP	LA
6625 - Phenol	EPA 8270	10185203	NELAP	LA
6665 - Pyrene	EPA 8270	10185203	NELAP	LA
6685 - Safrole	EPA 8270	10185203	NELAP	LA
5760 - bis(2-Chloroethoxy)methane	EPA 8270	10185203	NELAP	LA
5765 - bis(2-Chloroethyl) ether	EPA 8270	10185203	NELAP	LA
5780 - bis(2-Chloroisopropyl) ether	EPA 8270	10185203	NELAP	LA
5025 - n-Nitroso-di-n-butylamine	EPA 8270	10185203	NELAP	LA
6545 - n-Nitrosodi-n-propylamine	EPA 8270	10185203	NELAP	LA
6525 - n-Nitrosodiethylamine	EPA 8270	10185203	NELAP	LA

Air Emissions

Analyte	Method Name	Method Code	Type	AB
6530 - n-Nitrosodimethylamine	EPA 8270	10185203	NELAP	LA
6535 - n-Nitrosodiphenylamine	EPA 8270	10185203	NELAP	LA
6550 - n-Nitrosomethylethylamine	EPA 8270	10185203	NELAP	LA
6555 - n-Nitrosomorpholine	EPA 8270	10185203	NELAP	LA
6560 - n-Nitrosopiperidine	EPA 8270	10185203	NELAP	LA
6565 - n-Nitrosopyrrolidine	EPA 8270	10185203	NELAP	LA
6105 - p-Dimethylaminoazobenzene	EPA 8270	10185203	NELAP	LA
9519 - 1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	EPA 8290	10187209	NELAP	LA
9516 - 1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	EPA 8290	10187209	NELAP	LA
9426 - 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)	EPA 8290	10187209	NELAP	LA
9420 - 1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)	EPA 8290	10187209	NELAP	LA
9423 - 1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)	EPA 8290	10187209	NELAP	LA
9453 - 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd)	EPA 8290	10187209	NELAP	LA
9471 - 1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-Hxcdf)	EPA 8290	10187209	NELAP	LA
9456 - 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin(1,2,3,6,7,8-Hxcdd)	EPA 8290	10187209	NELAP	LA
9474 - 1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf)	EPA 8290	10187209	NELAP	LA
9459 - 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd)	EPA 8290	10187209	NELAP	LA
9477 - 1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf)	EPA 8290	10187209	NELAP	LA
9540 - 1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd)	EPA 8290	10187209	NELAP	LA
9543 - 1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf)	EPA 8290	10187209	NELAP	LA
9480 - 2,3,4,6,7,8-Hexachlorodibenzofuran	EPA 8290	10187209	NELAP	LA
9549 - 2,3,4,7,8-Pentachlorodibenzofuran	EPA 8290	10187209	NELAP	LA
9618 - 2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD)	EPA 8290	10187209	NELAP	LA
9612 - 2,3,7,8-Tetrachlorodibenzofuran	EPA 8290	10187209	NELAP	LA
100489 - Dibenzo-p-dioxins & dibenzofurans	EPA 8290	10187209	NELAP	LA
9438 - Total Hpcdd	EPA 8290	10187209	NELAP	LA
9444 - Total Hpcdf	EPA 8290	10187209	NELAP	LA
9468 - Total Hxcdd	EPA 8290	10187209	NELAP	LA
9483 - Total Hxcdf	EPA 8290	10187209	NELAP	LA
9555 - Total Pecdd	EPA 8290	10187209	NELAP	LA
9552 - Total Pecdf	EPA 8290	10187209	NELAP	LA
9609 - Total TCDD	EPA 8290	10187209	NELAP	LA
9615 - Total TCDF	EPA 8290	10187209	NELAP	LA
9519 - 1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	EPA 8290A	10187403	NELAP	LA
9516 - 1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	EPA 8290A	10187403	NELAP	LA
9426 - 1,2,3,4,6,7,8-Heptachlorodibenzo-p-	EPA 8290A	10187403	NELAP	LA

Air Emissions

Analyte	Method Name	Method Code	Type	AB
dioxin (1,2,3,4,6,7,8-hpcdd)				
9420 - 1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)	EPA 8290A	10187403	NELAP	LA
9423 - 1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)	EPA 8290A	10187403	NELAP	LA
9453 - 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd)	EPA 8290A	10187403	NELAP	LA
9471 - 1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-Hxcdf)	EPA 8290A	10187403	NELAP	LA
9456 - 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin(1,2,3,6,7,8-Hxcdd)	EPA 8290A	10187403	NELAP	LA
9474 - 1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf)	EPA 8290A	10187403	NELAP	LA
9459 - 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd)	EPA 8290A	10187403	NELAP	LA
9477 - 1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf)	EPA 8290A	10187403	NELAP	LA
9540 - 1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd)	EPA 8290A	10187403	NELAP	LA
9543 - 1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf)	EPA 8290A	10187403	NELAP	LA
9480 - 2,3,4,6,7,8-Hexachlorodibenzofuran	EPA 8290A	10187403	NELAP	LA
9549 - 2,3,4,7,8-Pentachlorodibenzofuran	EPA 8290A	10187403	NELAP	LA
9618 - 2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD)	EPA 8290A	10187403	NELAP	LA
9612 - 2,3,7,8-Tetrachlorodibenzofuran	EPA 8290A	10187403	NELAP	LA
100489 - Dibenzo-p-dioxins & dibenzofurans	EPA 8290A	10187403	NELAP	LA
9438 - Total Hpcdd	EPA 8290A	10187403	NELAP	LA
9444 - Total Hpcdf	EPA 8290A	10187403	NELAP	LA
9468 - Total Hxcdd	EPA 8290A	10187403	NELAP	LA
9483 - Total Hxcdf	EPA 8290A	10187403	NELAP	LA
9555 - Total Pecdd	EPA 8290A	10187403	NELAP	LA
9552 - Total Pecdf	EPA 8290A	10187403	NELAP	LA
9609 - Total TCDD	EPA 8290A	10187403	NELAP	LA
9615 - Total TCDF	EPA 8290A	10187403	NELAP	LA
1575 - Chloride	EPA 9057	10199801	NELAP	LA
1515 - Ammonia as N	EPA CTM-027	10214707	NELAP	LA
9519 - 1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	EPA Method 23	10246705	NELAP	LA
9516 - 1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	EPA Method 23	10246705	NELAP	LA
9426 - 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)	EPA Method 23	10246705	NELAP	LA
9420 - 1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)	EPA Method 23	10246705	NELAP	LA
9423 - 1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)	EPA Method 23	10246705	NELAP	LA
9453 - 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd)	EPA Method 23	10246705	NELAP	LA
9471 - 1,2,3,4,7,8-Hexachlorodibenzofuran	EPA Method 23	10246705	NELAP	LA

Air Emissions

Analyte	Method Name	Method Code	Type	AB
(1,2,3,4,7,8-Hxcdf)				
9456 - 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin(1,2,3,6,7,8-Hxcdd)	EPA Method 23	10246705	NELAP	LA
9474 - 1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf)	EPA Method 23	10246705	NELAP	LA
9459 - 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd)	EPA Method 23	10246705	NELAP	LA
9477 - 1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf)	EPA Method 23	10246705	NELAP	LA
9540 - 1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd)	EPA Method 23	10246705	NELAP	LA
9543 - 1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf)	EPA Method 23	10246705	NELAP	LA
9480 - 2,3,4,6,7,8-Hexachlorodibenzofuran	EPA Method 23	10246705	NELAP	LA
9549 - 2,3,4,7,8-Pentachlorodibenzofuran	EPA Method 23	10246705	NELAP	LA
9618 - 2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD)	EPA Method 23	10246705	NELAP	LA
9612 - 2,3,7,8-Tetrachlorodibenzofuran	EPA Method 23	10246705	NELAP	LA
9438 - Total Hpcdd	EPA Method 23	10246705	NELAP	LA
9444 - Total Hpcdf	EPA Method 23	10246705	NELAP	LA
9468 - Total Hxcdd	EPA Method 23	10246705	NELAP	LA
9483 - Total Hxcdf	EPA Method 23	10246705	NELAP	LA
9555 - Total Pecdd	EPA Method 23	10246705	NELAP	LA
9552 - Total Pecdf	EPA Method 23	10246705	NELAP	LA
9609 - Total TCDD	EPA Method 23	10246705	NELAP	LA
9615 - Total TCDF	EPA Method 23	10246705	NELAP	LA
5500 - Acenaphthene	EPA TO-13A	10248405	NELAP	LA
5505 - Acenaphthylene	EPA TO-13A	10248405	NELAP	LA
5555 - Anthracene	EPA TO-13A	10248405	NELAP	LA
5575 - Benz(a)anthracene	EPA TO-13A	10248405	NELAP	LA
5580 - Benzo(a)pyrene	EPA TO-13A	10248405	NELAP	LA
5585 - Benzo(b)fluoranthene	EPA TO-13A	10248405	NELAP	LA
5605 - Benzo(e)pyrene	EPA TO-13A	10248405	NELAP	LA
5590 - Benzo(g,h,i)perylene	EPA TO-13A	10248405	NELAP	LA
5600 - Benzo(k)fluoranthene	EPA TO-13A	10248405	NELAP	LA
5855 - Chrysene	EPA TO-13A	10248405	NELAP	LA
5856 - Coronene	EPA TO-13A	10248405	NELAP	LA
5895 - Dibenz(a,h)anthracene	EPA TO-13A	10248405	NELAP	LA
6265 - Fluoranthene	EPA TO-13A	10248405	NELAP	LA
6270 - Fluorene	EPA TO-13A	10248405	NELAP	LA
6315 - Indeno(1,2,3-cd)pyrene	EPA TO-13A	10248405	NELAP	LA
5005 - Naphthalene	EPA TO-13A	10248405	NELAP	LA
6608 - Perylene	EPA TO-13A	10248405	NELAP	LA
6615 - Phenanthrene	EPA TO-13A	10248405	NELAP	LA
6665 - Pyrene	EPA TO-13A	10248405	NELAP	LA
7355 - 4,4'-DDD	EPA TO-4A	10249204	NELAP	LA
7360 - 4,4'-DDE	EPA TO-4A	10249204	NELAP	LA
7365 - 4,4'-DDT	EPA TO-4A	10249204	NELAP	LA
8880 - Aroclor-1016 (PCB-1016)	EPA TO-4A	10249204	NELAP	LA
8885 - Aroclor-1221 (PCB-1221)	EPA TO-4A	10249204	NELAP	LA
8890 - Aroclor-1232 (PCB-1232)	EPA TO-4A	10249204	NELAP	LA
8895 - Aroclor-1242 (PCB-1242)	EPA TO-4A	10249204	NELAP	LA
8900 - Aroclor-1248 (PCB-1248)	EPA TO-4A	10249204	NELAP	LA
8905 - Aroclor-1254 (PCB-1254)	EPA TO-4A	10249204	NELAP	LA
8910 - Aroclor-1260 (PCB-1260)	EPA TO-4A	10249204	NELAP	LA

Air Emissions

Analyte	Method Name	Method Code	Type	AB
8913 - Aroclor-1268 (PCB-1268)	EPA TO-4A	10249204	NELAP	LA
9519 - 1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	EPA TO-9A	10249408	NELAP	LA
9516 - 1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	EPA TO-9A	10249408	NELAP	LA
9426 - 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)	EPA TO-9A	10249408	NELAP	LA
9420 - 1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)	EPA TO-9A	10249408	NELAP	LA
9423 - 1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)	EPA TO-9A	10249408	NELAP	LA
9453 - 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd)	EPA TO-9A	10249408	NELAP	LA
9471 - 1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-Hxcdf)	EPA TO-9A	10249408	NELAP	LA
9456 - 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin(1,2,3,6,7,8-Hxcdd)	EPA TO-9A	10249408	NELAP	LA
9474 - 1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf)	EPA TO-9A	10249408	NELAP	LA
9459 - 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd)	EPA TO-9A	10249408	NELAP	LA
9477 - 1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf)	EPA TO-9A	10249408	NELAP	LA
9540 - 1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd)	EPA TO-9A	10249408	NELAP	LA
9543 - 1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf)	EPA TO-9A	10249408	NELAP	LA
9480 - 2,3,4,6,7,8-Hexachlorodibenzofuran	EPA TO-9A	10249408	NELAP	LA
9549 - 2,3,4,7,8-Pentachlorodibenzofuran	EPA TO-9A	10249408	NELAP	LA
9618 - 2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD)	EPA TO-9A	10249408	NELAP	LA
9612 - 2,3,7,8-Tetrachlorodibenzofuran	EPA TO-9A	10249408	NELAP	LA
9438 - Total Hpcdd	EPA TO-9A	10249408	NELAP	LA
9444 - Total Hpcdf	EPA TO-9A	10249408	NELAP	LA
9468 - Total Hxcdd	EPA TO-9A	10249408	NELAP	LA
9483 - Total Hxcdf	EPA TO-9A	10249408	NELAP	LA
9555 - Total Pecdd	EPA TO-9A	10249408	NELAP	LA
9552 - Total Pecdf	EPA TO-9A	10249408	NELAP	LA
9609 - Total TCDD	EPA TO-9A	10249408	NELAP	LA
9615 - Total TCDF	EPA TO-9A	10249408	NELAP	LA
1095 - Mercury	EPA 101A	10401204	NELAP	LA
4467 - Condensible Particulate Matter	EPA 202	10403006	NELAP	LA
100798 - Extractable Condensable Particulate Matter	EPA 202	10403006	NELAP	LA
100799 - Non-extractable Condensable Particulate Matter	EPA 202	10403006	NELAP	LA
1541 - Bromine	EPA 26	10403108	NELAP	LA
1575 - Chloride	EPA 26	10403108	NELAP	LA
1580 - Chlorine	EPA 26	10403108	NELAP	LA
1770 - Hydrochloric acid (Hydrogen chloride (gas only))	EPA 26	10403108	NELAP	LA
100096 - Hydrogen Bromide (HBr)	EPA 26	10403108	NELAP	LA
1775 - Hydrogen fluoride (Hydrofluoric	EPA 26	10403108	NELAP	LA

Air Emissions

Analyte	Method Name	Method Code	Type	AB
acid)				
1541 - Bromine	EPA 26A	10403200	NELAP	LA
1575 - Chloride	EPA 26A	10403200	NELAP	LA
1580 - Chlorine	EPA 26A	10403200	NELAP	LA
1770 - Hydrochloric acid (Hydrogen chloride (gas only))	EPA 26A	10403200	NELAP	LA
100096 - Hydrogen Bromide (HBr)	EPA 26A	10403200	NELAP	LA
1775 - Hydrogen fluoride (Hydrofluoric acid)	EPA 26A	10403200	NELAP	LA
1095 - Mercury	EPA Method 29 (CVAA)	10403302	NELAP	LA
1000 - Aluminum	EPA Method 29 (ICP-MS)	10403700	NELAP	LA
1005 - Antimony	EPA Method 29 (ICP-MS)	10403700	NELAP	LA
1010 - Arsenic	EPA Method 29 (ICP-MS)	10403700	NELAP	LA
1015 - Barium	EPA Method 29 (ICP-MS)	10403700	NELAP	LA
1020 - Beryllium	EPA Method 29 (ICP-MS)	10403700	NELAP	LA
1030 - Cadmium	EPA Method 29 (ICP-MS)	10403700	NELAP	LA
1040 - Chromium	EPA Method 29 (ICP-MS)	10403700	NELAP	LA
1050 - Cobalt	EPA Method 29 (ICP-MS)	10403700	NELAP	LA
1055 - Copper	EPA Method 29 (ICP-MS)	10403700	NELAP	LA
1070 - Iron	EPA Method 29 (ICP-MS)	10403700	NELAP	LA
1075 - Lead	EPA Method 29 (ICP-MS)	10403700	NELAP	LA
1090 - Manganese	EPA Method 29 (ICP-MS)	10403700	NELAP	LA
1100 - Molybdenum	EPA Method 29 (ICP-MS)	10403700	NELAP	LA
1105 - Nickel	EPA Method 29 (ICP-MS)	10403700	NELAP	LA
1140 - Selenium	EPA Method 29 (ICP-MS)	10403700	NELAP	LA
1150 - Silver	EPA Method 29 (ICP-MS)	10403700	NELAP	LA
1165 - Thallium	EPA Method 29 (ICP-MS)	10403700	NELAP	LA
1175 - Tin	EPA Method 29 (ICP-MS)	10403700	NELAP	LA
1910 - Total Phosphorus	EPA Method 29 (ICP-MS)	10403700	NELAP	LA
1185 - Vanadium	EPA Method 29 (ICP-MS)	10403700	NELAP	LA
1190 - Zinc	EPA Method 29 (ICP-MS)	10403700	NELAP	LA
3915 - Particulates	EPA 5	10404305	NELAP	LA
3915 - Particulates	EPA Method 5D	10404601	NELAP	LA
1095 - Mercury	ASTM D6784	30033104	NELAP	LA

Non Potable Water

Analyte	Method Name	Method Code	Type	AB
9519 - 1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	EPA 1613B	10120602	NELAP	LA
9516 - 1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	EPA 1613B	10120602	NELAP	LA
9426 - 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)	EPA 1613B	10120602	NELAP	LA
9420 - 1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)	EPA 1613B	10120602	NELAP	LA
9423 - 1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)	EPA 1613B	10120602	NELAP	LA
9453 - 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd)	EPA 1613B	10120602	NELAP	LA
9471 - 1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-Hxcdf)	EPA 1613B	10120602	NELAP	LA

Non Potable Water

Analyte	Method Name	Method Code	Type	AB
9456 - 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin(1,2,3,6,7,8-Hxcdd)	EPA 1613B	10120602	NELAP	LA
9474 - 1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf)	EPA 1613B	10120602	NELAP	LA
9459 - 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd)	EPA 1613B	10120602	NELAP	LA
9477 - 1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf)	EPA 1613B	10120602	NELAP	LA
9540 - 1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd)	EPA 1613B	10120602	NELAP	LA
9543 - 1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf)	EPA 1613B	10120602	NELAP	LA
9480 - 2,3,4,6,7,8-Hexachlorodibenzofuran	EPA 1613B	10120602	NELAP	LA
9549 - 2,3,4,7,8-Pentachlorodibenzofuran	EPA 1613B	10120602	NELAP	LA
9618 - 2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD)	EPA 1613B	10120602	NELAP	LA
9612 - 2,3,7,8-Tetrachlorodibenzofuran	EPA 1613B	10120602	NELAP	LA
9438 - Total Hpcdd	EPA 1613B	10120602	NELAP	LA
9444 - Total Hpcdf	EPA 1613B	10120602	NELAP	LA
9468 - Total Hxcdd	EPA 1613B	10120602	NELAP	LA
9483 - Total Hxcdf	EPA 1613B	10120602	NELAP	LA
9555 - Total Pecdd	EPA 1613B	10120602	NELAP	LA
9552 - Total Pecdf	EPA 1613B	10120602	NELAP	LA
9609 - Total TCDD	EPA 1613B	10120602	NELAP	LA
9615 - Total TCDF	EPA 1613B	10120602	NELAP	LA
9873 - 2,2',3,3',4',5,6-Heptabromodiphenylether (BDE-177)	EPA 1614A	10120704	NELAP	LA
9902 - 2,2',3,3',4,4',5,5',6-Nonabromodiphenylether (BDE-206)	EPA 1614A	10120704	NELAP	LA
9892 - 2,2',3,3',4,4',5,6'-Octabromodiphenylether (BDE-196)	EPA 1614A	10120704	NELAP	LA
9903 - 2,2',3,3',4,4',5,6,6'-Nonabromodiphenylether (BDE-207)	EPA 1614A	10120704	NELAP	LA
9893 - 2,2',3,3',4,4',6,6'-Octabromodiphenylether (BDE-197)	EPA 1614A	10120704	NELAP	LA
9867 - 2,2',3,3',4,4',6-Heptabromodiphenylether (BDE-171)	EPA 1614A	10120704	NELAP	LA
9897 - 2,2',3,3',4,5',6,6'-Octabromodiphenylether (BDE-201)	EPA 1614A	10120704	NELAP	LA
9904 - 2,2',3,3',4,5,5',6,6'-Nonabromodiphenylether (BDE-208)	EPA 1614A	10120704	NELAP	LA
9896 - 2,2',3,3',4,5,6,6'-Octabromodiphenylether (BDE-200)	EPA 1614A	10120704	NELAP	LA
9872 - 2,2',3,3',4,6,6'-Heptabromodiphenylether (BDE-176)	EPA 1614A	10120704	NELAP	LA
9789 - 2,2',3,4',5-Pentabromodiphenylether (BDE-90)	EPA 1614A	10120704	NELAP	LA
9879 - 2,2',3,4,4',5',6-Heptabromodiphenylether (BDE-183)	EPA 1614A	10120704	NELAP	LA
9835 - 2,2',3,4,4',5'-Hexabromodiphenylether (BDE-138)	EPA 1614A	10120704	NELAP	LA
9899 - 2,2',3,4,4',5,5',6-Octabromodiphenylether (BDE-203)	EPA 1614A	10120704	NELAP	LA
9876 - 2,2',3,4,4',5,5'-Heptabromodiphenylether (BDE-180)	EPA 1614A	10120704	NELAP	LA

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Analyte	Method Name	Method Code	Type	AB
9878 - 2,2',3,4,4',5,6'-Heptabromodiphenylether (BDE-182)	EPA 1614A	10120704	NELAP	LA
9900 - 2,2',3,4,4',5,6,6'-Octabromodiphenylether (BDE-204)	EPA 1614A	10120704	NELAP	LA
9877 - 2,2',3,4,4',5,6-Heptabromodiphenylether (BDE-181)	EPA 1614A	10120704	NELAP	LA
9837 - 2,2',3,4,4',6'-Hexabromodiphenylether (BDE-140)	EPA 1614A	10120704	NELAP	LA
9880 - 2,2',3,4,4',6,6'-Heptabromodiphenylether (BDE-184)	EPA 1614A	10120704	NELAP	LA
9836 - 2,2',3,4,4',6-Hexabromodiphenylether (BDE-139)	EPA 1614A	10120704	NELAP	LA
9784 - 2,2',3,4,4'-Pentabromodiphenylether (BDE-85)	EPA 1614A	10120704	NELAP	LA
9850 - 2,2',4,4',5',6-Hexabromodiphenylether (BDE-154)	EPA 1614A	10120704	NELAP	LA
9569 - 2,2',4,4',5,5'-Hexabromodiphenyl ether (BDE-153)	EPA 1614A	10120704	NELAP	LA
9571 - 2,2',4,4',5-Pentabromodiphenyl ether (BDE-99)	EPA 1614A	10120704	NELAP	LA
9851 - 2,2',4,4',6,6'-Hexabromodiphenylether (BDE-155)	EPA 1614A	10120704	NELAP	LA
9572 - 2,2',4,4',6-Pentabromodiphenyl ether (BDE-100)	EPA 1614A	10120704	NELAP	LA
9773 - 2,2',4,4'-Tetrabromodiphenyl ether (BDE-47)	EPA 1614A	10120704	NELAP	LA
9747 - 2,2',4,5'-Tetrabromodiphenylether (BDE-49)	EPA 1614A	10120704	NELAP	LA
9716 - 2,2',4-Tribromodiphenylether (BDE-17)	EPA 1614A	10120704	NELAP	LA
9749 - 2,2'4,6'-Tetrabromodiphenylether (BDE-51)	EPA 1614A	10120704	NELAP	LA
9769 - 2,3',4',6-Tetrabromodiphenylether (BDE-71)	EPA 1614A	10120704	NELAP	LA
9815 - 2,3',4,4',5-Pentabromodiphenylether (BDE-118)	EPA 1614A	10120704	NELAP	LA
9764 - 2,3',4,4'-Tetrabromodiphenylether (BDE-66)	EPA 1614A	10120704	NELAP	LA
9724 - 2,3',4-Tribromodiphenylether (BDE-25)	EPA 1614A	10120704	NELAP	LA
9887 - 2,3,3',4,4',5',6-Heptabromodiphenylether (BDE-191)	EPA 1614A	10120704	NELAP	LA
9901 - 2,3,3',4,4',5,5',6-Octabromodiphenylether (BDE-205)	EPA 1614A	10120704	NELAP	LA
9886 - 2,3,3',4,4',5,6-Heptabromodiphenylether (BDE-190)	EPA 1614A	10120704	NELAP	LA
9852 - 2,3,3',4,4,'5-Hexabromodiphenylether (BDE-156)	EPA 1614A	10120704	NELAP	LA
9862 - 2,3,4,4',5,6-Hexabromodiphenylether (BDE-166)	EPA 1614A	10120704	NELAP	LA
9813 - 2,3,4,5,6-Pentabromodiphenylether (BDE-116)	EPA 1614A	10120704	NELAP	LA
9720 - 2,3,4-Tribromodiphenylether (BDE-21)	EPA 1614A	10120704	NELAP	LA
9731 - 2,4',6-Tribromodiphenylether (BDE-	EPA 1614A	10120704	NELAP	LA

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Analyte	Method Name	Method Code	Type	AB
32)				
9774 - 2,4,4',6-Tetrabromodiphenylether (BDE-75)	EPA 1614A	10120704	NELAP	LA
9729 - 2,4,6-Tribromodiphenylether (BDE-30)	EPA 1614A	10120704	NELAP	LA
9706 - 2,4-Dibromodiphenylether (BDE-7)	EPA 1614A	10120704	NELAP	LA
9709 - 2,6-Dibromodiphenylether (BDE-10)	EPA 1614A	10120704	NELAP	LA
9700 - 2-Bromodiphenylether (BDE-1)	EPA 1614A	10120704	NELAP	LA
9865 - 3,3',4,4',5,5'-Hexabromodiphenylether (BDE-169)	EPA 1614A	10120704	NELAP	LA
9823 - 3,3',4,4',5-Pentabromodiphenylether (BDE-126)	EPA 1614A	10120704	NELAP	LA
9776 - 3,3',4,4'-Tetrabromodiphenylether (BDE-77)	EPA 1614A	10120704	NELAP	LA
9734 - 3,3',4-Tribromodiphenylether (BDE-35)	EPA 1614A	10120704	NELAP	LA
9712 - 3,4'-Dibromodiphenylether (BDE-13)	EPA 1614A	10120704	NELAP	LA
9736 - 3,4,4'-Tribromodiphenylether (BDE-37)	EPA 1614A	10120704	NELAP	LA
9711 - 3,4-Dibromodiphenylether (BDE-12)	EPA 1614A	10120704	NELAP	LA
9701 - 3-Bromodiphenylether (BDE-2)	EPA 1614A	10120704	NELAP	LA
9714 - 4,4'-Dibromodiphenylether (BDE-15)	EPA 1614A	10120704	NELAP	LA
5660 - 4-Bromophenyl phenyl ether	EPA 1614A	10120704	NELAP	LA
8902 - Coelution - Dibromodiphenyl ethers (BDE-8 + BDE-11)	EPA 1614A	10120704	NELAP	LA
9908 - Coelution - Pentabromodiphenyl ethers (BDE-119 + BDE-120)	EPA 1614A	10120704	NELAP	LA
9909 - Coelution - Tribromodiphenyl ethers (BDE-28 + BDE-33)	EPA 1614A	10120704	NELAP	LA
9905 - Decabromodiphenylether (BDE-209)	EPA 1614A	10120704	NELAP	LA
9105 - 2,2',3,3',4,4',5,5',6,6'-Decachlorobiphenyl (BZ-209)	EPA 1668A	10129405	NELAP	LA
9095 - 2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ-206)	EPA 1668A	10129405	NELAP	LA
9090 - 2,2',3,3',4,4',5,5'-Octachlorobiphenyl (BZ-194)	EPA 1668A	10129405	NELAP	LA
9102 - 2,2',3,3',4,4',5,6'-Octachlorobiphenyl (BZ-196)	EPA 1668A	10129405	NELAP	LA
9101 - 2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl (BZ-207)	EPA 1668A	10129405	NELAP	LA
9103 - 2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ-195)	EPA 1668A	10129405	NELAP	LA
9065 - 2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ-170)	EPA 1668A	10129405	NELAP	LA
9104 - 2,2',3,3',4,4',6,6'-Octachlorobiphenyl (BZ-197)	EPA 1668A	10129405	NELAP	LA
9106 - 2,2',3,3',4,4',6-Heptachlorobiphenyl (BZ-171)	EPA 1668A	10129405	NELAP	LA
9020 - 2,2',3,3',4,4'-Hexachlorobiphenyl (BZ-128)	EPA 1668A	10129405	NELAP	LA
9114 - 2,2',3,3',4,5',6'-Heptachlorobiphenyl (BZ-177)	EPA 1668A	10129405	NELAP	LA
9112 - 2,2',3,3',4,5',6,6'-Octachlorobiphenyl	EPA 1668A	10129405	NELAP	LA

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Analyte	Method Name	Method Code	Type	AB
(BZ-201)				
9115 - 2,2',3,3',4,5',6-Heptachlorobiphenyl (BZ-175)	EPA 1668A	10129405	NELAP	LA
9117 - 2,2',3,3',4,5'-Hexachlorobiphenyl (BZ-130)	EPA 1668A	10129405	NELAP	LA
9108 - 2,2',3,3',4,5,5',6'-Octachlorobiphenyl (BZ-199)	EPA 1668A	10129405	NELAP	LA
9107 - 2,2',3,3',4,5,5',6,6'-Nonachlorobiphenyl (BZ-208)	EPA 1668A	10129405	NELAP	LA
9109 - 2,2',3,3',4,5,5',6-Octachlorobiphenyl (BZ-198)	EPA 1668A	10129405	NELAP	LA
9110 - 2,2',3,3',4,5,5'-Heptachlorobiphenyl (BZ-172)	EPA 1668A	10129405	NELAP	LA
9116 - 2,2',3,3',4,5,6'-Heptachlorobiphenyl (BZ-174)	EPA 1668A	10129405	NELAP	LA
9111 - 2,2',3,3',4,5,6,6'-Octachlorobiphenyl (BZ-200)	EPA 1668A	10129405	NELAP	LA
9113 - 2,2',3,3',4,5,6-Heptachlorobiphenyl (BZ-173)	EPA 1668A	10129405	NELAP	LA
9118 - 2,2',3,3',4,5-Hexachlorobiphenyl (BZ-129)	EPA 1668A	10129405	NELAP	LA
9120 - 2,2',3,3',4,6'-Hexachlorobiphenyl (BZ-132)	EPA 1668A	10129405	NELAP	LA
9119 - 2,2',3,3',4,6,6'-Heptachlorobiphenyl (BZ-176)	EPA 1668A	10129405	NELAP	LA
9121 - 2,2',3,3',4,6-Hexachlorobiphenyl (BZ-131)	EPA 1668A	10129405	NELAP	LA
9122 - 2,2',3,3',4-Pentachlorobiphenyl (BZ-82)	EPA 1668A	10129405	NELAP	LA
9123 - 2,2',3,3',5,5',6,6'-Octachlorobiphenyl (BZ-202)	EPA 1668A	10129405	NELAP	LA
9124 - 2,2',3,3',5,5',6-Heptachlorobiphenyl (BZ-178)	EPA 1668A	10129405	NELAP	LA
9125 - 2,2',3,3',5,5'-Hexachlorobiphenyl (BZ-133)	EPA 1668A	10129405	NELAP	LA
9127 - 2,2',3,3',5,6'-Hexachlorobiphenyl (BZ-135)	EPA 1668A	10129405	NELAP	LA
9126 - 2,2',3,3',5,6,6'-Heptachlorobiphenyl (BZ-179)	EPA 1668A	10129405	NELAP	LA
9128 - 2,2',3,3',5,6-Hexachlorobiphenyl (BZ-134)	EPA 1668A	10129405	NELAP	LA
9129 - 2,2',3,3',5-Pentachlorobiphenyl (BZ-83)	EPA 1668A	10129405	NELAP	LA
9130 - 2,2',3,3',6,6'-Hexachlorobiphenyl (BZ-136)	EPA 1668A	10129405	NELAP	LA
9131 - 2,2',3,3',6-Pentachlorobiphenyl (BZ-84)	EPA 1668A	10129405	NELAP	LA
9132 - 2,2',3,3'-Tetrachlorobiphenyl (BZ-40)	EPA 1668A	10129405	NELAP	LA
9151 - 2,2',3,4',5',6-Hexachlorobiphenyl (BZ-149)	EPA 1668A	10129405	NELAP	LA
9154 - 2,2',3,4',5'-Pentachlorobiphenyl (BZ-97)	EPA 1668A	10129405	NELAP	LA
9080 - 2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ-187)	EPA 1668A	10129405	NELAP	LA

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Analyte	Method Name	Method Code	Type	AB
9144 - 2,2',3,4',5,5'-Hexachlorobiphenyl (BZ-146)	EPA 1668A	10129405	NELAP	LA
9147 - 2,2',3,4',5,6'-Hexachlorobiphenyl (BZ-148)	EPA 1668A	10129405	NELAP	LA
9146 - 2,2',3,4',5,6,6'-Heptachlorobiphenyl (BZ-188)	EPA 1668A	10129405	NELAP	LA
9149 - 2,2',3,4',5,6-Hexachlorobiphenyl (BZ-147)	EPA 1668A	10129405	NELAP	LA
9155 - 2,2',3,4',5-Pentachlorobiphenyl (BZ-90)	EPA 1668A	10129405	NELAP	LA
9159 - 2,2',3,4',6'-Pentachlorobiphenyl (BZ-98)	EPA 1668A	10129405	NELAP	LA
9157 - 2,2',3,4',6,6'-Hexachlorobiphenyl (BZ-150)	EPA 1668A	10129405	NELAP	LA
9160 - 2,2',3,4',6-Pentachlorobiphenyl (BZ-91)	EPA 1668A	10129405	NELAP	LA
9162 - 2,2',3,4'-Tetrachlorobiphenyl (BZ-42)	EPA 1668A	10129405	NELAP	LA
9075 - 2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ-183)	EPA 1668A	10129405	NELAP	LA
9025 - 2,2',3,4,4',5'-Hexachlorobiphenyl (BZ-138)	EPA 1668A	10129405	NELAP	LA
9133 - 2,2',3,4,4',5,5',6-Octachlorobiphenyl (BZ-203)	EPA 1668A	10129405	NELAP	LA
9134 - 2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ-180)	EPA 1668A	10129405	NELAP	LA
9136 - 2,2',3,4,4',5,6'-Heptachlorobiphenyl (BZ-182)	EPA 1668A	10129405	NELAP	LA
9135 - 2,2',3,4,4',5,6,6'-Octachlorobiphenyl (BZ-204)	EPA 1668A	10129405	NELAP	LA
9137 - 2,2',3,4,4',5,6-Heptachlorobiphenyl (BZ-181)	EPA 1668A	10129405	NELAP	LA
9138 - 2,2',3,4,4',5-Hexachlorobiphenyl (BZ-137)	EPA 1668A	10129405	NELAP	LA
9140 - 2,2',3,4,4',6'-Hexachlorobiphenyl (BZ-140)	EPA 1668A	10129405	NELAP	LA
9139 - 2,2',3,4,4',6,6'-Heptachlorobiphenyl (BZ-184)	EPA 1668A	10129405	NELAP	LA
9141 - 2,2',3,4,4',6-Hexachlorobiphenyl (BZ-139)	EPA 1668A	10129405	NELAP	LA
9142 - 2,2',3,4,4'-Pentachlorobiphenyl (BZ-85)	EPA 1668A	10129405	NELAP	LA
9150 - 2,2',3,4,5',6-Hexachlorobiphenyl (BZ-144)	EPA 1668A	10129405	NELAP	LA
8975 - 2,2',3,4,5'-Pentachlorobiphenyl (BZ-87)	EPA 1668A	10129405	NELAP	LA
9143 - 2,2',3,4,5,5',6-Heptachlorobiphenyl (BZ-185)	EPA 1668A	10129405	NELAP	LA
9030 - 2,2',3,4,5,5'-Hexachlorobiphenyl (BZ-141)	EPA 1668A	10129405	NELAP	LA
9152 - 2,2',3,4,5,6'-Hexachlorobiphenyl (BZ-143)	EPA 1668A	10129405	NELAP	LA
9145 - 2,2',3,4,5,6,6'-Heptachlorobiphenyl (BZ-186)	EPA 1668A	10129405	NELAP	LA
9148 - 2,2',3,4,5,6-Hexachlorobiphenyl	EPA 1668A	10129405	NELAP	LA

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Analyte	Method Name	Method Code	Type	AB
(BZ-142)				
9153 - 2,2',3,4,5-Pentachlorobiphenyl (BZ-86)	EPA 1668A	10129405	NELAP	LA
9161 - 2,2',3,4,6'-Pentachlorobiphenyl (BZ-89)	EPA 1668A	10129405	NELAP	LA
9156 - 2,2',3,4,6,6'-Hexachlorobiphenyl (BZ-145)	EPA 1668A	10129405	NELAP	LA
9158 - 2,2',3,4,6-Pentachlorobiphenyl (BZ-88)	EPA 1668A	10129405	NELAP	LA
9163 - 2,2',3,4-Tetrachlorobiphenyl (BZ-41)	EPA 1668A	10129405	NELAP	LA
9166 - 2,2',3,5',6-Pentachlorobiphenyl (BZ-95)	EPA 1668A	10129405	NELAP	LA
8945 - 2,2',3,5'-Tetrachlorobiphenyl (BZ-44)	EPA 1668A	10129405	NELAP	LA
9035 - 2,2',3,5,5',6-Hexachlorobiphenyl (BZ-151)	EPA 1668A	10129405	NELAP	LA
9164 - 2,2',3,5,5'-Pentachlorobiphenyl (BZ-92)	EPA 1668A	10129405	NELAP	LA
9167 - 2,2',3,5,6'-Pentachlorobiphenyl (BZ-94)	EPA 1668A	10129405	NELAP	LA
9165 - 2,2',3,5,6,6'-Hexachlorobiphenyl (BZ-152)	EPA 1668A	10129405	NELAP	LA
9168 - 2,2',3,5,6-Pentachlorobiphenyl (BZ-93)	EPA 1668A	10129405	NELAP	LA
9169 - 2,2',3,5-Tetrachlorobiphenyl (BZ-43)	EPA 1668A	10129405	NELAP	LA
9171 - 2,2',3,6'-Tetrachlorobiphenyl (BZ-46)	EPA 1668A	10129405	NELAP	LA
9170 - 2,2',3,6,6'-Pentachlorobiphenyl (BZ-96)	EPA 1668A	10129405	NELAP	LA
9172 - 2,2',3,6-Tetrachlorobiphenyl (BZ-45)	EPA 1668A	10129405	NELAP	LA
9173 - 2,2',3-Trichlorobiphenyl (BZ-16)	EPA 1668A	10129405	NELAP	LA
9040 - 2,2',4,4',5,5'-Hexachlorobiphenyl (BZ-153)	EPA 1668A	10129405	NELAP	LA
9174 - 2,2',4,4',5,6'-Hexachlorobiphenyl (BZ-154)	EPA 1668A	10129405	NELAP	LA
9175 - 2,2',4,4',5-Pentachlorobiphenyl (BZ-99)	EPA 1668A	10129405	NELAP	LA
9176 - 2,2',4,4',6,6'-Hexachlorobiphenyl (BZ-155)	EPA 1668A	10129405	NELAP	LA
9177 - 2,2',4,4',6-Pentachlorobiphenyl (BZ-100)	EPA 1668A	10129405	NELAP	LA
9178 - 2,2',4,4'-Tetrachlorobiphenyl (BZ-47)	EPA 1668A	10129405	NELAP	LA
9179 - 2,2',4,5',6-Pentachlorobiphenyl (BZ-103)	EPA 1668A	10129405	NELAP	LA
8950 - 2,2',4,5'-Tetrachlorobiphenyl (BZ-49)	EPA 1668A	10129405	NELAP	LA
8980 - 2,2',4,5,5'-Pentachlorobiphenyl (BZ-101)	EPA 1668A	10129405	NELAP	LA
9180 - 2,2',4,5,6'-Pentachlorobiphenyl (BZ-102)	EPA 1668A	10129405	NELAP	LA
9181 - 2,2',4,5-Tetrachlorobiphenyl (BZ-	EPA 1668A	10129405	NELAP	LA

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Analyte	Method Name	Method Code	Type	AB
48)				
9183 - 2,2',4,6'-Tetrachlorobiphenyl (BZ-51)	EPA 1668A	10129405	NELAP	LA
9182 - 2,2',4,6,6'-Pentachlorobiphenyl (BZ-104)	EPA 1668A	10129405	NELAP	LA
9184 - 2,2',4,6-Tetrachlorobiphenyl (BZ-50)	EPA 1668A	10129405	NELAP	LA
9185 - 2,2',4-Trichlorobiphenyl (BZ-17)	EPA 1668A	10129405	NELAP	LA
8955 - 2,2',5,5'-Tetrachlorobiphenyl (BZ-52)	EPA 1668A	10129405	NELAP	LA
9186 - 2,2',5,6'-Tetrachlorobiphenyl (BZ-53)	EPA 1668A	10129405	NELAP	LA
8930 - 2,2',5-Trichlorobiphenyl (BZ-18)	EPA 1668A	10129405	NELAP	LA
9187 - 2,2',6,6'-Tetrachlorobiphenyl (BZ-54)	EPA 1668A	10129405	NELAP	LA
9188 - 2,2',6-Trichlorobiphenyl (BZ-19)	EPA 1668A	10129405	NELAP	LA
9189 - 2,2'-Dichlorobiphenyl (BZ-4)	EPA 1668A	10129405	NELAP	LA
9224 - 2,3',4',5',6-Pentachlorobiphenyl (BZ-125)	EPA 1668A	10129405	NELAP	LA
9229 - 2,3',4',5'-Tetrachlorobiphenyl (BZ-76)	EPA 1668A	10129405	NELAP	LA
9222 - 2,3',4',5,5'-Pentachlorobiphenyl (BZ-124)	EPA 1668A	10129405	NELAP	LA
9230 - 2,3',4',5-Tetrachlorobiphenyl (BZ-70)	EPA 1668A	10129405	NELAP	LA
9237 - 2,3',4',6-Tetrachlorobiphenyl (BZ-71)	EPA 1668A	10129405	NELAP	LA
9239 - 2,3',4'-Trichlorobiphenyl (BZ-33)	EPA 1668A	10129405	NELAP	LA
9218 - 2,3',4,4',5',6-Hexachlorobiphenyl (BZ-168)	EPA 1668A	10129405	NELAP	LA
9000 - 2,3',4,4',5'-Pentachlorobiphenyl (BZ-123)	EPA 1668A	10129405	NELAP	LA
9011 - 2,3',4,4',5'-Pentachlorobiphenyl (BZ-123)	EPA 1668A	10129405	NELAP	LA
9055 - 2,3',4,4',5,5'-Hexachlorobiphenyl (BZ-167)	EPA 1668A	10129405	NELAP	LA
8995 - 2,3',4,4',5-Pentachlorobiphenyl (BZ-118)	EPA 1668A	10129405	NELAP	LA
9220 - 2,3',4,4',6-Pentachlorobiphenyl (BZ-119)	EPA 1668A	10129405	NELAP	LA
8960 - 2,3',4,4'-Tetrachlorobiphenyl (BZ-66)	EPA 1668A	10129405	NELAP	LA
9226 - 2,3',4,5',6-Pentachlorobiphenyl (BZ-121)	EPA 1668A	10129405	NELAP	LA
9231 - 2,3',4,5'-Tetrachlorobiphenyl (BZ-68)	EPA 1668A	10129405	NELAP	LA
9223 - 2,3',4,5,5'-Pentachlorobiphenyl (BZ-120)	EPA 1668A	10129405	NELAP	LA
9232 - 2,3',4,5-Tetrachlorobiphenyl (BZ-67)	EPA 1668A	10129405	NELAP	LA
9235 - 2,3',4,6-Tetrachlorobiphenyl (BZ-69)	EPA 1668A	10129405	NELAP	LA
9240 - 2,3',4-Trichlorobiphenyl (BZ-25)	EPA 1668A	10129405	NELAP	LA
9244 - 2,3',5',6-Tetrachlorobiphenyl (BZ-73)	EPA 1668A	10129405	NELAP	LA

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Analyte	Method Name	Method Code	Type	AB
9246 - 2,3',5'-Trichlorobiphenyl (BZ-34)	EPA 1668A	10129405	NELAP	LA
9242 - 2,3',5,5'-Tetrachlorobiphenyl (BZ-72)	EPA 1668A	10129405	NELAP	LA
8935 - 2,3',5-Trichlorobiphenyl (BZ-26)	EPA 1668A	10129405	NELAP	LA
9248 - 2,3',6-Trichlorobiphenyl (BZ-27)	EPA 1668A	10129405	NELAP	LA
9249 - 2,3'-Dichlorobiphenyl (BZ-6)	EPA 1668A	10129405	NELAP	LA
9201 - 2,3,3',4',5',6-Hexachlorobiphenyl (BZ-164)	EPA 1668A	10129405	NELAP	LA
9202 - 2,3,3',4',5'-Pentachlorobiphenyl (BZ-122)	EPA 1668A	10129405	NELAP	LA
9195 - 2,3,3',4',5,5',6-Heptachlorobiphenyl (BZ-193)	EPA 1668A	10129405	NELAP	LA
9197 - 2,3,3',4',5,5'-Hexachlorobiphenyl (BZ-162)	EPA 1668A	10129405	NELAP	LA
9199 - 2,3,3',4',5,6-Hexachlorobiphenyl (BZ-163)	EPA 1668A	10129405	NELAP	LA
9205 - 2,3,3',4',5-Pentachlorobiphenyl (BZ-107)	EPA 1668A	10129405	NELAP	LA
8990 - 2,3,3',4',6-Pentachlorobiphenyl (BZ-110)	EPA 1668A	10129405	NELAP	LA
9207 - 2,3,3',4'-Tetrachlorobiphenyl (BZ-56)	EPA 1668A	10129405	NELAP	LA
9192 - 2,3,3',4,4',5',6-Heptachlorobiphenyl (BZ-191)	EPA 1668A	10129405	NELAP	LA
9045 - 2,3,3',4,4',5'-Hexachlorobiphenyl (BZ-157)	EPA 1668A	10129405	NELAP	LA
9190 - 2,3,3',4,4',5,5',6-Octachlorobiphenyl (BZ-205)	EPA 1668A	10129405	NELAP	LA
9085 - 2,3,3',4,4',5,5'-Heptachlorobiphenyl (BZ-189)	EPA 1668A	10129405	NELAP	LA
9191 - 2,3,3',4,4',5,6-Heptachlorobiphenyl (BZ-190)	EPA 1668A	10129405	NELAP	LA
9050 - 2,3,3',4,4',5-Hexachlorobiphenyl (BZ-156)	EPA 1668A	10129405	NELAP	LA
9193 - 2,3,3',4,4',6-Hexachlorobiphenyl (BZ-158)	EPA 1668A	10129405	NELAP	LA
8985 - 2,3,3',4,4'-Pentachlorobiphenyl (BZ-105)	EPA 1668A	10129405	NELAP	LA
9200 - 2,3,3',4,5',6-Hexachlorobiphenyl (BZ-161)	EPA 1668A	10129405	NELAP	LA
9203 - 2,3,3',4,5'-Pentachlorobiphenyl (BZ-108)	EPA 1668A	10129405	NELAP	LA
9194 - 2,3,3',4,5,5',6-Heptachlorobiphenyl (BZ-192)	EPA 1668A	10129405	NELAP	LA
9196 - 2,3,3',4,5,5'-Hexachlorobiphenyl (BZ-159)	EPA 1668A	10129405	NELAP	LA
9198 - 2,3,3',4,5,6-Hexachlorobiphenyl (BZ-160)	EPA 1668A	10129405	NELAP	LA
9204 - 2,3,3',4,5-Pentachlorobiphenyl (BZ-106)	EPA 1668A	10129405	NELAP	LA
9206 - 2,3,3',4,6-Pentachlorobiphenyl (BZ-109)	EPA 1668A	10129405	NELAP	LA
9208 - 2,3,3',4-Tetrachlorobiphenyl (BZ-55)	EPA 1668A	10129405	NELAP	LA
9212 - 2,3,3',5',6-Pentachlorobiphenyl	EPA 1668A	10129405	NELAP	LA

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Analyte	Method Name	Method Code	Type	AB
(BZ-113)				
9213 - 2,3,3',5'-Tetrachlorobiphenyl (BZ-58)	EPA 1668A	10129405	NELAP	LA
9209 - 2,3,3',5,5',6-Hexachlorobiphenyl (BZ-165)	EPA 1668A	10129405	NELAP	LA
9210 - 2,3,3',5,5'-Pentachlorobiphenyl (BZ-111)	EPA 1668A	10129405	NELAP	LA
9211 - 2,3,3',5,6-Pentachlorobiphenyl (BZ-112)	EPA 1668A	10129405	NELAP	LA
9214 - 2,3,3',5-Tetrachlorobiphenyl (BZ-57)	EPA 1668A	10129405	NELAP	LA
9215 - 2,3,3',6-Tetrachlorobiphenyl (BZ-59)	EPA 1668A	10129405	NELAP	LA
9216 - 2,3,3'-Trichlorobiphenyl (BZ-20)	EPA 1668A	10129405	NELAP	LA
9227 - 2,3,4',5,6-Pentachlorobiphenyl (BZ-117)	EPA 1668A	10129405	NELAP	LA
9233 - 2,3,4',5-Tetrachlorobiphenyl (BZ-63)	EPA 1668A	10129405	NELAP	LA
9236 - 2,3,4',6-Tetrachlorobiphenyl (BZ-64)	EPA 1668A	10129405	NELAP	LA
9241 - 2,3,4'-Trichlorobiphenyl (BZ-22)	EPA 1668A	10129405	NELAP	LA
9217 - 2,3,4,4',5,6-Hexachlorobiphenyl (BZ-166)	EPA 1668A	10129405	NELAP	LA
9005 - 2,3,4,4',5-Pentachlorobiphenyl (BZ-114)	EPA 1668A	10129405	NELAP	LA
9219 - 2,3,4,4',6-Pentachlorobiphenyl (BZ-115)	EPA 1668A	10129405	NELAP	LA
9221 - 2,3,4,4'-Tetrachlorobiphenyl (BZ-60)	EPA 1668A	10129405	NELAP	LA
9225 - 2,3,4,5,6-Pentachlorobiphenyl (BZ-116)	EPA 1668A	10129405	NELAP	LA
9228 - 2,3,4,5-Tetrachlorobiphenyl (BZ-61)	EPA 1668A	10129405	NELAP	LA
9234 - 2,3,4,6-Tetrachlorobiphenyl (BZ-62)	EPA 1668A	10129405	NELAP	LA
9238 - 2,3,4-Trichlorobiphenyl (BZ-21)	EPA 1668A	10129405	NELAP	LA
9243 - 2,3,5,6-Tetrachlorobiphenyl (BZ-65)	EPA 1668A	10129405	NELAP	LA
9245 - 2,3,5-Trichlorobiphenyl (BZ-23)	EPA 1668A	10129405	NELAP	LA
9247 - 2,3,6-Trichlorobiphenyl (BZ-24)	EPA 1668A	10129405	NELAP	LA
8920 - 2,3-Dichlorobiphenyl (BZ-5)	EPA 1668A	10129405	NELAP	LA
8940 - 2,4',5-Trichlorobiphenyl (BZ-31)	EPA 1668A	10129405	NELAP	LA
9255 - 2,4',6-Trichlorobiphenyl (BZ-32)	EPA 1668A	10129405	NELAP	LA
9256 - 2,4'-Dichlorobiphenyl (BZ-8)	EPA 1668A	10129405	NELAP	LA
9250 - 2,4,4',5-Tetrachlorobiphenyl (BZ-74)	EPA 1668A	10129405	NELAP	LA
9251 - 2,4,4',6-Tetrachlorobiphenyl (BZ-75)	EPA 1668A	10129405	NELAP	LA
9252 - 2,4,4'-Trichlorobiphenyl (BZ-28)	EPA 1668A	10129405	NELAP	LA
9253 - 2,4,5-Trichlorobiphenyl (BZ-29)	EPA 1668A	10129405	NELAP	LA
9254 - 2,4,6-Trichlorobiphenyl (BZ-30)	EPA 1668A	10129405	NELAP	LA
9257 - 2,4-Dichlorobiphenyl (BZ-7)	EPA 1668A	10129405	NELAP	LA
9258 - 2,5-Dichlorobiphenyl (BZ-9)	EPA 1668A	10129405	NELAP	LA
9259 - 2,6-Dichlorobiphenyl (BZ-10)	EPA 1668A	10129405	NELAP	LA
8915 - 2-Chlorobiphenyl (BZ-1)	EPA 1668A	10129405	NELAP	LA

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Analyte	Method Name	Method Code	Type	AB
9060 - 3,3',4,4',5,5'-Hexachlorobiphenyl (BZ-169)	EPA 1668A	10129405	NELAP	LA
9015 - 3,3',4,4',5-Pentachlorobiphenyl (BZ-126)	EPA 1668A	10129405	NELAP	LA
8965 - 3,3',4,4'-Tetrachlorobiphenyl (BZ-77)	EPA 1668A	10129405	NELAP	LA
9261 - 3,3',4,5'-Tetrachlorobiphenyl (BZ-79)	EPA 1668A	10129405	NELAP	LA
9260 - 3,3',4,5,5'-Pentachlorobiphenyl (BZ-127)	EPA 1668A	10129405	NELAP	LA
9262 - 3,3',4,5-Tetrachlorobiphenyl (BZ-78)	EPA 1668A	10129405	NELAP	LA
9263 - 3,3',4-Trichlorobiphenyl (BZ-35)	EPA 1668A	10129405	NELAP	LA
9264 - 3,3',5,5'-Tetrachlorobiphenyl (BZ-80)	EPA 1668A	10129405	NELAP	LA
9265 - 3,3',5-Trichlorobiphenyl (BZ-36)	EPA 1668A	10129405	NELAP	LA
8925 - 3,3'-Dichlorobiphenyl (BZ-11)	EPA 1668A	10129405	NELAP	LA
9268 - 3,4',5-Trichlorobiphenyl (BZ-39)	EPA 1668A	10129405	NELAP	LA
9269 - 3,4'-Dichlorobiphenyl (BZ-13)	EPA 1668A	10129405	NELAP	LA
8970 - 3,4,4',5-Tetrachlorobiphenyl (BZ-81)	EPA 1668A	10129405	NELAP	LA
9266 - 3,4,4'-Trichlorobiphenyl (BZ-37)	EPA 1668A	10129405	NELAP	LA
9267 - 3,4,5-Trichlorobiphenyl (BZ-38)	EPA 1668A	10129405	NELAP	LA
9270 - 3,4-Dichlorobiphenyl (BZ-12)	EPA 1668A	10129405	NELAP	LA
9271 - 3,5-Dichlorobiphenyl (BZ-14)	EPA 1668A	10129405	NELAP	LA
9272 - 3-Chlorobiphenyl (BZ-2)	EPA 1668A	10129405	NELAP	LA
9273 - 4,4'-Dichlorobiphenyl (BZ-15)	EPA 1668A	10129405	NELAP	LA
9274 - 4-Chlorobiphenyl (BZ-3)	EPA 1668A	10129405	NELAP	LA
1444 - Separatory Funnel Liquid-liquid extraction	EPA 3510C	10138202	NELAP	LA
9105 - 2,2',3,3',4,4',5,5',6,6'-Decachlorobiphenyl (BZ-209)	EPA 1668C	10262109	NELAP	LA
9095 - 2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ-206)	EPA 1668C	10262109	NELAP	LA
9090 - 2,2',3,3',4,4',5,5'-Octachlorobiphenyl (BZ-194)	EPA 1668C	10262109	NELAP	LA
9102 - 2,2',3,3',4,4',5,6'-Octachlorobiphenyl (BZ-196)	EPA 1668C	10262109	NELAP	LA
9101 - 2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl (BZ-207)	EPA 1668C	10262109	NELAP	LA
9103 - 2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ-195)	EPA 1668C	10262109	NELAP	LA
9065 - 2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ-170)	EPA 1668C	10262109	NELAP	LA
9104 - 2,2',3,3',4,4',6,6'-Octachlorobiphenyl (BZ-197)	EPA 1668C	10262109	NELAP	LA
9106 - 2,2',3,3',4,4',6-Heptachlorobiphenyl (BZ-171)	EPA 1668C	10262109	NELAP	LA
9020 - 2,2',3,3',4,4'-Hexachlorobiphenyl (BZ-128)	EPA 1668C	10262109	NELAP	LA
9114 - 2,2',3,3',4,5',6'-Heptachlorobiphenyl (BZ-177)	EPA 1668C	10262109	NELAP	LA
9112 - 2,2',3,3',4,5',6,6'-Octachlorobiphenyl (BZ-201)	EPA 1668C	10262109	NELAP	LA
9115 - 2,2',3,3',4,5',6-Heptachlorobiphenyl	EPA 1668C	10262109	NELAP	LA

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Analyte	Method Name	Method Code	Type	AB
(BZ-175)				
9117 - 2,2',3,3',4,5'-Hexachlorobiphenyl (BZ-130)	EPA 1668C	10262109	NELAP	LA
9108 - 2,2',3,3',4,5,5',6'-Octachlorobiphenyl (BZ-199)	EPA 1668C	10262109	NELAP	LA
9107 - 2,2',3,3',4,5,5',6,6'-Nonachlorobiphenyl (BZ-208)	EPA 1668C	10262109	NELAP	LA
9109 - 2,2',3,3',4,5,5',6-Octachlorobiphenyl (BZ-198)	EPA 1668C	10262109	NELAP	LA
9110 - 2,2',3,3',4,5,5'-Heptachlorobiphenyl (BZ-172)	EPA 1668C	10262109	NELAP	LA
9116 - 2,2',3,3',4,5,6'-Heptachlorobiphenyl (BZ-174)	EPA 1668C	10262109	NELAP	LA
9111 - 2,2',3,3',4,5,6,6'-Octachlorobiphenyl (BZ-200)	EPA 1668C	10262109	NELAP	LA
9113 - 2,2',3,3',4,5,6-Heptachlorobiphenyl (BZ-173)	EPA 1668C	10262109	NELAP	LA
9118 - 2,2',3,3',4,5-Hexachlorobiphenyl (BZ-129)	EPA 1668C	10262109	NELAP	LA
9120 - 2,2',3,3',4,6'-Hexachlorobiphenyl (BZ-132)	EPA 1668C	10262109	NELAP	LA
9119 - 2,2',3,3',4,6,6'-Heptachlorobiphenyl (BZ-176)	EPA 1668C	10262109	NELAP	LA
9121 - 2,2',3,3',4,6-Hexachlorobiphenyl (BZ-131)	EPA 1668C	10262109	NELAP	LA
9122 - 2,2',3,3',4-Pentachlorobiphenyl (BZ-82)	EPA 1668C	10262109	NELAP	LA
9123 - 2,2',3,3',5,5',6,6'-Octachlorobiphenyl (BZ-202)	EPA 1668C	10262109	NELAP	LA
9124 - 2,2',3,3',5,5',6-Heptachlorobiphenyl (BZ-178)	EPA 1668C	10262109	NELAP	LA
9125 - 2,2',3,3',5,5'-Hexachlorobiphenyl (BZ-133)	EPA 1668C	10262109	NELAP	LA
9127 - 2,2',3,3',5,6'-Hexachlorobiphenyl (BZ-135)	EPA 1668C	10262109	NELAP	LA
9126 - 2,2',3,3',5,6,6'-Heptachlorobiphenyl (BZ-179)	EPA 1668C	10262109	NELAP	LA
9128 - 2,2',3,3',5,6-Hexachlorobiphenyl (BZ-134)	EPA 1668C	10262109	NELAP	LA
9129 - 2,2',3,3',5-Pentachlorobiphenyl (BZ-83)	EPA 1668C	10262109	NELAP	LA
9130 - 2,2',3,3',6,6'-Hexachlorobiphenyl (BZ-136)	EPA 1668C	10262109	NELAP	LA
9131 - 2,2',3,3',6-Pentachlorobiphenyl (BZ-84)	EPA 1668C	10262109	NELAP	LA
9132 - 2,2',3,3'-Tetrachlorobiphenyl (BZ-40)	EPA 1668C	10262109	NELAP	LA
9151 - 2,2',3,4',5',6-Hexachlorobiphenyl (BZ-149)	EPA 1668C	10262109	NELAP	LA
9154 - 2,2',3,4',5'-Pentachlorobiphenyl (BZ-97)	EPA 1668C	10262109	NELAP	LA
9080 - 2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ-187)	EPA 1668C	10262109	NELAP	LA
9144 - 2,2',3,4',5,5'-Hexachlorobiphenyl (BZ-146)	EPA 1668C	10262109	NELAP	LA

Non Potable Water

Analyte	Method Name	Method Code	Type	AB
9147 - 2,2',3,4',5,6'-Hexachlorobiphenyl (BZ-148)	EPA 1668C	10262109	NELAP	LA
9146 - 2,2',3,4',5,6,6'-Heptachlorobiphenyl (BZ-188)	EPA 1668C	10262109	NELAP	LA
9149 - 2,2',3,4',5,6-Hexachlorobiphenyl (BZ-147)	EPA 1668C	10262109	NELAP	LA
9155 - 2,2',3,4',5-Pentachlorobiphenyl (BZ-90)	EPA 1668C	10262109	NELAP	LA
9159 - 2,2',3,4',6'-Pentachlorobiphenyl (BZ-98)	EPA 1668C	10262109	NELAP	LA
9157 - 2,2',3,4',6,6'-Hexachlorobiphenyl (BZ-150)	EPA 1668C	10262109	NELAP	LA
9160 - 2,2',3,4',6-Pentachlorobiphenyl (BZ-91)	EPA 1668C	10262109	NELAP	LA
9162 - 2,2',3,4'-Tetrachlorobiphenyl (BZ-42)	EPA 1668C	10262109	NELAP	LA
9075 - 2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ-183)	EPA 1668C	10262109	NELAP	LA
9025 - 2,2',3,4,4',5'-Hexachlorobiphenyl (BZ-138)	EPA 1668C	10262109	NELAP	LA
9133 - 2,2',3,4,4',5,5',6-Octachlorobiphenyl (BZ-203)	EPA 1668C	10262109	NELAP	LA
9134 - 2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ-180)	EPA 1668C	10262109	NELAP	LA
9136 - 2,2',3,4,4',5,6'-Heptachlorobiphenyl (BZ-182)	EPA 1668C	10262109	NELAP	LA
9135 - 2,2',3,4,4',5,6,6'-Octachlorobiphenyl (BZ-204)	EPA 1668C	10262109	NELAP	LA
9137 - 2,2',3,4,4',5,6-Heptachlorobiphenyl (BZ-181)	EPA 1668C	10262109	NELAP	LA
9138 - 2,2',3,4,4',5-Hexachlorobiphenyl (BZ-137)	EPA 1668C	10262109	NELAP	LA
9140 - 2,2',3,4,4',6'-Hexachlorobiphenyl (BZ-140)	EPA 1668C	10262109	NELAP	LA
9139 - 2,2',3,4,4',6,6'-Heptachlorobiphenyl (BZ-184)	EPA 1668C	10262109	NELAP	LA
9141 - 2,2',3,4,4',6-Hexachlorobiphenyl (BZ-139)	EPA 1668C	10262109	NELAP	LA
9142 - 2,2',3,4,4'-Pentachlorobiphenyl (BZ-85)	EPA 1668C	10262109	NELAP	LA
9150 - 2,2',3,4,5',6-Hexachlorobiphenyl (BZ-144)	EPA 1668C	10262109	NELAP	LA
8975 - 2,2',3,4,5'-Pentachlorobiphenyl (BZ-87)	EPA 1668C	10262109	NELAP	LA
9143 - 2,2',3,4,5,5',6-Heptachlorobiphenyl (BZ-185)	EPA 1668C	10262109	NELAP	LA
9030 - 2,2',3,4,5,5'-Hexachlorobiphenyl (BZ-141)	EPA 1668C	10262109	NELAP	LA
9152 - 2,2',3,4,5,6'-Hexachlorobiphenyl (BZ-143)	EPA 1668C	10262109	NELAP	LA
9145 - 2,2',3,4,5,6,6'-Heptachlorobiphenyl (BZ-186)	EPA 1668C	10262109	NELAP	LA
9148 - 2,2',3,4,5,6-Hexachlorobiphenyl (BZ-142)	EPA 1668C	10262109	NELAP	LA
9153 - 2,2',3,4,5-Pentachlorobiphenyl (BZ-	EPA 1668C	10262109	NELAP	LA

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Analyte	Method Name	Method Code	Type	AB
86)				
9161 - 2,2',3,4,6'-Pentachlorobiphenyl (BZ-89)	EPA 1668C	10262109	NELAP	LA
9156 - 2,2',3,4,6,6'-Hexachlorobiphenyl (BZ-145)	EPA 1668C	10262109	NELAP	LA
9158 - 2,2',3,4,6-Pentachlorobiphenyl (BZ-88)	EPA 1668C	10262109	NELAP	LA
9163 - 2,2',3,4-Tetrachlorobiphenyl (BZ-41)	EPA 1668C	10262109	NELAP	LA
9166 - 2,2',3,5',6-Pentachlorobiphenyl (BZ-95)	EPA 1668C	10262109	NELAP	LA
8945 - 2,2',3,5'-Tetrachlorobiphenyl (BZ-44)	EPA 1668C	10262109	NELAP	LA
9035 - 2,2',3,5,5',6-Hexachlorobiphenyl (BZ-151)	EPA 1668C	10262109	NELAP	LA
9164 - 2,2',3,5,5'-Pentachlorobiphenyl (BZ-92)	EPA 1668C	10262109	NELAP	LA
9167 - 2,2',3,5,6'-Pentachlorobiphenyl (BZ-94)	EPA 1668C	10262109	NELAP	LA
9165 - 2,2',3,5,6,6'-Hexachlorobiphenyl (BZ-152)	EPA 1668C	10262109	NELAP	LA
9168 - 2,2',3,5,6-Pentachlorobiphenyl (BZ-93)	EPA 1668C	10262109	NELAP	LA
9169 - 2,2',3,5-Tetrachlorobiphenyl (BZ-43)	EPA 1668C	10262109	NELAP	LA
9171 - 2,2',3,6'-Tetrachlorobiphenyl (BZ-46)	EPA 1668C	10262109	NELAP	LA
9170 - 2,2',3,6,6'-Pentachlorobiphenyl (BZ-96)	EPA 1668C	10262109	NELAP	LA
9172 - 2,2',3,6-Tetrachlorobiphenyl (BZ-45)	EPA 1668C	10262109	NELAP	LA
9173 - 2,2',3-Trichlorobiphenyl (BZ-16)	EPA 1668C	10262109	NELAP	LA
9040 - 2,2',4,4',5,5'-Hexachlorobiphenyl (BZ-153)	EPA 1668C	10262109	NELAP	LA
9174 - 2,2',4,4',5,6'-Hexachlorobiphenyl (BZ-154)	EPA 1668C	10262109	NELAP	LA
9175 - 2,2',4,4',5-Pentachlorobiphenyl (BZ-99)	EPA 1668C	10262109	NELAP	LA
9176 - 2,2',4,4',6,6'-Hexachlorobiphenyl (BZ-155)	EPA 1668C	10262109	NELAP	LA
9177 - 2,2',4,4',6-Pentachlorobiphenyl (BZ-100)	EPA 1668C	10262109	NELAP	LA
9178 - 2,2',4,4'-Tetrachlorobiphenyl (BZ-47)	EPA 1668C	10262109	NELAP	LA
9179 - 2,2',4,5',6-Pentachlorobiphenyl (BZ-103)	EPA 1668C	10262109	NELAP	LA
8950 - 2,2',4,5'-Tetrachlorobiphenyl (BZ-49)	EPA 1668C	10262109	NELAP	LA
8980 - 2,2',4,5,5'-Pentachlorobiphenyl (BZ-101)	EPA 1668C	10262109	NELAP	LA
9180 - 2,2',4,5,6'-Pentachlorobiphenyl (BZ-102)	EPA 1668C	10262109	NELAP	LA
9181 - 2,2',4,5-Tetrachlorobiphenyl (BZ-48)	EPA 1668C	10262109	NELAP	LA
9183 - 2,2',4,6'-Tetrachlorobiphenyl (BZ-	EPA 1668C	10262109	NELAP	LA

Non Potable Water

Analyte	Method Name	Method Code	Type	AB
51)				
9182 - 2,2',4,6,6'-Pentachlorobiphenyl (BZ-104)	EPA 1668C	10262109	NELAP	LA
9184 - 2,2',4,6-Tetrachlorobiphenyl (BZ-50)	EPA 1668C	10262109	NELAP	LA
9185 - 2,2',4-Trichlorobiphenyl (BZ-17)	EPA 1668C	10262109	NELAP	LA
8955 - 2,2',5,5'-Tetrachlorobiphenyl (BZ-52)	EPA 1668C	10262109	NELAP	LA
9186 - 2,2',5,6'-Tetrachlorobiphenyl (BZ-53)	EPA 1668C	10262109	NELAP	LA
8930 - 2,2',5-Trichlorobiphenyl (BZ-18)	EPA 1668C	10262109	NELAP	LA
9187 - 2,2',6,6'-Tetrachlorobiphenyl (BZ-54)	EPA 1668C	10262109	NELAP	LA
9188 - 2,2',6-Trichlorobiphenyl (BZ-19)	EPA 1668C	10262109	NELAP	LA
9189 - 2,2'-Dichlorobiphenyl (BZ-4)	EPA 1668C	10262109	NELAP	LA
9224 - 2,3',4',5',6-Pentachlorobiphenyl (BZ-125)	EPA 1668C	10262109	NELAP	LA
9229 - 2,3',4',5'-Tetrachlorobiphenyl (BZ-76)	EPA 1668C	10262109	NELAP	LA
9222 - 2,3',4',5,5'-Pentachlorobiphenyl (BZ-124)	EPA 1668C	10262109	NELAP	LA
9230 - 2,3',4',5-Tetrachlorobiphenyl (BZ-70)	EPA 1668C	10262109	NELAP	LA
9237 - 2,3',4',6-Tetrachlorobiphenyl (BZ-71)	EPA 1668C	10262109	NELAP	LA
9239 - 2,3',4'-Trichlorobiphenyl (BZ-33)	EPA 1668C	10262109	NELAP	LA
9218 - 2,3',4,4',5',6-Hexachlorobiphenyl (BZ-168)	EPA 1668C	10262109	NELAP	LA
9000 - 2,3',4,4',5'-Pentachlorobiphenyl (BZ-123)	EPA 1668C	10262109	NELAP	LA
9011 - 2,3',4,4',5'-Pentachlorobiphenyl (BZ-123)	EPA 1668C	10262109	NELAP	LA
9055 - 2,3',4,4',5,5'-Hexachlorobiphenyl (BZ-167)	EPA 1668C	10262109	NELAP	LA
8995 - 2,3',4,4',5-Pentachlorobiphenyl (BZ-118)	EPA 1668C	10262109	NELAP	LA
9220 - 2,3',4,4',6-Pentachlorobiphenyl (BZ-119)	EPA 1668C	10262109	NELAP	LA
8960 - 2,3',4,4'-Tetrachlorobiphenyl (BZ-66)	EPA 1668C	10262109	NELAP	LA
9226 - 2,3',4,5',6-Pentachlorobiphenyl (BZ-121)	EPA 1668C	10262109	NELAP	LA
9231 - 2,3',4,5'-Tetrachlorobiphenyl (BZ-68)	EPA 1668C	10262109	NELAP	LA
9223 - 2,3',4,5,5'-Pentachlorobiphenyl (BZ-120)	EPA 1668C	10262109	NELAP	LA
9232 - 2,3',4,5-Tetrachlorobiphenyl (BZ-67)	EPA 1668C	10262109	NELAP	LA
9235 - 2,3',4,6-Tetrachlorobiphenyl (BZ-69)	EPA 1668C	10262109	NELAP	LA
9240 - 2,3',4-Trichlorobiphenyl (BZ-25)	EPA 1668C	10262109	NELAP	LA
9244 - 2,3',5',6-Tetrachlorobiphenyl (BZ-73)	EPA 1668C	10262109	NELAP	LA
9246 - 2,3',5'-Trichlorobiphenyl (BZ-34)	EPA 1668C	10262109	NELAP	LA
9242 - 2,3',5,5'-Tetrachlorobiphenyl (BZ-	EPA 1668C	10262109	NELAP	LA

Non Potable Water

Analyte	Method Name	Method Code	Type	AB
72)				
8935 - 2,3',5-Trichlorobiphenyl (BZ-26)	EPA 1668C	10262109	NELAP	LA
9248 - 2,3',6-Trichlorobiphenyl (BZ-27)	EPA 1668C	10262109	NELAP	LA
9249 - 2,3'-Dichlorobiphenyl (BZ-6)	EPA 1668C	10262109	NELAP	LA
9201 - 2,3,3',4',5',6-Hexachlorobiphenyl (BZ-164)	EPA 1668C	10262109	NELAP	LA
9202 - 2,3,3',4',5'-Pentachlorobiphenyl (BZ-122)	EPA 1668C	10262109	NELAP	LA
9195 - 2,3,3',4',5,5',6-Heptachlorobiphenyl (BZ-193)	EPA 1668C	10262109	NELAP	LA
9197 - 2,3,3',4',5,5'-Hexachlorobiphenyl (BZ-162)	EPA 1668C	10262109	NELAP	LA
9199 - 2,3,3',4',5,6-Hexachlorobiphenyl (BZ-163)	EPA 1668C	10262109	NELAP	LA
9205 - 2,3,3',4',5-Pentachlorobiphenyl (BZ-107)	EPA 1668C	10262109	NELAP	LA
8990 - 2,3,3',4',6-Pentachlorobiphenyl (BZ-110)	EPA 1668C	10262109	NELAP	LA
9207 - 2,3,3',4'-Tetrachlorobiphenyl (BZ-56)	EPA 1668C	10262109	NELAP	LA
9192 - 2,3,3',4,4',5',6-Heptachlorobiphenyl (BZ-191)	EPA 1668C	10262109	NELAP	LA
9045 - 2,3,3',4,4',5'-Hexachlorobiphenyl (BZ-157)	EPA 1668C	10262109	NELAP	LA
9190 - 2,3,3',4,4',5,5',6-Octachlorobiphenyl (BZ-205)	EPA 1668C	10262109	NELAP	LA
9085 - 2,3,3',4,4',5,5'-Heptachlorobiphenyl (BZ-189)	EPA 1668C	10262109	NELAP	LA
9191 - 2,3,3',4,4',5,6-Heptachlorobiphenyl (BZ-190)	EPA 1668C	10262109	NELAP	LA
9050 - 2,3,3',4,4',5-Hexachlorobiphenyl (BZ-156)	EPA 1668C	10262109	NELAP	LA
9193 - 2,3,3',4,4',6-Hexachlorobiphenyl (BZ-158)	EPA 1668C	10262109	NELAP	LA
8985 - 2,3,3',4,4'-Pentachlorobiphenyl (BZ-105)	EPA 1668C	10262109	NELAP	LA
9200 - 2,3,3',4,5',6-Hexachlorobiphenyl (BZ-161)	EPA 1668C	10262109	NELAP	LA
9203 - 2,3,3',4,5'-Pentachlorobiphenyl (BZ-108)	EPA 1668C	10262109	NELAP	LA
9194 - 2,3,3',4,5,5',6-Heptachlorobiphenyl (BZ-192)	EPA 1668C	10262109	NELAP	LA
9196 - 2,3,3',4,5,5'-Hexachlorobiphenyl (BZ-159)	EPA 1668C	10262109	NELAP	LA
9198 - 2,3,3',4,5,6-Hexachlorobiphenyl (BZ-160)	EPA 1668C	10262109	NELAP	LA
9204 - 2,3,3',4,5-Pentachlorobiphenyl (BZ-106)	EPA 1668C	10262109	NELAP	LA
9206 - 2,3,3',4,6-Pentachlorobiphenyl (BZ-109)	EPA 1668C	10262109	NELAP	LA
9208 - 2,3,3',4-Tetrachlorobiphenyl (BZ-55)	EPA 1668C	10262109	NELAP	LA
9212 - 2,3,3',5',6-Pentachlorobiphenyl (BZ-113)	EPA 1668C	10262109	NELAP	LA
9213 - 2,3,3',5'-Tetrachlorobiphenyl (BZ-	EPA 1668C	10262109	NELAP	LA

Non Potable Water

Analyte	Method Name	Method Code	Type	AB
58)				
9209 - 2,3,3',5,5',6-Hexachlorobiphenyl (BZ-165)	EPA 1668C	10262109	NELAP	LA
9210 - 2,3,3',5,5'-Pentachlorobiphenyl (BZ-111)	EPA 1668C	10262109	NELAP	LA
9211 - 2,3,3',5,6-Pentachlorobiphenyl (BZ-112)	EPA 1668C	10262109	NELAP	LA
9214 - 2,3,3',5-Tetrachlorobiphenyl (BZ-57)	EPA 1668C	10262109	NELAP	LA
9215 - 2,3,3',6-Tetrachlorobiphenyl (BZ-59)	EPA 1668C	10262109	NELAP	LA
9216 - 2,3,3'-Trichlorobiphenyl (BZ-20)	EPA 1668C	10262109	NELAP	LA
9227 - 2,3,4',5,6-Pentachlorobiphenyl (BZ-117)	EPA 1668C	10262109	NELAP	LA
9233 - 2,3,4',5-Tetrachlorobiphenyl (BZ-63)	EPA 1668C	10262109	NELAP	LA
9236 - 2,3,4',6-Tetrachlorobiphenyl (BZ-64)	EPA 1668C	10262109	NELAP	LA
9241 - 2,3,4'-Trichlorobiphenyl (BZ-22)	EPA 1668C	10262109	NELAP	LA
9217 - 2,3,4,4',5,6-Hexachlorobiphenyl (BZ-166)	EPA 1668C	10262109	NELAP	LA
9005 - 2,3,4,4',5-Pentachlorobiphenyl (BZ-114)	EPA 1668C	10262109	NELAP	LA
9219 - 2,3,4,4',6-Pentachlorobiphenyl (BZ-115)	EPA 1668C	10262109	NELAP	LA
9221 - 2,3,4,4'-Tetrachlorobiphenyl (BZ-60)	EPA 1668C	10262109	NELAP	LA
9225 - 2,3,4,5,6-Pentachlorobiphenyl (BZ-116)	EPA 1668C	10262109	NELAP	LA
9228 - 2,3,4,5-Tetrachlorobiphenyl (BZ-61)	EPA 1668C	10262109	NELAP	LA
9234 - 2,3,4,6-Tetrachlorobiphenyl (BZ-62)	EPA 1668C	10262109	NELAP	LA
9238 - 2,3,4-Trichlorobiphenyl (BZ-21)	EPA 1668C	10262109	NELAP	LA
9243 - 2,3,5,6-Tetrachlorobiphenyl (BZ-65)	EPA 1668C	10262109	NELAP	LA
9245 - 2,3,5-Trichlorobiphenyl (BZ-23)	EPA 1668C	10262109	NELAP	LA
9247 - 2,3,6-Trichlorobiphenyl (BZ-24)	EPA 1668C	10262109	NELAP	LA
8920 - 2,3-Dichlorobiphenyl (BZ-5)	EPA 1668C	10262109	NELAP	LA
8940 - 2,4',5-Trichlorobiphenyl (BZ-31)	EPA 1668C	10262109	NELAP	LA
9255 - 2,4',6-Trichlorobiphenyl (BZ-32)	EPA 1668C	10262109	NELAP	LA
9256 - 2,4'-Dichlorobiphenyl (BZ-8)	EPA 1668C	10262109	NELAP	LA
9250 - 2,4,4',5-Tetrachlorobiphenyl (BZ-74)	EPA 1668C	10262109	NELAP	LA
9251 - 2,4,4',6-Tetrachlorobiphenyl (BZ-75)	EPA 1668C	10262109	NELAP	LA
9252 - 2,4,4'-Trichlorobiphenyl (BZ-28)	EPA 1668C	10262109	NELAP	LA
9253 - 2,4,5-Trichlorobiphenyl (BZ-29)	EPA 1668C	10262109	NELAP	LA
9254 - 2,4,6-Trichlorobiphenyl (BZ-30)	EPA 1668C	10262109	NELAP	LA
9257 - 2,4-Dichlorobiphenyl (BZ-7)	EPA 1668C	10262109	NELAP	LA
9258 - 2,5-Dichlorobiphenyl (BZ-9)	EPA 1668C	10262109	NELAP	LA
9259 - 2,6-Dichlorobiphenyl (BZ-10)	EPA 1668C	10262109	NELAP	LA
8915 - 2-Chlorobiphenyl (BZ-1)	EPA 1668C	10262109	NELAP	LA
9060 - 3,3',4,4',5,5'-Hexachlorobiphenyl (BZ-169)	EPA 1668C	10262109	NELAP	LA

Non Potable Water

Analyte	Method Name	Method Code	Type	AB
9015 - 3,3',4,4',5-Pentachlorobiphenyl (BZ-126)	EPA 1668C	10262109	NELAP	LA
8965 - 3,3',4,4'-Tetrachlorobiphenyl (BZ-77)	EPA 1668C	10262109	NELAP	LA
9261 - 3,3',4,5'-Tetrachlorobiphenyl (BZ-79)	EPA 1668C	10262109	NELAP	LA
9260 - 3,3',4,5,5'-Pentachlorobiphenyl (BZ-127)	EPA 1668C	10262109	NELAP	LA
9262 - 3,3',4,5-Tetrachlorobiphenyl (BZ-78)	EPA 1668C	10262109	NELAP	LA
9263 - 3,3',4-Trichlorobiphenyl (BZ-35)	EPA 1668C	10262109	NELAP	LA
9264 - 3,3',5,5'-Tetrachlorobiphenyl (BZ-80)	EPA 1668C	10262109	NELAP	LA
9265 - 3,3',5-Trichlorobiphenyl (BZ-36)	EPA 1668C	10262109	NELAP	LA
8925 - 3,3'-Dichlorobiphenyl (BZ-11)	EPA 1668C	10262109	NELAP	LA
9268 - 3,4',5-Trichlorobiphenyl (BZ-39)	EPA 1668C	10262109	NELAP	LA
9269 - 3,4'-Dichlorobiphenyl (BZ-13)	EPA 1668C	10262109	NELAP	LA
8970 - 3,4,4',5-Tetrachlorobiphenyl (BZ-81)	EPA 1668C	10262109	NELAP	LA
9266 - 3,4,4'-Trichlorobiphenyl (BZ-37)	EPA 1668C	10262109	NELAP	LA
9267 - 3,4,5-Trichlorobiphenyl (BZ-38)	EPA 1668C	10262109	NELAP	LA
9270 - 3,4-Dichlorobiphenyl (BZ-12)	EPA 1668C	10262109	NELAP	LA
9271 - 3,5-Dichlorobiphenyl (BZ-14)	EPA 1668C	10262109	NELAP	LA
9272 - 3-Chlorobiphenyl (BZ-2)	EPA 1668C	10262109	NELAP	LA
9273 - 4,4'-Dichlorobiphenyl (BZ-15)	EPA 1668C	10262109	NELAP	LA
9274 - 4-Chlorobiphenyl (BZ-3)	EPA 1668C	10262109	NELAP	LA

Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
9519 - 1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	EPA 1613B	10120602	NELAP	LA
9516 - 1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	EPA 1613B	10120602	NELAP	LA
9426 - 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)	EPA 1613B	10120602	NELAP	LA
9420 - 1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)	EPA 1613B	10120602	NELAP	LA
9423 - 1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)	EPA 1613B	10120602	NELAP	LA
9453 - 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd)	EPA 1613B	10120602	NELAP	LA
9471 - 1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-Hxcdf)	EPA 1613B	10120602	NELAP	LA
9456 - 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin(1,2,3,6,7,8-Hxcdd)	EPA 1613B	10120602	NELAP	LA
9474 - 1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf)	EPA 1613B	10120602	NELAP	LA
9459 - 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd)	EPA 1613B	10120602	NELAP	LA
9477 - 1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf)	EPA 1613B	10120602	NELAP	LA

Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
9540 - 1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd)	EPA 1613B	10120602	NELAP	LA
9543 - 1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf)	EPA 1613B	10120602	NELAP	LA
9480 - 2,3,4,6,7,8-Hexachlorodibenzofuran	EPA 1613B	10120602	NELAP	LA
9549 - 2,3,4,7,8-Pentachlorodibenzofuran	EPA 1613B	10120602	NELAP	LA
9618 - 2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD)	EPA 1613B	10120602	NELAP	LA
9612 - 2,3,7,8-Tetrachlorodibenzofuran	EPA 1613B	10120602	NELAP	LA
9438 - Total Hpcdd	EPA 1613B	10120602	NELAP	LA
9444 - Total Hpcdf	EPA 1613B	10120602	NELAP	LA
9468 - Total Hxcdd	EPA 1613B	10120602	NELAP	LA
9483 - Total Hxcdf	EPA 1613B	10120602	NELAP	LA
9555 - Total Pecdd	EPA 1613B	10120602	NELAP	LA
9552 - Total Pecdf	EPA 1613B	10120602	NELAP	LA
9609 - Total TCDD	EPA 1613B	10120602	NELAP	LA
9615 - Total TCDF	EPA 1613B	10120602	NELAP	LA
9873 - 2,2',3,3',4',5,6-Heptabromodiphenylether (BDE-177)	EPA 1614A	10120704	NELAP	LA
9902 - 2,2',3,3',4,4',5,5',6-Nonabromodiphenylether (BDE-206)	EPA 1614A	10120704	NELAP	LA
9892 - 2,2',3,3',4,4',5,6'-Octabromodiphenylether (BDE-196)	EPA 1614A	10120704	NELAP	LA
9903 - 2,2',3,3',4,4',5,6,6'-Nonabromodiphenylether (BDE-207)	EPA 1614A	10120704	NELAP	LA
9893 - 2,2',3,3',4,4',6,6'-Octabromodiphenylether (BDE-197)	EPA 1614A	10120704	NELAP	LA
9867 - 2,2',3,3',4,4',6-Heptabromodiphenylether (BDE-171)	EPA 1614A	10120704	NELAP	LA
9897 - 2,2',3,3',4,5',6,6'-Octabromodiphenylether (BDE-201)	EPA 1614A	10120704	NELAP	LA
9904 - 2,2',3,3',4,5,5',6,6'-Nonabromodiphenylether (BDE-208)	EPA 1614A	10120704	NELAP	LA
9896 - 2,2',3,3',4,5,6,6'-Octabromodiphenylether (BDE-200)	EPA 1614A	10120704	NELAP	LA
9872 - 2,2',3,3',4,6,6'-Heptabromodiphenylether (BDE-176)	EPA 1614A	10120704	NELAP	LA
9789 - 2,2',3,4',5-Pentabromodiphenylether (BDE-90)	EPA 1614A	10120704	NELAP	LA
9879 - 2,2',3,4,4',5',6-Heptabromodiphenylether (BDE-183)	EPA 1614A	10120704	NELAP	LA
9835 - 2,2',3,4,4',5'-Hexabromodiphenylether (BDE-138)	EPA 1614A	10120704	NELAP	LA
9899 - 2,2',3,4,4',5,5',6-Octabromodiphenylether (BDE-203)	EPA 1614A	10120704	NELAP	LA
9876 - 2,2',3,4,4',5,5'-Heptabromodiphenylether (BDE-180)	EPA 1614A	10120704	NELAP	LA
9878 - 2,2',3,4,4',5,6'-Heptabromodiphenylether (BDE-182)	EPA 1614A	10120704	NELAP	LA
9900 - 2,2',3,4,4',5,6,6'-Octabromodiphenylether (BDE-204)	EPA 1614A	10120704	NELAP	LA
9877 - 2,2',3,4,4',5,6-Heptabromodiphenylether (BDE-181)	EPA 1614A	10120704	NELAP	LA
9837 - 2,2',3,4,4',6'-Hexabromodiphenylether (BDE-140)	EPA 1614A	10120704	NELAP	LA

Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
9880 - 2,2',3,4,4',6,6'-Heptabromodiphenylether (BDE-184)	EPA 1614A	10120704	NELAP	LA
9836 - 2,2',3,4,4',6-Hexabromodiphenylether (BDE-139)	EPA 1614A	10120704	NELAP	LA
9784 - 2,2',3,4,4'-Pentabromodiphenylether (BDE-85)	EPA 1614A	10120704	NELAP	LA
9850 - 2,2',4,4',5',6-Hexabromodiphenylether (BDE-154)	EPA 1614A	10120704	NELAP	LA
9569 - 2,2',4,4',5,5'-Hexabromodiphenyl ether (BDE-153)	EPA 1614A	10120704	NELAP	LA
9571 - 2,2',4,4',5-Pentabromodiphenyl ether (BDE-99)	EPA 1614A	10120704	NELAP	LA
9851 - 2,2',4,4',6,6'-Hexabromodiphenylether (BDE-155)	EPA 1614A	10120704	NELAP	LA
9572 - 2,2',4,4',6-Pentabromodiphenyl ether (BDE-100)	EPA 1614A	10120704	NELAP	LA
9773 - 2,2',4,4'-Tetrabromodiphenyl ether (BDE-47)	EPA 1614A	10120704	NELAP	LA
9747 - 2,2',4,5'-Tetrabromodiphenylether (BDE-49)	EPA 1614A	10120704	NELAP	LA
9716 - 2,2',4-Tribromodiphenylether (BDE-17)	EPA 1614A	10120704	NELAP	LA
9749 - 2,2'4,6'-Tetrabromodiphenylether (BDE-51)	EPA 1614A	10120704	NELAP	LA
9769 - 2,3',4',6-Tetrabromodiphenylether (BDE-71)	EPA 1614A	10120704	NELAP	LA
9815 - 2,3',4,4',5-Pentabromodiphenylether (BDE-118)	EPA 1614A	10120704	NELAP	LA
9764 - 2,3',4,4'-Tetrabromodiphenylether (BDE-66)	EPA 1614A	10120704	NELAP	LA
9724 - 2,3',4-Tribromodiphenylether (BDE-25)	EPA 1614A	10120704	NELAP	LA
9887 - 2,3,3',4,4',5',6-Heptabromodiphenylether (BDE-191)	EPA 1614A	10120704	NELAP	LA
9901 - 2,3,3',4,4',5,5',6-Octabromodiphenylether (BDE-205)	EPA 1614A	10120704	NELAP	LA
9886 - 2,3,3',4,4',5,6-Heptabromodiphenylether (BDE-190)	EPA 1614A	10120704	NELAP	LA
9852 - 2,3,3',4,4,'5-Hexabromodiphenylether (BDE-156)	EPA 1614A	10120704	NELAP	LA
9862 - 2,3,4,4',5,6-Hexabromodiphenylether (BDE-166)	EPA 1614A	10120704	NELAP	LA
9813 - 2,3,4,5,6-Pentabromodiphenylether (BDE-116)	EPA 1614A	10120704	NELAP	LA
9720 - 2,3,4-Tribromodiphenylether (BDE-21)	EPA 1614A	10120704	NELAP	LA
9731 - 2,4',6-Tribromodiphenylether (BDE-32)	EPA 1614A	10120704	NELAP	LA
9774 - 2,4,4',6-Tetrabromodiphenylether (BDE-75)	EPA 1614A	10120704	NELAP	LA
9729 - 2,4,6-Tribromodiphenylether (BDE-30)	EPA 1614A	10120704	NELAP	LA
9706 - 2,4-Dibromodiphenylether (BDE-7)	EPA 1614A	10120704	NELAP	LA
9709 - 2,6-Dibromodiphenylether (BDE-10)	EPA 1614A	10120704	NELAP	LA
9700 - 2-Bromodiphenylether (BDE-1)	EPA 1614A	10120704	NELAP	LA

Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
9865 - 3,3',4,4',5,5'-Hexabromodiphenylether (BDE-169)	EPA 1614A	10120704	NELAP	LA
9823 - 3,3',4,4',5-Pentabromodiphenylether (BDE-126)	EPA 1614A	10120704	NELAP	LA
9776 - 3,3',4,4'-Tetrabromodiphenylether (BDE-77)	EPA 1614A	10120704	NELAP	LA
9734 - 3,3',4-Tribromodiphenylether (BDE-35)	EPA 1614A	10120704	NELAP	LA
9712 - 3,4'-Dibromodiphenylether (BDE-13)	EPA 1614A	10120704	NELAP	LA
9736 - 3,4,4'-Tribromodiphenylether (BDE-37)	EPA 1614A	10120704	NELAP	LA
9711 - 3,4-Dibromodiphenylether (BDE-12)	EPA 1614A	10120704	NELAP	LA
9701 - 3-Bromodiphenylether (BDE-2)	EPA 1614A	10120704	NELAP	LA
9714 - 4,4'-Dibromodiphenylether (BDE-15)	EPA 1614A	10120704	NELAP	LA
5660 - 4-Bromophenyl phenyl ether	EPA 1614A	10120704	NELAP	LA
8902 - Coelution - Dibromodiphenyl ethers (BDE-8 + BDE-11)	EPA 1614A	10120704	NELAP	LA
9908 - Coelution - Pentabromodiphenyl ethers (BDE-119 + BDE-120)	EPA 1614A	10120704	NELAP	LA
9909 - Coelution - Tribromodiphenyl ethers (BDE-28 + BDE-33)	EPA 1614A	10120704	NELAP	LA
9905 - Decabromodiphenylether (BDE-209)	EPA 1614A	10120704	NELAP	LA
9105 - 2,2',3,3',4,4',5,5',6,6'-Decachlorobiphenyl (BZ-209)	EPA 1668A	10129405	NELAP	LA
9095 - 2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ-206)	EPA 1668A	10129405	NELAP	LA
9090 - 2,2',3,3',4,4',5,5'-Octachlorobiphenyl (BZ-194)	EPA 1668A	10129405	NELAP	LA
9102 - 2,2',3,3',4,4',5,6'-Octachlorobiphenyl (BZ-196)	EPA 1668A	10129405	NELAP	LA
9101 - 2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl (BZ-207)	EPA 1668A	10129405	NELAP	LA
9103 - 2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ-195)	EPA 1668A	10129405	NELAP	LA
9065 - 2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ-170)	EPA 1668A	10129405	NELAP	LA
9104 - 2,2',3,3',4,4',6,6'-Octachlorobiphenyl (BZ-197)	EPA 1668A	10129405	NELAP	LA
9106 - 2,2',3,3',4,4',6-Heptachlorobiphenyl (BZ-171)	EPA 1668A	10129405	NELAP	LA
9020 - 2,2',3,3',4,4'-Hexachlorobiphenyl (BZ-128)	EPA 1668A	10129405	NELAP	LA
9114 - 2,2',3,3',4,5',6'-Heptachlorobiphenyl (BZ-177)	EPA 1668A	10129405	NELAP	LA
9112 - 2,2',3,3',4,5',6,6'-Octachlorobiphenyl (BZ-201)	EPA 1668A	10129405	NELAP	LA
9115 - 2,2',3,3',4,5',6-Heptachlorobiphenyl (BZ-175)	EPA 1668A	10129405	NELAP	LA
9117 - 2,2',3,3',4,5'-Hexachlorobiphenyl (BZ-130)	EPA 1668A	10129405	NELAP	LA
9108 - 2,2',3,3',4,5,5',6'-Octachlorobiphenyl (BZ-199)	EPA 1668A	10129405	NELAP	LA
9107 - 2,2',3,3',4,5,5',6,6'-	EPA 1668A	10129405	NELAP	LA

Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
Nonachlorobiphenyl (BZ-208)				
9109 - 2,2',3,3',4,5,5',6-Octachlorobiphenyl (BZ-198)	EPA 1668A	10129405	NELAP	LA
9110 - 2,2',3,3',4,5,5'-Heptachlorobiphenyl (BZ-172)	EPA 1668A	10129405	NELAP	LA
9116 - 2,2',3,3',4,5,6'-Heptachlorobiphenyl (BZ-174)	EPA 1668A	10129405	NELAP	LA
9111 - 2,2',3,3',4,5,6,6'-Octachlorobiphenyl (BZ-200)	EPA 1668A	10129405	NELAP	LA
9113 - 2,2',3,3',4,5,6-Heptachlorobiphenyl (BZ-173)	EPA 1668A	10129405	NELAP	LA
9118 - 2,2',3,3',4,5-Hexachlorobiphenyl (BZ-129)	EPA 1668A	10129405	NELAP	LA
9120 - 2,2',3,3',4,6'-Hexachlorobiphenyl (BZ-132)	EPA 1668A	10129405	NELAP	LA
9119 - 2,2',3,3',4,6,6'-Heptachlorobiphenyl (BZ-176)	EPA 1668A	10129405	NELAP	LA
9121 - 2,2',3,3',4,6-Hexachlorobiphenyl (BZ-131)	EPA 1668A	10129405	NELAP	LA
9122 - 2,2',3,3',4-Pentachlorobiphenyl (BZ-82)	EPA 1668A	10129405	NELAP	LA
9123 - 2,2',3,3',5,5',6,6'-Octachlorobiphenyl (BZ-202)	EPA 1668A	10129405	NELAP	LA
9124 - 2,2',3,3',5,5',6-Heptachlorobiphenyl (BZ-178)	EPA 1668A	10129405	NELAP	LA
9125 - 2,2',3,3',5,5'-Hexachlorobiphenyl (BZ-133)	EPA 1668A	10129405	NELAP	LA
9127 - 2,2',3,3',5,6'-Hexachlorobiphenyl (BZ-135)	EPA 1668A	10129405	NELAP	LA
9126 - 2,2',3,3',5,6,6'-Heptachlorobiphenyl (BZ-179)	EPA 1668A	10129405	NELAP	LA
9128 - 2,2',3,3',5,6-Hexachlorobiphenyl (BZ-134)	EPA 1668A	10129405	NELAP	LA
9129 - 2,2',3,3',5-Pentachlorobiphenyl (BZ-83)	EPA 1668A	10129405	NELAP	LA
9130 - 2,2',3,3',6,6'-Hexachlorobiphenyl (BZ-136)	EPA 1668A	10129405	NELAP	LA
9131 - 2,2',3,3',6-Pentachlorobiphenyl (BZ-84)	EPA 1668A	10129405	NELAP	LA
9132 - 2,2',3,3'-Tetrachlorobiphenyl (BZ-40)	EPA 1668A	10129405	NELAP	LA
9151 - 2,2',3,4',5',6-Hexachlorobiphenyl (BZ-149)	EPA 1668A	10129405	NELAP	LA
9154 - 2,2',3,4',5'-Pentachlorobiphenyl (BZ-97)	EPA 1668A	10129405	NELAP	LA
9080 - 2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ-187)	EPA 1668A	10129405	NELAP	LA
9144 - 2,2',3,4',5,5'-Hexachlorobiphenyl (BZ-146)	EPA 1668A	10129405	NELAP	LA
9147 - 2,2',3,4',5,6'-Hexachlorobiphenyl (BZ-148)	EPA 1668A	10129405	NELAP	LA
9146 - 2,2',3,4',5,6,6'-Heptachlorobiphenyl (BZ-188)	EPA 1668A	10129405	NELAP	LA
9149 - 2,2',3,4',5,6-Hexachlorobiphenyl (BZ-147)	EPA 1668A	10129405	NELAP	LA

Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
9155 - 2,2',3,4',5-Pentachlorobiphenyl (BZ-90)	EPA 1668A	10129405	NELAP	LA
9159 - 2,2',3,4',6'-Pentachlorobiphenyl (BZ-98)	EPA 1668A	10129405	NELAP	LA
9157 - 2,2',3,4',6,6'-Hexachlorobiphenyl (BZ-150)	EPA 1668A	10129405	NELAP	LA
9160 - 2,2',3,4',6-Pentachlorobiphenyl (BZ-91)	EPA 1668A	10129405	NELAP	LA
9162 - 2,2',3,4'-Tetrachlorobiphenyl (BZ-42)	EPA 1668A	10129405	NELAP	LA
9075 - 2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ-183)	EPA 1668A	10129405	NELAP	LA
9025 - 2,2',3,4,4',5'-Hexachlorobiphenyl (BZ-138)	EPA 1668A	10129405	NELAP	LA
9133 - 2,2',3,4,4',5,5',6-Octachlorobiphenyl (BZ-203)	EPA 1668A	10129405	NELAP	LA
9134 - 2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ-180)	EPA 1668A	10129405	NELAP	LA
9136 - 2,2',3,4,4',5,6'-Heptachlorobiphenyl (BZ-182)	EPA 1668A	10129405	NELAP	LA
9135 - 2,2',3,4,4',5,6,6'-Octachlorobiphenyl (BZ-204)	EPA 1668A	10129405	NELAP	LA
9137 - 2,2',3,4,4',5,6-Heptachlorobiphenyl (BZ-181)	EPA 1668A	10129405	NELAP	LA
9138 - 2,2',3,4,4',5-Hexachlorobiphenyl (BZ-137)	EPA 1668A	10129405	NELAP	LA
9140 - 2,2',3,4,4',6'-Hexachlorobiphenyl (BZ-140)	EPA 1668A	10129405	NELAP	LA
9139 - 2,2',3,4,4',6,6'-Heptachlorobiphenyl (BZ-184)	EPA 1668A	10129405	NELAP	LA
9141 - 2,2',3,4,4',6-Hexachlorobiphenyl (BZ-139)	EPA 1668A	10129405	NELAP	LA
9142 - 2,2',3,4,4'-Pentachlorobiphenyl (BZ-85)	EPA 1668A	10129405	NELAP	LA
9150 - 2,2',3,4,5',6-Hexachlorobiphenyl (BZ-144)	EPA 1668A	10129405	NELAP	LA
8975 - 2,2',3,4,5'-Pentachlorobiphenyl (BZ-87)	EPA 1668A	10129405	NELAP	LA
9143 - 2,2',3,4,5,5',6-Heptachlorobiphenyl (BZ-185)	EPA 1668A	10129405	NELAP	LA
9030 - 2,2',3,4,5,5'-Hexachlorobiphenyl (BZ-141)	EPA 1668A	10129405	NELAP	LA
9152 - 2,2',3,4,5,6'-Hexachlorobiphenyl (BZ-143)	EPA 1668A	10129405	NELAP	LA
9145 - 2,2',3,4,5,6,6'-Heptachlorobiphenyl (BZ-186)	EPA 1668A	10129405	NELAP	LA
9148 - 2,2',3,4,5,6-Hexachlorobiphenyl (BZ-142)	EPA 1668A	10129405	NELAP	LA
9153 - 2,2',3,4,5-Pentachlorobiphenyl (BZ-86)	EPA 1668A	10129405	NELAP	LA
9161 - 2,2',3,4,6'-Pentachlorobiphenyl (BZ-89)	EPA 1668A	10129405	NELAP	LA
9156 - 2,2',3,4,6,6'-Hexachlorobiphenyl (BZ-145)	EPA 1668A	10129405	NELAP	LA
9158 - 2,2',3,4,6-Pentachlorobiphenyl (BZ-	EPA 1668A	10129405	NELAP	LA

Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
88)				
9163 - 2,2',3,4-Tetrachlorobiphenyl (BZ-41)	EPA 1668A	10129405	NELAP	LA
9166 - 2,2',3,5',6-Pentachlorobiphenyl (BZ-95)	EPA 1668A	10129405	NELAP	LA
8945 - 2,2',3,5'-Tetrachlorobiphenyl (BZ-44)	EPA 1668A	10129405	NELAP	LA
9035 - 2,2',3,5,5',6-Hexachlorobiphenyl (BZ-151)	EPA 1668A	10129405	NELAP	LA
9164 - 2,2',3,5,5'-Pentachlorobiphenyl (BZ-92)	EPA 1668A	10129405	NELAP	LA
9167 - 2,2',3,5,6'-Pentachlorobiphenyl (BZ-94)	EPA 1668A	10129405	NELAP	LA
9165 - 2,2',3,5,6,6'-Hexachlorobiphenyl (BZ-152)	EPA 1668A	10129405	NELAP	LA
9168 - 2,2',3,5,6-Pentachlorobiphenyl (BZ-93)	EPA 1668A	10129405	NELAP	LA
9169 - 2,2',3,5-Tetrachlorobiphenyl (BZ-43)	EPA 1668A	10129405	NELAP	LA
9171 - 2,2',3,6'-Tetrachlorobiphenyl (BZ-46)	EPA 1668A	10129405	NELAP	LA
9170 - 2,2',3,6,6'-Pentachlorobiphenyl (BZ-96)	EPA 1668A	10129405	NELAP	LA
9172 - 2,2',3,6-Tetrachlorobiphenyl (BZ-45)	EPA 1668A	10129405	NELAP	LA
9173 - 2,2',3-Trichlorobiphenyl (BZ-16)	EPA 1668A	10129405	NELAP	LA
9040 - 2,2',4,4',5,5'-Hexachlorobiphenyl (BZ-153)	EPA 1668A	10129405	NELAP	LA
9174 - 2,2',4,4',5,6'-Hexachlorobiphenyl (BZ-154)	EPA 1668A	10129405	NELAP	LA
9175 - 2,2',4,4',5-Pentachlorobiphenyl (BZ-99)	EPA 1668A	10129405	NELAP	LA
9176 - 2,2',4,4',6,6'-Hexachlorobiphenyl (BZ-155)	EPA 1668A	10129405	NELAP	LA
9177 - 2,2',4,4',6-Pentachlorobiphenyl (BZ-100)	EPA 1668A	10129405	NELAP	LA
9178 - 2,2',4,4'-Tetrachlorobiphenyl (BZ-47)	EPA 1668A	10129405	NELAP	LA
9179 - 2,2',4,5',6-Pentachlorobiphenyl (BZ-103)	EPA 1668A	10129405	NELAP	LA
8950 - 2,2',4,5'-Tetrachlorobiphenyl (BZ-49)	EPA 1668A	10129405	NELAP	LA
8980 - 2,2',4,5,5'-Pentachlorobiphenyl (BZ-101)	EPA 1668A	10129405	NELAP	LA
9180 - 2,2',4,5,6'-Pentachlorobiphenyl (BZ-102)	EPA 1668A	10129405	NELAP	LA
9181 - 2,2',4,5-Tetrachlorobiphenyl (BZ-48)	EPA 1668A	10129405	NELAP	LA
9183 - 2,2',4,6'-Tetrachlorobiphenyl (BZ-51)	EPA 1668A	10129405	NELAP	LA
9182 - 2,2',4,6,6'-Pentachlorobiphenyl (BZ-104)	EPA 1668A	10129405	NELAP	LA
9184 - 2,2',4,6-Tetrachlorobiphenyl (BZ-50)	EPA 1668A	10129405	NELAP	LA
9185 - 2,2',4-Trichlorobiphenyl (BZ-17)	EPA 1668A	10129405	NELAP	LA

Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
8955 - 2,2',5,5'-Tetrachlorobiphenyl (BZ-52)	EPA 1668A	10129405	NELAP	LA
9186 - 2,2',5,6'-Tetrachlorobiphenyl (BZ-53)	EPA 1668A	10129405	NELAP	LA
8930 - 2,2',5-Trichlorobiphenyl (BZ-18)	EPA 1668A	10129405	NELAP	LA
9187 - 2,2',6,6'-Tetrachlorobiphenyl (BZ-54)	EPA 1668A	10129405	NELAP	LA
9188 - 2,2',6-Trichlorobiphenyl (BZ-19)	EPA 1668A	10129405	NELAP	LA
9189 - 2,2'-Dichlorobiphenyl (BZ-4)	EPA 1668A	10129405	NELAP	LA
9224 - 2,3',4',5',6-Pentachlorobiphenyl (BZ-125)	EPA 1668A	10129405	NELAP	LA
9229 - 2,3',4',5'-Tetrachlorobiphenyl (BZ-76)	EPA 1668A	10129405	NELAP	LA
9222 - 2,3',4',5,5'-Pentachlorobiphenyl (BZ-124)	EPA 1668A	10129405	NELAP	LA
9230 - 2,3',4',5-Tetrachlorobiphenyl (BZ-70)	EPA 1668A	10129405	NELAP	LA
9237 - 2,3',4',6-Tetrachlorobiphenyl (BZ-71)	EPA 1668A	10129405	NELAP	LA
9239 - 2,3',4'-Trichlorobiphenyl (BZ-33)	EPA 1668A	10129405	NELAP	LA
9218 - 2,3',4,4',5',6-Hexachlorobiphenyl (BZ-168)	EPA 1668A	10129405	NELAP	LA
9011 - 2,3',4,4',5'-Pentachlorobiphenyl (BZ-123)	EPA 1668A	10129405	NELAP	LA
9000 - 2,3',4,4',5'-Pentachlorobiphenyl (BZ-123)	EPA 1668A	10129405	NELAP	LA
9055 - 2,3',4,4',5,5'-Hexachlorobiphenyl (BZ-167)	EPA 1668A	10129405	NELAP	LA
8995 - 2,3',4,4',5-Pentachlorobiphenyl (BZ-118)	EPA 1668A	10129405	NELAP	LA
9220 - 2,3',4,4',6-Pentachlorobiphenyl (BZ-119)	EPA 1668A	10129405	NELAP	LA
8960 - 2,3',4,4'-Tetrachlorobiphenyl (BZ-66)	EPA 1668A	10129405	NELAP	LA
9226 - 2,3',4,5',6-Pentachlorobiphenyl (BZ-121)	EPA 1668A	10129405	NELAP	LA
9231 - 2,3',4,5'-Tetrachlorobiphenyl (BZ-68)	EPA 1668A	10129405	NELAP	LA
9223 - 2,3',4,5,5'-Pentachlorobiphenyl (BZ-120)	EPA 1668A	10129405	NELAP	LA
9232 - 2,3',4,5-Tetrachlorobiphenyl (BZ-67)	EPA 1668A	10129405	NELAP	LA
9235 - 2,3',4,6-Tetrachlorobiphenyl (BZ-69)	EPA 1668A	10129405	NELAP	LA
9240 - 2,3',4-Trichlorobiphenyl (BZ-25)	EPA 1668A	10129405	NELAP	LA
9244 - 2,3',5',6-Tetrachlorobiphenyl (BZ-73)	EPA 1668A	10129405	NELAP	LA
9246 - 2,3',5'-Trichlorobiphenyl (BZ-34)	EPA 1668A	10129405	NELAP	LA
9242 - 2,3',5,5'-Tetrachlorobiphenyl (BZ-72)	EPA 1668A	10129405	NELAP	LA
8935 - 2,3',5-Trichlorobiphenyl (BZ-26)	EPA 1668A	10129405	NELAP	LA
9248 - 2,3',6-Trichlorobiphenyl (BZ-27)	EPA 1668A	10129405	NELAP	LA
9249 - 2,3'-Dichlorobiphenyl (BZ-6)	EPA 1668A	10129405	NELAP	LA
9201 - 2,3,3',4',5',6-Hexachlorobiphenyl (BZ-164)	EPA 1668A	10129405	NELAP	LA

Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
9202 - 2,3,3',4',5'-Pentachlorobiphenyl (BZ-122)	EPA 1668A	10129405	NELAP	LA
9195 - 2,3,3',4',5,5',6-Heptachlorobiphenyl (BZ-193)	EPA 1668A	10129405	NELAP	LA
9197 - 2,3,3',4',5,5'-Hexachlorobiphenyl (BZ-162)	EPA 1668A	10129405	NELAP	LA
9199 - 2,3,3',4',5,6-Hexachlorobiphenyl (BZ-163)	EPA 1668A	10129405	NELAP	LA
9205 - 2,3,3',4',5-Pentachlorobiphenyl (BZ-107)	EPA 1668A	10129405	NELAP	LA
8990 - 2,3,3',4',6-Pentachlorobiphenyl (BZ-110)	EPA 1668A	10129405	NELAP	LA
9207 - 2,3,3',4'-Tetrachlorobiphenyl (BZ-56)	EPA 1668A	10129405	NELAP	LA
9192 - 2,3,3',4,4',5',6-Heptachlorobiphenyl (BZ-191)	EPA 1668A	10129405	NELAP	LA
9045 - 2,3,3',4,4',5'-Hexachlorobiphenyl (BZ-157)	EPA 1668A	10129405	NELAP	LA
9190 - 2,3,3',4,4',5,5',6-Octachlorobiphenyl (BZ-205)	EPA 1668A	10129405	NELAP	LA
9085 - 2,3,3',4,4',5,5'-Heptachlorobiphenyl (BZ-189)	EPA 1668A	10129405	NELAP	LA
9191 - 2,3,3',4,4',5,6-Heptachlorobiphenyl (BZ-190)	EPA 1668A	10129405	NELAP	LA
9050 - 2,3,3',4,4',5-Hexachlorobiphenyl (BZ-156)	EPA 1668A	10129405	NELAP	LA
9193 - 2,3,3',4,4',6-Hexachlorobiphenyl (BZ-158)	EPA 1668A	10129405	NELAP	LA
8985 - 2,3,3',4,4'-Pentachlorobiphenyl (BZ-105)	EPA 1668A	10129405	NELAP	LA
9200 - 2,3,3',4,5',6-Hexachlorobiphenyl (BZ-161)	EPA 1668A	10129405	NELAP	LA
9203 - 2,3,3',4,5'-Pentachlorobiphenyl (BZ-108)	EPA 1668A	10129405	NELAP	LA
9194 - 2,3,3',4,5,5',6-Heptachlorobiphenyl (BZ-192)	EPA 1668A	10129405	NELAP	LA
9196 - 2,3,3',4,5,5'-Hexachlorobiphenyl (BZ-159)	EPA 1668A	10129405	NELAP	LA
9198 - 2,3,3',4,5,6-Hexachlorobiphenyl (BZ-160)	EPA 1668A	10129405	NELAP	LA
9204 - 2,3,3',4,5-Pentachlorobiphenyl (BZ-106)	EPA 1668A	10129405	NELAP	LA
9206 - 2,3,3',4,6-Pentachlorobiphenyl (BZ-109)	EPA 1668A	10129405	NELAP	LA
9208 - 2,3,3',4-Tetrachlorobiphenyl (BZ-55)	EPA 1668A	10129405	NELAP	LA
9212 - 2,3,3',5',6-Pentachlorobiphenyl (BZ-113)	EPA 1668A	10129405	NELAP	LA
9213 - 2,3,3',5'-Tetrachlorobiphenyl (BZ-58)	EPA 1668A	10129405	NELAP	LA
9209 - 2,3,3',5,5',6-Hexachlorobiphenyl (BZ-165)	EPA 1668A	10129405	NELAP	LA
9210 - 2,3,3',5,5'-Pentachlorobiphenyl (BZ-111)	EPA 1668A	10129405	NELAP	LA
9211 - 2,3,3',5,6-Pentachlorobiphenyl (BZ-	EPA 1668A	10129405	NELAP	LA

Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
112)				
9214 - 2,3,3',5-Tetrachlorobiphenyl (BZ-57)	EPA 1668A	10129405	NELAP	LA
9215 - 2,3,3',6-Tetrachlorobiphenyl (BZ-59)	EPA 1668A	10129405	NELAP	LA
9216 - 2,3,3'-Trichlorobiphenyl (BZ-20)	EPA 1668A	10129405	NELAP	LA
9227 - 2,3,4',5,6-Pentachlorobiphenyl (BZ-117)	EPA 1668A	10129405	NELAP	LA
9233 - 2,3,4',5-Tetrachlorobiphenyl (BZ-63)	EPA 1668A	10129405	NELAP	LA
9236 - 2,3,4',6-Tetrachlorobiphenyl (BZ-64)	EPA 1668A	10129405	NELAP	LA
9241 - 2,3,4'-Trichlorobiphenyl (BZ-22)	EPA 1668A	10129405	NELAP	LA
9217 - 2,3,4,4',5,6-Hexachlorobiphenyl (BZ-166)	EPA 1668A	10129405	NELAP	LA
9005 - 2,3,4,4',5-Pentachlorobiphenyl (BZ-114)	EPA 1668A	10129405	NELAP	LA
9219 - 2,3,4,4',6-Pentachlorobiphenyl (BZ-115)	EPA 1668A	10129405	NELAP	LA
9221 - 2,3,4,4'-Tetrachlorobiphenyl (BZ-60)	EPA 1668A	10129405	NELAP	LA
9225 - 2,3,4,5,6-Pentachlorobiphenyl (BZ-116)	EPA 1668A	10129405	NELAP	LA
9228 - 2,3,4,5-Tetrachlorobiphenyl (BZ-61)	EPA 1668A	10129405	NELAP	LA
9234 - 2,3,4,6-Tetrachlorobiphenyl (BZ-62)	EPA 1668A	10129405	NELAP	LA
9238 - 2,3,4-Trichlorobiphenyl (BZ-21)	EPA 1668A	10129405	NELAP	LA
9243 - 2,3,5,6-Tetrachlorobiphenyl (BZ-65)	EPA 1668A	10129405	NELAP	LA
9245 - 2,3,5-Trichlorobiphenyl (BZ-23)	EPA 1668A	10129405	NELAP	LA
9247 - 2,3,6-Trichlorobiphenyl (BZ-24)	EPA 1668A	10129405	NELAP	LA
8920 - 2,3-Dichlorobiphenyl (BZ-5)	EPA 1668A	10129405	NELAP	LA
8940 - 2,4',5-Trichlorobiphenyl (BZ-31)	EPA 1668A	10129405	NELAP	LA
9255 - 2,4',6-Trichlorobiphenyl (BZ-32)	EPA 1668A	10129405	NELAP	LA
9256 - 2,4'-Dichlorobiphenyl (BZ-8)	EPA 1668A	10129405	NELAP	LA
9250 - 2,4,4',5-Tetrachlorobiphenyl (BZ-74)	EPA 1668A	10129405	NELAP	LA
9251 - 2,4,4',6-Tetrachlorobiphenyl (BZ-75)	EPA 1668A	10129405	NELAP	LA
9252 - 2,4,4'-Trichlorobiphenyl (BZ-28)	EPA 1668A	10129405	NELAP	LA
9253 - 2,4,5-Trichlorobiphenyl (BZ-29)	EPA 1668A	10129405	NELAP	LA
9254 - 2,4,6-Trichlorobiphenyl (BZ-30)	EPA 1668A	10129405	NELAP	LA
9257 - 2,4-Dichlorobiphenyl (BZ-7)	EPA 1668A	10129405	NELAP	LA
9258 - 2,5-Dichlorobiphenyl (BZ-9)	EPA 1668A	10129405	NELAP	LA
9259 - 2,6-Dichlorobiphenyl (BZ-10)	EPA 1668A	10129405	NELAP	LA
8915 - 2-Chlorobiphenyl (BZ-1)	EPA 1668A	10129405	NELAP	LA
9060 - 3,3',4,4',5,5'-Hexachlorobiphenyl (BZ-169)	EPA 1668A	10129405	NELAP	LA
9015 - 3,3',4,4',5-Pentachlorobiphenyl (BZ-126)	EPA 1668A	10129405	NELAP	LA
8965 - 3,3',4,4'-Tetrachlorobiphenyl (BZ-77)	EPA 1668A	10129405	NELAP	LA
9261 - 3,3',4,5'-Tetrachlorobiphenyl (BZ-79)	EPA 1668A	10129405	NELAP	LA

Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
9260 - 3,3',4,5,5'-Pentachlorobiphenyl (BZ-127)	EPA 1668A	10129405	NELAP	LA
9262 - 3,3',4,5-Tetrachlorobiphenyl (BZ-78)	EPA 1668A	10129405	NELAP	LA
9263 - 3,3',4-Trichlorobiphenyl (BZ-35)	EPA 1668A	10129405	NELAP	LA
9264 - 3,3',5,5'-Tetrachlorobiphenyl (BZ-80)	EPA 1668A	10129405	NELAP	LA
9265 - 3,3',5-Trichlorobiphenyl (BZ-36)	EPA 1668A	10129405	NELAP	LA
8925 - 3,3'-Dichlorobiphenyl (BZ-11)	EPA 1668A	10129405	NELAP	LA
9268 - 3,4',5-Trichlorobiphenyl (BZ-39)	EPA 1668A	10129405	NELAP	LA
9269 - 3,4'-Dichlorobiphenyl (BZ-13)	EPA 1668A	10129405	NELAP	LA
8970 - 3,4,4',5-Tetrachlorobiphenyl (BZ-81)	EPA 1668A	10129405	NELAP	LA
9266 - 3,4,4'-Trichlorobiphenyl (BZ-37)	EPA 1668A	10129405	NELAP	LA
9267 - 3,4,5-Trichlorobiphenyl (BZ-38)	EPA 1668A	10129405	NELAP	LA
9270 - 3,4-Dichlorobiphenyl (BZ-12)	EPA 1668A	10129405	NELAP	LA
9271 - 3,5-Dichlorobiphenyl (BZ-14)	EPA 1668A	10129405	NELAP	LA
9272 - 3-Chlorobiphenyl (BZ-2)	EPA 1668A	10129405	NELAP	LA
9273 - 4,4'-Dichlorobiphenyl (BZ-15)	EPA 1668A	10129405	NELAP	LA
9274 - 4-Chlorobiphenyl (BZ-3)	EPA 1668A	10129405	NELAP	LA
8580 - 2,4'-DDD	EPA 1699	10133105	NELAP	LA
8585 - 2,4'-DDE	EPA 1699	10133105	NELAP	LA
8590 - 2,4'-DDT	EPA 1699	10133105	NELAP	LA
7355 - 4,4'-DDD	EPA 1699	10133105	NELAP	LA
7360 - 4,4'-DDE	EPA 1699	10133105	NELAP	LA
7361 - 4,4'-DDMU	EPA 1699	10133105	NELAP	LA
7365 - 4,4'-DDT	EPA 1699	10133105	NELAP	LA
7025 - Aldrin	EPA 1699	10133105	NELAP	LA
7470 - Dieldrin	EPA 1699	10133105	NELAP	LA
7510 - Endosulfan I	EPA 1699	10133105	NELAP	LA
7515 - Endosulfan II	EPA 1699	10133105	NELAP	LA
7520 - Endosulfan sulfate	EPA 1699	10133105	NELAP	LA
7540 - Endrin	EPA 1699	10133105	NELAP	LA
7530 - Endrin aldehyde	EPA 1699	10133105	NELAP	LA
7535 - Endrin ketone	EPA 1699	10133105	NELAP	LA
7685 - Heptachlor	EPA 1699	10133105	NELAP	LA
7690 - Heptachlor epoxide	EPA 1699	10133105	NELAP	LA
7810 - Methoxychlor	EPA 1699	10133105	NELAP	LA
7870 - Mirex	EPA 1699	10133105	NELAP	LA
7110 - alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 1699	10133105	NELAP	LA
7240 - alpha-Chlordane	EPA 1699	10133105	NELAP	LA
7115 - beta-BHC (beta-Hexachlorocyclohexane)	EPA 1699	10133105	NELAP	LA
7925 - cis-Nonachlor	EPA 1699	10133105	NELAP	LA
7105 - delta-BHC	EPA 1699	10133105	NELAP	LA
7120 - gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 1699	10133105	NELAP	LA
7245 - gamma-Chlordane	EPA 1699	10133105	NELAP	LA
7910 - trans-Nonachlor	EPA 1699	10133105	NELAP	LA
1444 - Separatory Funnel Liquid-liquid extraction	EPA 3510C	10138202	NELAP	LA
1452 - Soxhlet Extraction	EPA 3540C	10140202	NELAP	LA
1030 - Cadmium	EPA 6020	10156000	NELAP	LA
1040 - Chromium	EPA 6020	10156000	NELAP	LA

Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
1050 - Cobalt	EPA 6020	10156000	NELAP	LA
1055 - Copper	EPA 6020	10156000	NELAP	LA
1070 - Iron	EPA 6020	10156000	NELAP	LA
1075 - Lead	EPA 6020	10156000	NELAP	LA
1090 - Manganese	EPA 6020	10156000	NELAP	LA
1095 - Mercury	EPA 6020	10156000	NELAP	LA
1100 - Molybdenum	EPA 6020	10156000	NELAP	LA
1105 - Nickel	EPA 6020	10156000	NELAP	LA
1140 - Selenium	EPA 6020	10156000	NELAP	LA
1150 - Silver	EPA 6020	10156000	NELAP	LA
1165 - Thallium	EPA 6020	10156000	NELAP	LA
1175 - Tin	EPA 6020	10156000	NELAP	LA
1910 - Total Phosphorus	EPA 6020	10156000	NELAP	LA
1185 - Vanadium	EPA 6020	10156000	NELAP	LA
1190 - Zinc	EPA 6020	10156000	NELAP	LA
1030 - Cadmium	EPA 6020	10156204	NELAP	LA
1040 - Chromium	EPA 6020	10156204	NELAP	LA
1050 - Cobalt	EPA 6020	10156204	NELAP	LA
1055 - Copper	EPA 6020	10156204	NELAP	LA
1070 - Iron	EPA 6020	10156204	NELAP	LA
1075 - Lead	EPA 6020	10156204	NELAP	LA
1090 - Manganese	EPA 6020	10156204	NELAP	LA
1095 - Mercury	EPA 6020	10156204	NELAP	LA
1100 - Molybdenum	EPA 6020	10156204	NELAP	LA
1105 - Nickel	EPA 6020	10156204	NELAP	LA
1140 - Selenium	EPA 6020	10156204	NELAP	LA
1150 - Silver	EPA 6020	10156204	NELAP	LA
1165 - Thallium	EPA 6020	10156204	NELAP	LA
1175 - Tin	EPA 6020	10156204	NELAP	LA
1910 - Total Phosphorus	EPA 6020	10156204	NELAP	LA
1185 - Vanadium	EPA 6020	10156204	NELAP	LA
1190 - Zinc	EPA 6020	10156204	NELAP	LA
1000 - Aluminum	EPA 6020A	10156408	NELAP	LA
1005 - Antimony	EPA 6020A	10156408	NELAP	LA
1010 - Arsenic	EPA 6020A	10156408	NELAP	LA
1015 - Barium	EPA 6020A	10156408	NELAP	LA
1020 - Beryllium	EPA 6020A	10156408	NELAP	LA
1030 - Cadmium	EPA 6020A	10156408	NELAP	LA
1040 - Chromium	EPA 6020A	10156408	NELAP	LA
1050 - Cobalt	EPA 6020A	10156408	NELAP	LA
1055 - Copper	EPA 6020A	10156408	NELAP	LA
1070 - Iron	EPA 6020A	10156408	NELAP	LA
1075 - Lead	EPA 6020A	10156408	NELAP	LA
1090 - Manganese	EPA 6020A	10156408	NELAP	LA
1100 - Molybdenum	EPA 6020A	10156408	NELAP	LA
1105 - Nickel	EPA 6020A	10156408	NELAP	LA
1909 - Phosphorus	EPA 6020A	10156408	NELAP	LA
1140 - Selenium	EPA 6020A	10156408	NELAP	LA
1150 - Silver	EPA 6020A	10156408	NELAP	LA
1165 - Thallium	EPA 6020A	10156408	NELAP	LA
1175 - Tin	EPA 6020A	10156408	NELAP	LA
1910 - Total Phosphorus	EPA 6020A	10156408	NELAP	LA
1185 - Vanadium	EPA 6020A	10156408	NELAP	LA
1190 - Zinc	EPA 6020A	10156408	NELAP	LA
1000 - Aluminum	EPA 6020A, Rev.1	10156419	NELAP	LA

Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
1005 - Antimony	EPA 6020A, Rev.1	10156419	NELAP	LA
1010 - Arsenic	EPA 6020A, Rev.1	10156419	NELAP	LA
1015 - Barium	EPA 6020A, Rev.1	10156419	NELAP	LA
1020 - Beryllium	EPA 6020A, Rev.1	10156419	NELAP	LA
1030 - Cadmium	EPA 6020A, Rev.1	10156419	NELAP	LA
1040 - Chromium	EPA 6020A, Rev.1	10156419	NELAP	LA
1050 - Cobalt	EPA 6020A, Rev.1	10156419	NELAP	LA
1055 - Copper	EPA 6020A, Rev.1	10156419	NELAP	LA
1070 - Iron	EPA 6020A, Rev.1	10156419	NELAP	LA
1075 - Lead	EPA 6020A, Rev.1	10156419	NELAP	LA
1090 - Manganese	EPA 6020A, Rev.1	10156419	NELAP	LA
1100 - Molybdenum	EPA 6020A, Rev.1	10156419	NELAP	LA
1105 - Nickel	EPA 6020A, Rev.1	10156419	NELAP	LA
1140 - Selenium	EPA 6020A, Rev.1	10156419	NELAP	LA
1150 - Silver	EPA 6020A, Rev.1	10156419	NELAP	LA
1165 - Thallium	EPA 6020A, Rev.1	10156419	NELAP	LA
1175 - Tin	EPA 6020A, Rev.1	10156419	NELAP	LA
1185 - Vanadium	EPA 6020A, Rev.1	10156419	NELAP	LA
1190 - Zinc	EPA 6020A, Rev.1	10156419	NELAP	LA
5160 - 1,1,1-Trichloroethane	EPA 8260B	10184802	NELAP	LA
5110 - 1,1,2,2-Tetrachloroethane	EPA 8260B	10184802	NELAP	LA
5165 - 1,1,2-Trichloroethane	EPA 8260B	10184802	NELAP	LA
4630 - 1,1-Dichloroethane	EPA 8260B	10184802	NELAP	LA
5180 - 1,2,3-Trichloropropane	EPA 8260B	10184802	NELAP	LA
4635 - 1,2-Dichloroethane (Ethylene dichloride)	EPA 8260B	10184802	NELAP	LA
4655 - 1,2-Dichloropropane	EPA 8260B	10184802	NELAP	LA
4410 - 2-Butanone (Methyl ethyl ketone, MEK)	EPA 8260B	10184802	NELAP	LA
4860 - 2-Hexanone	EPA 8260B	10184802	NELAP	LA
4315 - Acetone	EPA 8260B	10184802	NELAP	LA
4375 - Benzene	EPA 8260B	10184802	NELAP	LA
4395 - Bromodichloromethane	EPA 8260B	10184802	NELAP	LA
4400 - Bromoform	EPA 8260B	10184802	NELAP	LA
4450 - Carbon disulfide	EPA 8260B	10184802	NELAP	LA
4455 - Carbon tetrachloride	EPA 8260B	10184802	NELAP	LA
4475 - Chlorobenzene	EPA 8260B	10184802	NELAP	LA
4575 - Chlorodibromomethane	EPA 8260B	10184802	NELAP	LA
4485 - Chloroethane (Ethyl chloride)	EPA 8260B	10184802	NELAP	LA
4505 - Chloroform	EPA 8260B	10184802	NELAP	LA
4595 - Dibromomethane (Methylene bromide)	EPA 8260B	10184802	NELAP	LA
4765 - Ethylbenzene	EPA 8260B	10184802	NELAP	LA
4950 - Methyl bromide (Bromomethane)	EPA 8260B	10184802	NELAP	LA
4960 - Methyl chloride (Chloromethane)	EPA 8260B	10184802	NELAP	LA
4975 - Methylene chloride (Dichloromethane)	EPA 8260B	10184802	NELAP	LA
5100 - Styrene	EPA 8260B	10184802	NELAP	LA
5115 - Tetrachloroethylene (Perchloroethylene)	EPA 8260B	10184802	NELAP	LA
5140 - Toluene	EPA 8260B	10184802	NELAP	LA
5170 - Trichloroethene (Trichloroethylene)	EPA 8260B	10184802	NELAP	LA
5175 - Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	EPA 8260B	10184802	NELAP	LA
5235 - Vinyl chloride	EPA 8260B	10184802	NELAP	LA

Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
4705 - cis & trans-1,2-Dichloroethene	EPA 8260B	10184802	NELAP	LA
4645 - cis-1,2-Dichloroethylene	EPA 8260B	10184802	NELAP	LA
4680 - cis-1,3-Dichloropropene	EPA 8260B	10184802	NELAP	LA
5240 - m+p-xylene	EPA 8260B	10184802	NELAP	LA
5245 - m-Xylene	EPA 8260B	10184802	NELAP	LA
5250 - o-Xylene	EPA 8260B	10184802	NELAP	LA
5255 - p-Xylene	EPA 8260B	10184802	NELAP	LA
4700 - trans-1,2-Dichloroethylene	EPA 8260B	10184802	NELAP	LA
4685 - trans-1,3-Dichloropropylene	EPA 8260B	10184802	NELAP	LA
6703 - 1,1'-Biphenyl (BZ-0)	EPA 8270D	10186002	NELAP	LA
6715 - 1,2,4,5-Tetrachlorobenzene	EPA 8270D	10186002	NELAP	LA
5155 - 1,2,4-Trichlorobenzene	EPA 8270D	10186002	NELAP	LA
4610 - 1,2-Dichlorobenzene	EPA 8270D	10186002	NELAP	LA
6885 - 1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8270D	10186002	NELAP	LA
4615 - 1,3-Dichlorobenzene	EPA 8270D	10186002	NELAP	LA
6160 - 1,3-Dinitrobenzene (1,3-DNB)	EPA 8270D	10186002	NELAP	LA
4835 - 1,3-Hexachlorobutadiene	EPA 8270D	10186002	NELAP	LA
4620 - 1,4-Dichlorobenzene	EPA 8270D	10186002	NELAP	LA
5790 - 1-Chloronaphthalene	EPA 8270D	10186002	NELAP	LA
6425 - 1-Naphthylamine	EPA 8270D	10186002	NELAP	LA
6735 - 2,3,4,6-Tetrachlorophenol	EPA 8270D	10186002	NELAP	LA
6835 - 2,4,5-Trichlorophenol	EPA 8270D	10186002	NELAP	LA
6840 - 2,4,6-Trichlorophenol	EPA 8270D	10186002	NELAP	LA
6000 - 2,4-Dichlorophenol	EPA 8270D	10186002	NELAP	LA
6130 - 2,4-Dimethylphenol	EPA 8270D	10186002	NELAP	LA
6175 - 2,4-Dinitrophenol	EPA 8270D	10186002	NELAP	LA
6185 - 2,4-Dinitrotoluene (2,4-DNT)	EPA 8270D	10186002	NELAP	LA
6005 - 2,6-Dichlorophenol	EPA 8270D	10186002	NELAP	LA
6190 - 2,6-Dinitrotoluene (2,6-DNT)	EPA 8270D	10186002	NELAP	LA
5515 - 2-Acetylaminofluorene	EPA 8270D	10186002	NELAP	LA
5795 - 2-Chloronaphthalene	EPA 8270D	10186002	NELAP	LA
5800 - 2-Chlorophenol	EPA 8270D	10186002	NELAP	LA
6360 - 2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	EPA 8270D	10186002	NELAP	LA
5145 - 2-Methylaniline (o-Toluidine)	EPA 8270D	10186002	NELAP	LA
6385 - 2-Methylnaphthalene	EPA 8270D	10186002	NELAP	LA
6400 - 2-Methylphenol (o-Cresol)	EPA 8270D	10186002	NELAP	LA
6430 - 2-Naphthylamine	EPA 8270D	10186002	NELAP	LA
6460 - 2-Nitroaniline	EPA 8270D	10186002	NELAP	LA
6490 - 2-Nitrophenol	EPA 8270D	10186002	NELAP	LA
6355 - 3-Methylcholanthrene	EPA 8270D	10186002	NELAP	LA
6405 - 3-Methylphenol (m-Cresol)	EPA 8270D	10186002	NELAP	LA
6465 - 3-Nitroaniline	EPA 8270D	10186002	NELAP	LA
5540 - 4-Aminobiphenyl	EPA 8270D	10186002	NELAP	LA
5660 - 4-Bromophenyl phenyl ether	EPA 8270D	10186002	NELAP	LA
5700 - 4-Chloro-3-methylphenol	EPA 8270D	10186002	NELAP	LA
5745 - 4-Chloroaniline	EPA 8270D	10186002	NELAP	LA
5825 - 4-Chlorophenyl phenylether	EPA 8270D	10186002	NELAP	LA
6410 - 4-Methylphenol (p-Cresol)	EPA 8270D	10186002	NELAP	LA
6470 - 4-Nitroaniline	EPA 8270D	10186002	NELAP	LA
6500 - 4-Nitrophenol	EPA 8270D	10186002	NELAP	LA
6115 - 7,12-Dimethylbenz(a) anthracene	EPA 8270D	10186002	NELAP	LA
9417 - 7h-Dibenzo(c,g) carbazole	EPA 8270D	10186002	NELAP	LA
5500 - Acenaphthene	EPA 8270D	10186002	NELAP	LA
5505 - Acenaphthylene	EPA 8270D	10186002	NELAP	LA

Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
5510 - Acetophenone	EPA 8270D	10186002	NELAP	LA
5545 - Aniline	EPA 8270D	10186002	NELAP	LA
5555 - Anthracene	EPA 8270D	10186002	NELAP	LA
5575 - Benz(a)anthracene	EPA 8270D	10186002	NELAP	LA
5580 - Benzo(a)pyrene	EPA 8270D	10186002	NELAP	LA
5585 - Benzo(b)fluoranthene	EPA 8270D	10186002	NELAP	LA
5590 - Benzo(g,h,i)perylene	EPA 8270D	10186002	NELAP	LA
5600 - Benzo(k)fluoranthene	EPA 8270D	10186002	NELAP	LA
5630 - Benzyl alcohol	EPA 8270D	10186002	NELAP	LA
5670 - Butyl benzyl phthalate	EPA 8270D	10186002	NELAP	LA
5855 - Chrysene	EPA 8270D	10186002	NELAP	LA
6065 - Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate, DEHP)	EPA 8270D	10186002	NELAP	LA
5925 - Di-n-butyl phthalate	EPA 8270D	10186002	NELAP	LA
6200 - Di-n-octyl phthalate	EPA 8270D	10186002	NELAP	LA
9354 - Dibenz(a, h) acridine	EPA 8270D	10186002	NELAP	LA
5900 - Dibenz(a, j) acridine	EPA 8270D	10186002	NELAP	LA
5895 - Dibenz(a,h)anthracene	EPA 8270D	10186002	NELAP	LA
5890 - Dibenzo(a,e) pyrene	EPA 8270D	10186002	NELAP	LA
9348 - Dibenzo(a,h) pyrene	EPA 8270D	10186002	NELAP	LA
9351 - Dibenzo(a,i) pyrene	EPA 8270D	10186002	NELAP	LA
5905 - Dibenzofuran	EPA 8270D	10186002	NELAP	LA
6070 - Diethyl phthalate	EPA 8270D	10186002	NELAP	LA
6135 - Dimethyl phthalate	EPA 8270D	10186002	NELAP	LA
8620 - Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 8270D	10186002	NELAP	LA
6205 - Diphenylamine	EPA 8270D	10186002	NELAP	LA
6260 - Ethyl methanesulfonate	EPA 8270D	10186002	NELAP	LA
6265 - Fluoranthene	EPA 8270D	10186002	NELAP	LA
6270 - Fluorene	EPA 8270D	10186002	NELAP	LA
6275 - Hexachlorobenzene	EPA 8270D	10186002	NELAP	LA
6285 - Hexachlorocyclopentadiene	EPA 8270D	10186002	NELAP	LA
4840 - Hexachloroethane	EPA 8270D	10186002	NELAP	LA
6295 - Hexachloropropene	EPA 8270D	10186002	NELAP	LA
6315 - Indeno(1,2,3-cd)pyrene	EPA 8270D	10186002	NELAP	LA
6320 - Isophorone	EPA 8270D	10186002	NELAP	LA
6325 - Isosafrole	EPA 8270D	10186002	NELAP	LA
6375 - Methyl methanesulfonate	EPA 8270D	10186002	NELAP	LA
5005 - Naphthalene	EPA 8270D	10186002	NELAP	LA
6590 - Pentachlorobenzene	EPA 8270D	10186002	NELAP	LA
5035 - Pentachloroethane	EPA 8270D	10186002	NELAP	LA
6600 - Pentachloronitrobenzene	EPA 8270D	10186002	NELAP	LA
6605 - Pentachlorophenol	EPA 8270D	10186002	NELAP	LA
6610 - Phenacetin	EPA 8270D	10186002	NELAP	LA
6615 - Phenanthrene	EPA 8270D	10186002	NELAP	LA
6625 - Phenol	EPA 8270D	10186002	NELAP	LA
6665 - Pyrene	EPA 8270D	10186002	NELAP	LA
6685 - Safrole	EPA 8270D	10186002	NELAP	LA
5760 - bis(2-Chloroethoxy)methane	EPA 8270D	10186002	NELAP	LA
5765 - bis(2-Chloroethyl) ether	EPA 8270D	10186002	NELAP	LA
5780 - bis(2-Chloroisopropyl) ether	EPA 8270D	10186002	NELAP	LA
5025 - n-Nitroso-di-n-butylamine	EPA 8270D	10186002	NELAP	LA
6545 - n-Nitrosodi-n-propylamine	EPA 8270D	10186002	NELAP	LA
6525 - n-Nitrosodiethylamine	EPA 8270D	10186002	NELAP	LA
6530 - n-Nitrosodimethylamine	EPA 8270D	10186002	NELAP	LA

Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
6535 - n-Nitrosodiphenylamine	EPA 8270D	10186002	NELAP	LA
6550 - n-Nitrosomethylethylamine	EPA 8270D	10186002	NELAP	LA
6555 - n-Nitrosomorpholine	EPA 8270D	10186002	NELAP	LA
6560 - n-Nitrosopiperidine	EPA 8270D	10186002	NELAP	LA
6565 - n-Nitrosopyrrolidine	EPA 8270D	10186002	NELAP	LA
6105 - p-Dimethylaminoazobenzene	EPA 8270D	10186002	NELAP	LA
9519 - 1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	EPA 8290	10187209	NELAP	LA
9516 - 1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	EPA 8290	10187209	NELAP	LA
9426 - 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)	EPA 8290	10187209	NELAP	LA
9420 - 1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)	EPA 8290	10187209	NELAP	LA
9423 - 1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)	EPA 8290	10187209	NELAP	LA
9453 - 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd)	EPA 8290	10187209	NELAP	LA
9471 - 1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-Hxcdf)	EPA 8290	10187209	NELAP	LA
9456 - 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin(1,2,3,6,7,8-Hxcdd)	EPA 8290	10187209	NELAP	LA
9474 - 1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf)	EPA 8290	10187209	NELAP	LA
9459 - 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd)	EPA 8290	10187209	NELAP	LA
9477 - 1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf)	EPA 8290	10187209	NELAP	LA
9540 - 1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd)	EPA 8290	10187209	NELAP	LA
9543 - 1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf)	EPA 8290	10187209	NELAP	LA
9480 - 2,3,4,6,7,8-Hexachlorodibenzofuran	EPA 8290	10187209	NELAP	LA
9549 - 2,3,4,7,8-Pentachlorodibenzofuran	EPA 8290	10187209	NELAP	LA
9618 - 2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD)	EPA 8290	10187209	NELAP	LA
9612 - 2,3,7,8-Tetrachlorodibenzofuran	EPA 8290	10187209	NELAP	LA
9438 - Total Hpcdd	EPA 8290	10187209	NELAP	LA
9444 - Total Hpcdf	EPA 8290	10187209	NELAP	LA
9468 - Total Hxcdd	EPA 8290	10187209	NELAP	LA
9483 - Total Hxcdf	EPA 8290	10187209	NELAP	LA
9555 - Total Pecdd	EPA 8290	10187209	NELAP	LA
9552 - Total Pecdf	EPA 8290	10187209	NELAP	LA
9609 - Total TCDD	EPA 8290	10187209	NELAP	LA
9615 - Total TCDF	EPA 8290	10187209	NELAP	LA
9618 - 2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD)	EPA 1613B	10257600	NELAP	LA
9105 - 2,2',3,3',4,4',5,5',6,6'-Decachlorobiphenyl (BZ-209)	EPA 1668C	10262109	NELAP	LA
9095 - 2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ-206)	EPA 1668C	10262109	NELAP	LA
9090 - 2,2',3,3',4,4',5,5'-Octachlorobiphenyl (BZ-194)	EPA 1668C	10262109	NELAP	LA

Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
9102 - 2,2',3,3',4,4',5,6'-Octachlorobiphenyl (BZ-196)	EPA 1668C	10262109	NELAP	LA
9101 - 2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl (BZ-207)	EPA 1668C	10262109	NELAP	LA
9103 - 2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ-195)	EPA 1668C	10262109	NELAP	LA
9065 - 2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ-170)	EPA 1668C	10262109	NELAP	LA
9104 - 2,2',3,3',4,4',6,6'-Octachlorobiphenyl (BZ-197)	EPA 1668C	10262109	NELAP	LA
9106 - 2,2',3,3',4,4',6-Heptachlorobiphenyl (BZ-171)	EPA 1668C	10262109	NELAP	LA
9020 - 2,2',3,3',4,4'-Hexachlorobiphenyl (BZ-128)	EPA 1668C	10262109	NELAP	LA
9114 - 2,2',3,3',4,5',6'-Heptachlorobiphenyl (BZ-177)	EPA 1668C	10262109	NELAP	LA
9112 - 2,2',3,3',4,5',6,6'-Octachlorobiphenyl (BZ-201)	EPA 1668C	10262109	NELAP	LA
9115 - 2,2',3,3',4,5',6-Heptachlorobiphenyl (BZ-175)	EPA 1668C	10262109	NELAP	LA
9117 - 2,2',3,3',4,5'-Hexachlorobiphenyl (BZ-130)	EPA 1668C	10262109	NELAP	LA
9108 - 2,2',3,3',4,5,5',6'-Octachlorobiphenyl (BZ-199)	EPA 1668C	10262109	NELAP	LA
9107 - 2,2',3,3',4,5,5',6,6'-Nonachlorobiphenyl (BZ-208)	EPA 1668C	10262109	NELAP	LA
9109 - 2,2',3,3',4,5,5',6-Octachlorobiphenyl (BZ-198)	EPA 1668C	10262109	NELAP	LA
9110 - 2,2',3,3',4,5,5'-Heptachlorobiphenyl (BZ-172)	EPA 1668C	10262109	NELAP	LA
9116 - 2,2',3,3',4,5,6'-Heptachlorobiphenyl (BZ-174)	EPA 1668C	10262109	NELAP	LA
9111 - 2,2',3,3',4,5,6,6'-Octachlorobiphenyl (BZ-200)	EPA 1668C	10262109	NELAP	LA
9113 - 2,2',3,3',4,5,6-Heptachlorobiphenyl (BZ-173)	EPA 1668C	10262109	NELAP	LA
9118 - 2,2',3,3',4,5-Hexachlorobiphenyl (BZ-129)	EPA 1668C	10262109	NELAP	LA
9120 - 2,2',3,3',4,6'-Hexachlorobiphenyl (BZ-132)	EPA 1668C	10262109	NELAP	LA
9119 - 2,2',3,3',4,6,6'-Heptachlorobiphenyl (BZ-176)	EPA 1668C	10262109	NELAP	LA
9121 - 2,2',3,3',4,6-Hexachlorobiphenyl (BZ-131)	EPA 1668C	10262109	NELAP	LA
9122 - 2,2',3,3',4-Pentachlorobiphenyl (BZ-82)	EPA 1668C	10262109	NELAP	LA
9123 - 2,2',3,3',5,5',6,6'-Octachlorobiphenyl (BZ-202)	EPA 1668C	10262109	NELAP	LA
9124 - 2,2',3,3',5,5',6-Heptachlorobiphenyl (BZ-178)	EPA 1668C	10262109	NELAP	LA
9125 - 2,2',3,3',5,5'-Hexachlorobiphenyl (BZ-133)	EPA 1668C	10262109	NELAP	LA
9127 - 2,2',3,3',5,6'-Hexachlorobiphenyl (BZ-135)	EPA 1668C	10262109	NELAP	LA
9126 - 2,2',3,3',5,6,6'-Heptachlorobiphenyl	EPA 1668C	10262109	NELAP	LA

Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
(BZ-179)				
9128 - 2,2',3,3',5,6-Hexachlorobiphenyl (BZ-134)	EPA 1668C	10262109	NELAP	LA
9129 - 2,2',3,3',5-Pentachlorobiphenyl (BZ-83)	EPA 1668C	10262109	NELAP	LA
9130 - 2,2',3,3',6,6'-Hexachlorobiphenyl (BZ-136)	EPA 1668C	10262109	NELAP	LA
9131 - 2,2',3,3',6-Pentachlorobiphenyl (BZ-84)	EPA 1668C	10262109	NELAP	LA
9132 - 2,2',3,3'-Tetrachlorobiphenyl (BZ-40)	EPA 1668C	10262109	NELAP	LA
9151 - 2,2',3,4',5',6-Hexachlorobiphenyl (BZ-149)	EPA 1668C	10262109	NELAP	LA
9154 - 2,2',3,4',5'-Pentachlorobiphenyl (BZ-97)	EPA 1668C	10262109	NELAP	LA
9080 - 2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ-187)	EPA 1668C	10262109	NELAP	LA
9144 - 2,2',3,4',5,5'-Hexachlorobiphenyl (BZ-146)	EPA 1668C	10262109	NELAP	LA
9147 - 2,2',3,4',5,6'-Hexachlorobiphenyl (BZ-148)	EPA 1668C	10262109	NELAP	LA
9146 - 2,2',3,4',5,6,6'-Heptachlorobiphenyl (BZ-188)	EPA 1668C	10262109	NELAP	LA
9149 - 2,2',3,4',5,6-Hexachlorobiphenyl (BZ-147)	EPA 1668C	10262109	NELAP	LA
9155 - 2,2',3,4',5-Pentachlorobiphenyl (BZ-90)	EPA 1668C	10262109	NELAP	LA
9159 - 2,2',3,4',6'-Pentachlorobiphenyl (BZ-98)	EPA 1668C	10262109	NELAP	LA
9157 - 2,2',3,4',6,6'-Hexachlorobiphenyl (BZ-150)	EPA 1668C	10262109	NELAP	LA
9160 - 2,2',3,4',6-Pentachlorobiphenyl (BZ-91)	EPA 1668C	10262109	NELAP	LA
9162 - 2,2',3,4'-Tetrachlorobiphenyl (BZ-42)	EPA 1668C	10262109	NELAP	LA
9075 - 2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ-183)	EPA 1668C	10262109	NELAP	LA
9025 - 2,2',3,4,4',5'-Hexachlorobiphenyl (BZ-138)	EPA 1668C	10262109	NELAP	LA
9133 - 2,2',3,4,4',5,5',6-Octachlorobiphenyl (BZ-203)	EPA 1668C	10262109	NELAP	LA
9134 - 2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ-180)	EPA 1668C	10262109	NELAP	LA
9136 - 2,2',3,4,4',5,6'-Heptachlorobiphenyl (BZ-182)	EPA 1668C	10262109	NELAP	LA
9135 - 2,2',3,4,4',5,6,6'-Octachlorobiphenyl (BZ-204)	EPA 1668C	10262109	NELAP	LA
9137 - 2,2',3,4,4',5,6-Heptachlorobiphenyl (BZ-181)	EPA 1668C	10262109	NELAP	LA
9138 - 2,2',3,4,4',5-Hexachlorobiphenyl (BZ-137)	EPA 1668C	10262109	NELAP	LA
9140 - 2,2',3,4,4',6'-Hexachlorobiphenyl (BZ-140)	EPA 1668C	10262109	NELAP	LA
9139 - 2,2',3,4,4',6,6'-Heptachlorobiphenyl (BZ-184)	EPA 1668C	10262109	NELAP	LA

Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
9141 - 2,2',3,4,4',6-Hexachlorobiphenyl (BZ-139)	EPA 1668C	10262109	NELAP	LA
9142 - 2,2',3,4,4'-Pentachlorobiphenyl (BZ-85)	EPA 1668C	10262109	NELAP	LA
9150 - 2,2',3,4,5',6-Hexachlorobiphenyl (BZ-144)	EPA 1668C	10262109	NELAP	LA
8975 - 2,2',3,4,5'-Pentachlorobiphenyl (BZ-87)	EPA 1668C	10262109	NELAP	LA
9143 - 2,2',3,4,5,5',6-Heptachlorobiphenyl (BZ-185)	EPA 1668C	10262109	NELAP	LA
9030 - 2,2',3,4,5,5'-Hexachlorobiphenyl (BZ-141)	EPA 1668C	10262109	NELAP	LA
9152 - 2,2',3,4,5,6'-Hexachlorobiphenyl (BZ-143)	EPA 1668C	10262109	NELAP	LA
9145 - 2,2',3,4,5,6,6'-Heptachlorobiphenyl (BZ-186)	EPA 1668C	10262109	NELAP	LA
9148 - 2,2',3,4,5,6-Hexachlorobiphenyl (BZ-142)	EPA 1668C	10262109	NELAP	LA
9153 - 2,2',3,4,5-Pentachlorobiphenyl (BZ-86)	EPA 1668C	10262109	NELAP	LA
9161 - 2,2',3,4,6'-Pentachlorobiphenyl (BZ-89)	EPA 1668C	10262109	NELAP	LA
9156 - 2,2',3,4,6,6'-Hexachlorobiphenyl (BZ-145)	EPA 1668C	10262109	NELAP	LA
9158 - 2,2',3,4,6-Pentachlorobiphenyl (BZ-88)	EPA 1668C	10262109	NELAP	LA
9163 - 2,2',3,4-Tetrachlorobiphenyl (BZ-41)	EPA 1668C	10262109	NELAP	LA
9166 - 2,2',3,5',6-Pentachlorobiphenyl (BZ-95)	EPA 1668C	10262109	NELAP	LA
8945 - 2,2',3,5'-Tetrachlorobiphenyl (BZ-44)	EPA 1668C	10262109	NELAP	LA
9035 - 2,2',3,5,5',6-Hexachlorobiphenyl (BZ-151)	EPA 1668C	10262109	NELAP	LA
9164 - 2,2',3,5,5'-Pentachlorobiphenyl (BZ-92)	EPA 1668C	10262109	NELAP	LA
9167 - 2,2',3,5,6'-Pentachlorobiphenyl (BZ-94)	EPA 1668C	10262109	NELAP	LA
9165 - 2,2',3,5,6,6'-Hexachlorobiphenyl (BZ-152)	EPA 1668C	10262109	NELAP	LA
9168 - 2,2',3,5,6-Pentachlorobiphenyl (BZ-93)	EPA 1668C	10262109	NELAP	LA
9169 - 2,2',3,5-Tetrachlorobiphenyl (BZ-43)	EPA 1668C	10262109	NELAP	LA
9171 - 2,2',3,6'-Tetrachlorobiphenyl (BZ-46)	EPA 1668C	10262109	NELAP	LA
9170 - 2,2',3,6,6'-Pentachlorobiphenyl (BZ-96)	EPA 1668C	10262109	NELAP	LA
9172 - 2,2',3,6-Tetrachlorobiphenyl (BZ-45)	EPA 1668C	10262109	NELAP	LA
9173 - 2,2',3-Trichlorobiphenyl (BZ-16)	EPA 1668C	10262109	NELAP	LA
9040 - 2,2',4,4',5,5'-Hexachlorobiphenyl (BZ-153)	EPA 1668C	10262109	NELAP	LA
9174 - 2,2',4,4',5,6'-Hexachlorobiphenyl (BZ-154)	EPA 1668C	10262109	NELAP	LA

Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
9175 - 2,2',4,4',5-Pentachlorobiphenyl (BZ-99)	EPA 1668C	10262109	NELAP	LA
9176 - 2,2',4,4',6,6'-Hexachlorobiphenyl (BZ-155)	EPA 1668C	10262109	NELAP	LA
9177 - 2,2',4,4',6-Pentachlorobiphenyl (BZ-100)	EPA 1668C	10262109	NELAP	LA
9178 - 2,2',4,4'-Tetrachlorobiphenyl (BZ-47)	EPA 1668C	10262109	NELAP	LA
9179 - 2,2',4,5',6-Pentachlorobiphenyl (BZ-103)	EPA 1668C	10262109	NELAP	LA
8950 - 2,2',4,5'-Tetrachlorobiphenyl (BZ-49)	EPA 1668C	10262109	NELAP	LA
8980 - 2,2',4,5,5'-Pentachlorobiphenyl (BZ-101)	EPA 1668C	10262109	NELAP	LA
9180 - 2,2',4,5,6'-Pentachlorobiphenyl (BZ-102)	EPA 1668C	10262109	NELAP	LA
9181 - 2,2',4,5-Tetrachlorobiphenyl (BZ-48)	EPA 1668C	10262109	NELAP	LA
9183 - 2,2',4,6'-Tetrachlorobiphenyl (BZ-51)	EPA 1668C	10262109	NELAP	LA
9182 - 2,2',4,6,6'-Pentachlorobiphenyl (BZ-104)	EPA 1668C	10262109	NELAP	LA
9184 - 2,2',4,6-Tetrachlorobiphenyl (BZ-50)	EPA 1668C	10262109	NELAP	LA
9185 - 2,2',4-Trichlorobiphenyl (BZ-17)	EPA 1668C	10262109	NELAP	LA
8955 - 2,2',5,5'-Tetrachlorobiphenyl (BZ-52)	EPA 1668C	10262109	NELAP	LA
9186 - 2,2',5,6'-Tetrachlorobiphenyl (BZ-53)	EPA 1668C	10262109	NELAP	LA
8930 - 2,2',5-Trichlorobiphenyl (BZ-18)	EPA 1668C	10262109	NELAP	LA
9187 - 2,2',6,6'-Tetrachlorobiphenyl (BZ-54)	EPA 1668C	10262109	NELAP	LA
9188 - 2,2',6-Trichlorobiphenyl (BZ-19)	EPA 1668C	10262109	NELAP	LA
9189 - 2,2'-Dichlorobiphenyl (BZ-4)	EPA 1668C	10262109	NELAP	LA
9224 - 2,3',4',5',6-Pentachlorobiphenyl (BZ-125)	EPA 1668C	10262109	NELAP	LA
9229 - 2,3',4',5'-Tetrachlorobiphenyl (BZ-76)	EPA 1668C	10262109	NELAP	LA
9222 - 2,3',4',5,5'-Pentachlorobiphenyl (BZ-124)	EPA 1668C	10262109	NELAP	LA
9230 - 2,3',4',5-Tetrachlorobiphenyl (BZ-70)	EPA 1668C	10262109	NELAP	LA
9237 - 2,3',4',6-Tetrachlorobiphenyl (BZ-71)	EPA 1668C	10262109	NELAP	LA
9239 - 2,3',4'-Trichlorobiphenyl (BZ-33)	EPA 1668C	10262109	NELAP	LA
9218 - 2,3',4,4',5',6-Hexachlorobiphenyl (BZ-168)	EPA 1668C	10262109	NELAP	LA
9000 - 2,3',4,4',5'-Pentachlorobiphenyl (BZ-123)	EPA 1668C	10262109	NELAP	LA
9011 - 2,3',4,4',5'-Pentachlorobiphenyl (BZ-123)	EPA 1668C	10262109	NELAP	LA
9055 - 2,3',4,4',5,5'-Hexachlorobiphenyl (BZ-167)	EPA 1668C	10262109	NELAP	LA
8995 - 2,3',4,4',5-Pentachlorobiphenyl (BZ-118)	EPA 1668C	10262109	NELAP	LA

Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
9220 - 2,3',4,4',6-Pentachlorobiphenyl (BZ-119)	EPA 1668C	10262109	NELAP	LA
8960 - 2,3',4,4'-Tetrachlorobiphenyl (BZ-66)	EPA 1668C	10262109	NELAP	LA
9226 - 2,3',4,5',6-Pentachlorobiphenyl (BZ-121)	EPA 1668C	10262109	NELAP	LA
9231 - 2,3',4,5'-Tetrachlorobiphenyl (BZ-68)	EPA 1668C	10262109	NELAP	LA
9223 - 2,3',4,5,5'-Pentachlorobiphenyl (BZ-120)	EPA 1668C	10262109	NELAP	LA
9232 - 2,3',4,5-Tetrachlorobiphenyl (BZ-67)	EPA 1668C	10262109	NELAP	LA
9235 - 2,3',4,6-Tetrachlorobiphenyl (BZ-69)	EPA 1668C	10262109	NELAP	LA
9240 - 2,3',4-Trichlorobiphenyl (BZ-25)	EPA 1668C	10262109	NELAP	LA
9244 - 2,3',5',6-Tetrachlorobiphenyl (BZ-73)	EPA 1668C	10262109	NELAP	LA
9246 - 2,3',5'-Trichlorobiphenyl (BZ-34)	EPA 1668C	10262109	NELAP	LA
9242 - 2,3',5,5'-Tetrachlorobiphenyl (BZ-72)	EPA 1668C	10262109	NELAP	LA
8935 - 2,3',5-Trichlorobiphenyl (BZ-26)	EPA 1668C	10262109	NELAP	LA
9248 - 2,3',6-Trichlorobiphenyl (BZ-27)	EPA 1668C	10262109	NELAP	LA
9249 - 2,3'-Dichlorobiphenyl (BZ-6)	EPA 1668C	10262109	NELAP	LA
9201 - 2,3,3',4',5',6-Hexachlorobiphenyl (BZ-164)	EPA 1668C	10262109	NELAP	LA
9202 - 2,3,3',4',5'-Pentachlorobiphenyl (BZ-122)	EPA 1668C	10262109	NELAP	LA
9195 - 2,3,3',4',5,5',6-Heptachlorobiphenyl (BZ-193)	EPA 1668C	10262109	NELAP	LA
9197 - 2,3,3',4',5,5'-Hexachlorobiphenyl (BZ-162)	EPA 1668C	10262109	NELAP	LA
9199 - 2,3,3',4',5,6-Hexachlorobiphenyl (BZ-163)	EPA 1668C	10262109	NELAP	LA
9205 - 2,3,3',4',5-Pentachlorobiphenyl (BZ-107)	EPA 1668C	10262109	NELAP	LA
8990 - 2,3,3',4',6-Pentachlorobiphenyl (BZ-110)	EPA 1668C	10262109	NELAP	LA
9207 - 2,3,3',4'-Tetrachlorobiphenyl (BZ-56)	EPA 1668C	10262109	NELAP	LA
9192 - 2,3,3',4,4',5',6-Heptachlorobiphenyl (BZ-191)	EPA 1668C	10262109	NELAP	LA
9045 - 2,3,3',4,4',5'-Hexachlorobiphenyl (BZ-157)	EPA 1668C	10262109	NELAP	LA
9190 - 2,3,3',4,4',5,5',6-Octachlorobiphenyl (BZ-205)	EPA 1668C	10262109	NELAP	LA
9085 - 2,3,3',4,4',5,5'-Heptachlorobiphenyl (BZ-189)	EPA 1668C	10262109	NELAP	LA
9191 - 2,3,3',4,4',5,6-Heptachlorobiphenyl (BZ-190)	EPA 1668C	10262109	NELAP	LA
9050 - 2,3,3',4,4',5-Hexachlorobiphenyl (BZ-156)	EPA 1668C	10262109	NELAP	LA
9193 - 2,3,3',4,4',6-Hexachlorobiphenyl (BZ-158)	EPA 1668C	10262109	NELAP	LA
8985 - 2,3,3',4,4'-Pentachlorobiphenyl (BZ-105)	EPA 1668C	10262109	NELAP	LA

Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
9200 - 2,3,3',4,5',6-Hexachlorobiphenyl (BZ-161)	EPA 1668C	10262109	NELAP	LA
9203 - 2,3,3',4,5'-Pentachlorobiphenyl (BZ-108)	EPA 1668C	10262109	NELAP	LA
9194 - 2,3,3',4,5,5',6-Heptachlorobiphenyl (BZ-192)	EPA 1668C	10262109	NELAP	LA
9196 - 2,3,3',4,5,5'-Hexachlorobiphenyl (BZ-159)	EPA 1668C	10262109	NELAP	LA
9198 - 2,3,3',4,5,6-Hexachlorobiphenyl (BZ-160)	EPA 1668C	10262109	NELAP	LA
9204 - 2,3,3',4,5-Pentachlorobiphenyl (BZ-106)	EPA 1668C	10262109	NELAP	LA
9206 - 2,3,3',4,6-Pentachlorobiphenyl (BZ-109)	EPA 1668C	10262109	NELAP	LA
9208 - 2,3,3',4-Tetrachlorobiphenyl (BZ-55)	EPA 1668C	10262109	NELAP	LA
9212 - 2,3,3',5',6-Pentachlorobiphenyl (BZ-113)	EPA 1668C	10262109	NELAP	LA
9213 - 2,3,3',5'-Tetrachlorobiphenyl (BZ-58)	EPA 1668C	10262109	NELAP	LA
9209 - 2,3,3',5,5',6-Hexachlorobiphenyl (BZ-165)	EPA 1668C	10262109	NELAP	LA
9210 - 2,3,3',5,5'-Pentachlorobiphenyl (BZ-111)	EPA 1668C	10262109	NELAP	LA
9211 - 2,3,3',5,6-Pentachlorobiphenyl (BZ-112)	EPA 1668C	10262109	NELAP	LA
9214 - 2,3,3',5-Tetrachlorobiphenyl (BZ-57)	EPA 1668C	10262109	NELAP	LA
9215 - 2,3,3',6-Tetrachlorobiphenyl (BZ-59)	EPA 1668C	10262109	NELAP	LA
9216 - 2,3,3'-Trichlorobiphenyl (BZ-20)	EPA 1668C	10262109	NELAP	LA
9227 - 2,3,4',5,6-Pentachlorobiphenyl (BZ-117)	EPA 1668C	10262109	NELAP	LA
9233 - 2,3,4',5-Tetrachlorobiphenyl (BZ-63)	EPA 1668C	10262109	NELAP	LA
9236 - 2,3,4',6-Tetrachlorobiphenyl (BZ-64)	EPA 1668C	10262109	NELAP	LA
9241 - 2,3,4'-Trichlorobiphenyl (BZ-22)	EPA 1668C	10262109	NELAP	LA
9217 - 2,3,4,4',5,6-Hexachlorobiphenyl (BZ-166)	EPA 1668C	10262109	NELAP	LA
9005 - 2,3,4,4',5-Pentachlorobiphenyl (BZ-114)	EPA 1668C	10262109	NELAP	LA
9219 - 2,3,4,4',6-Pentachlorobiphenyl (BZ-115)	EPA 1668C	10262109	NELAP	LA
9221 - 2,3,4,4'-Tetrachlorobiphenyl (BZ-60)	EPA 1668C	10262109	NELAP	LA
9225 - 2,3,4,5,6-Pentachlorobiphenyl (BZ-116)	EPA 1668C	10262109	NELAP	LA
9228 - 2,3,4,5-Tetrachlorobiphenyl (BZ-61)	EPA 1668C	10262109	NELAP	LA
9234 - 2,3,4,6-Tetrachlorobiphenyl (BZ-62)	EPA 1668C	10262109	NELAP	LA
9238 - 2,3,4-Trichlorobiphenyl (BZ-21)	EPA 1668C	10262109	NELAP	LA
9243 - 2,3,5,6-Tetrachlorobiphenyl (BZ-65)	EPA 1668C	10262109	NELAP	LA

Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
9245 - 2,3,5-Trichlorobiphenyl (BZ-23)	EPA 1668C	10262109	NELAP	LA
9247 - 2,3,6-Trichlorobiphenyl (BZ-24)	EPA 1668C	10262109	NELAP	LA
8920 - 2,3-Dichlorobiphenyl (BZ-5)	EPA 1668C	10262109	NELAP	LA
8940 - 2,4',5-Trichlorobiphenyl (BZ-31)	EPA 1668C	10262109	NELAP	LA
9255 - 2,4',6-Trichlorobiphenyl (BZ-32)	EPA 1668C	10262109	NELAP	LA
9256 - 2,4'-Dichlorobiphenyl (BZ-8)	EPA 1668C	10262109	NELAP	LA
9250 - 2,4,4',5-Tetrachlorobiphenyl (BZ-74)	EPA 1668C	10262109	NELAP	LA
9251 - 2,4,4',6-Tetrachlorobiphenyl (BZ-75)	EPA 1668C	10262109	NELAP	LA
9252 - 2,4,4'-Trichlorobiphenyl (BZ-28)	EPA 1668C	10262109	NELAP	LA
9253 - 2,4,5-Trichlorobiphenyl (BZ-29)	EPA 1668C	10262109	NELAP	LA
9254 - 2,4,6-Trichlorobiphenyl (BZ-30)	EPA 1668C	10262109	NELAP	LA
9257 - 2,4-Dichlorobiphenyl (BZ-7)	EPA 1668C	10262109	NELAP	LA
9258 - 2,5-Dichlorobiphenyl (BZ-9)	EPA 1668C	10262109	NELAP	LA
9259 - 2,6-Dichlorobiphenyl (BZ-10)	EPA 1668C	10262109	NELAP	LA
8915 - 2-Chlorobiphenyl (BZ-1)	EPA 1668C	10262109	NELAP	LA
9060 - 3,3',4,4',5,5'-Hexachlorobiphenyl (BZ-169)	EPA 1668C	10262109	NELAP	LA
9015 - 3,3',4,4',5-Pentachlorobiphenyl (BZ-126)	EPA 1668C	10262109	NELAP	LA
8965 - 3,3',4,4'-Tetrachlorobiphenyl (BZ-77)	EPA 1668C	10262109	NELAP	LA
9261 - 3,3',4,5'-Tetrachlorobiphenyl (BZ-79)	EPA 1668C	10262109	NELAP	LA
9260 - 3,3',4,5,5'-Pentachlorobiphenyl (BZ-127)	EPA 1668C	10262109	NELAP	LA
9262 - 3,3',4,5-Tetrachlorobiphenyl (BZ-78)	EPA 1668C	10262109	NELAP	LA
9263 - 3,3',4-Trichlorobiphenyl (BZ-35)	EPA 1668C	10262109	NELAP	LA
9264 - 3,3',5,5'-Tetrachlorobiphenyl (BZ-80)	EPA 1668C	10262109	NELAP	LA
9265 - 3,3',5-Trichlorobiphenyl (BZ-36)	EPA 1668C	10262109	NELAP	LA
8925 - 3,3'-Dichlorobiphenyl (BZ-11)	EPA 1668C	10262109	NELAP	LA
9268 - 3,4',5-Trichlorobiphenyl (BZ-39)	EPA 1668C	10262109	NELAP	LA
9269 - 3,4'-Dichlorobiphenyl (BZ-13)	EPA 1668C	10262109	NELAP	LA
8970 - 3,4,4',5-Tetrachlorobiphenyl (BZ-81)	EPA 1668C	10262109	NELAP	LA
9266 - 3,4,4'-Trichlorobiphenyl (BZ-37)	EPA 1668C	10262109	NELAP	LA
9267 - 3,4,5-Trichlorobiphenyl (BZ-38)	EPA 1668C	10262109	NELAP	LA
9270 - 3,4-Dichlorobiphenyl (BZ-12)	EPA 1668C	10262109	NELAP	LA
9271 - 3,5-Dichlorobiphenyl (BZ-14)	EPA 1668C	10262109	NELAP	LA
9272 - 3-Chlorobiphenyl (BZ-2)	EPA 1668C	10262109	NELAP	LA
9273 - 4,4'-Dichlorobiphenyl (BZ-15)	EPA 1668C	10262109	NELAP	LA
9274 - 4-Chlorobiphenyl (BZ-3)	EPA 1668C	10262109	NELAP	LA

Biological Tissue

Analyte	Method Name	Method Code	Type	AB
NONE	NONE	NONE	NONE	NONE

Mixon, Karen

From: Tyrrell, Ken
Sent: Monday, July 09, 2018 10:44 AM
To: Christine L. Hein; Christy Marquez; David Weber; Debbie Silva; Denise Fellers; Drew Gilpin; Eileen Tierney; Frederick Wolf; Gerald George; Greg Christianson; Hans P. Feige; Howard Cumberland; Jeff Ring; Jim Dragna; Karen Traeger; Kelmar, Laura; Kirsten L. Nathanson; Kline, Danni; Linda Baker; Loren Dunn; Mark Strandberg; Mat Cusma; Minihan, Anne S.; Nathan F Blomgren; Nicole Ott (nott@integral-corp.com); Norm DuPont; Peter Saba; PH.Admin.Record; Scott Rowlands
Cc: Pretare, Jennifer; Anne Fitzpatrick (afitzpatrick@geosyntec.com); Ruffle, Betsy; Keith Kroeger; Mixon, Karen; Dahl, Amy; Julia Klens Caprio
Subject: FYI.... EPA Conditional Approval -- FW: Change Request 09 - Lab Switching for Subsurface Core Samples

PRIVILEGED AND CONFIDENTIAL / JOINT DEFENSE COMMUNICATION / ATTORNEY CLIENT WORK PRODUCT

For your information

Action required of the AECOM/Geosyntec chemists.

EPA conditional approval of CR09 is offered below.

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From: Zhen, Davis [mailto:Zhen.Davis@epa.gov]
Sent: Monday, July 9, 2018 10:39 AM
To: Tyrrell, Ken <ken.tyrrell@aecom.com>
Cc: Scott Coffey <coffeyse@cdmsmith.com>; younghs@cdmsmith.com; Vickstrom, Kyle E. <vickstromke@cdmsmith.com>
Subject: Re: Change Request 09 - Lab Switching for Subsurface Core Samples

Ken,

EPA has reviewed and conditionally approves of Change Request 9 pending on your submittal of the supporting information below:

- QA manual for ALS Burlington
- Confirmation of whether ALS Burlington is NELAP accredited for the 1699 HR-GC/MS method for pesticides
    - If NELAP accredited, append certificate to this change request
    - If not NELAP accredited, add a note to this change request stating that ALS Burlington does not carry this certification for the method in question

Please note that QAPP Section 2.4 states that all analytical labs will be NELAP accredited. Any deviation from this will need to be detailed with supporting information in a change request.

Thanks,

****
Davis Zhen, Manager
Site Cleanup Unit 2
Office of Environmental Cleanup
1200 Sixth Avenue Suite 155
M/S ECL – 122, Seattle, WA 98101
Tel: (206) 553-7660
Cell: (206) 437-5826
****

From: Tyrrell, Ken <ken.tyrrell@aecom.com>
Sent: Wednesday, June 27, 2018 6:53 PM
To: Zhen, Davis <Zhen.Davis@epa.gov>
Cc: Coffey, Scott <CoffeySE@cdmsmith.com>; Young, Howard S. <younghs@cdmsmith.com>; Vickstrom, Kyle E. <vickstromke@cdmsmith.com>
Subject: Change Request 09 - Lab Switching for Subsurface Core Samples

Davis,

Attached is Change Request 09 (CR09) about switching subsurface core samples.

The CR is self-explanatory but here's a summary:

The subsurface sediment samples to be collected for chlorinated pesticides (specifically DDx isomers) and polynuclear aromatic hydrocarbons (PAHs) will be moved from ALS Kelso to the alternate laboratories presented in the table below.

Analyte Group	QAPP (ALS Kelso)	Alternate Laboratory		
		Laboratory	Method	SOP ID/Revision/Date
Pesticides (DDx only)	1699M GC/MS/MS	ALS Burlington	1699 HR-GC/MS	BU-TM-1103, Rev. 7, 2/2/2017
PAHs	8270D-SIM	TA Seattle	8270D-SIM	TA-MS-0315, Rev. 4, 4/25/18 (Analytical) TA-OP-0367, Rev. 7, 12/29/17 (Prep)

Let me know if you have any questions.

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CHANGE REQUEST FORM

Portland Harbor PDI Studies, 2018

Page: 1 of 1 Change No: 16

CHANGE REQUEST

Surface water samples will be submitted to Analytical Resources Inc. (ARI) located in Tukwila, WA for analysis for pentachlorophenol by EPA Method 8041A. ARI is NELAP accredited for this test method via their ORELAP accreditation. The method detection limit (MDL) and quantitation limit for pentachlorophenol in surface water will be revised from 0.005 ug/L to 0.014 ug/L and 0.04 ug/L to 0.025 ug/L, respectively.

Applicable Reference:

Quality Assurance Project Plan, Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling, Portland Harbor Superfund Site, Agency Approval Draft dated March 23, 2018, as amended by Change Requests 06, 07, and 09.

Description of Change:

The analytical MDL and quantitation limit for pentachlorophenol in surface water samples presented in Table 2c of the QAPP will be changed as follows:

units: ug/L

Reference	Method	ROD Cleanup Level	Project Quantitation Limit	Achievable Laboratory MDL
QAPP	8270D-SIM	0.03	0.04	0.005
CR-16	8041A		0.025	0.014
Alternate Method	8270D-LL		1.0	0.34

The analysis by the 8041A method will be performed by ARI. Sample matrix interferences can impact the ability to achieve the lower quantitation limit using method 8041A, therefore, pentachlorophenol will also be analyzed at ALS-Kelso with bis-2-(ethylhexyl)phthalate using method 8270D-LL to compare the results between the two methods for the first sampling event. This information will be used to assess any difficulties that may be encountered using method 8041A in future surface water sampling events. The MDL and reporting limit for method 8270D-LL are provided in the table above.

Reason for Change:

At the time of QAPP development, the 8270D-SIM method developed by ALS-Kelso and presented in the QAPP was the only GCMS method and the only laboratory capable of achieving the ROD cleanup level (CUL) for pentachlorophenol in water. However, ALS-Kelso can no longer support the method, and a check of other laboratories that use a similar method (GCMS 8270 based) indicated similar MDLs and quantitation limits to ALS-Kelso's 8270D-LL method. However, the MDL and quantitation limit achievable under method 8270D-LL is above the ROD CUL. The MDL and quantitation limit using method 8041A, a GC only method, can achieve the ROD CUL. ARI is the only local laboratory that can support this method and the low detection levels. The laboratories that are currently conducting laboratory work on the project do not support the 8041A method and alternate methods were not able to achieve the ROD cleanup level.

Impact on Present and Completed Work:

The ROD CUL for pentachlorophenol is 0.03 ug/L for surface water. With the requested change, the cleanup level should be met so there is no adverse impact to the project.

Requested By: Ken Tyrrell (AECOM Project Coordinator) Date: 8/30/2018

Acknowledged By: _____ (EPA Project Manager) Date: _____

APPROVAL

Senior Technical Advisor Karen Mixon Date: 8/30/2018

Client Project Coordinator: Ken Tyrrell Date: 8/30/2018

EPA Project Manager: _____ Date: _____

Mixon, Karen

From: Tyrrell, Ken
Sent: Friday, August 31, 2018 8:26 AM
To: Christine L. Hein; Christy Marquez; David Weber; Debbie Silva; Denise Fellers; Drew Gilpin; Eileen Tierney; Frederick Wolf; Gerald George; Greg Christianson; Hans P. Feige; Howard Cumberland; Jeff Ring; Jim Dragna; Karen Traeger; Kelmar, Laura; Kirsten L. Nathanson; Kline, Danni; Linda Baker; Loren Dunn; Mark Strandberg; Mat Cusma; Minihan, Anne S.; Nathan F Blomgren; Nicole Ott (nott@integral-corp.com); Norm DuPont; Peter Saba; PH.Admin.Record; Scott Rowlands
Cc: Pretare, Jennifer; Anne Fitzpatrick (afitzpatrick@geosyntec.com); Ruffle, Betsy; Keith Kroeger; Mixon, Karen; Dahl, Amy; Kline, Danni
Subject: FYI...EPA Approval and Request for ARI Docs -- FW: Change Request CR16 - Analyzing Pentachlorophenol in Surface Water

PRIVILEGED AND CONFIDENTIAL / JOINT DEFENSE COMMUNICATION / ATTORNEY CLIENT WORK PRODUCT

For your information – action needed by team chemists

EPA approves of Change Request 16 for the use of ARI.

As part of the approval the EPA requests a set of documents from ARI (as they did w/ the other previous labs).

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From: Zhen, Davis [mailto:Zhen.Davis@epa.gov]
Sent: Friday, August 31, 2018 8:18 AM
To: Tyrrell, Ken <ken.tyrrell@aecom.com>
Cc: Scott Coffey <coffeyse@cdmsmith.com>; Vickstrom, Kyle E. <vickstromke@cdmsmith.com>; younghs@cdmsmith.com
Subject: FW: Change Request CR16 - Analyzing Pentachlorophenol in Surface Water

Ken,

As a follow-up to my email yesterday evening, EPA has reviewed the revised CR-16 and approves of the requested change. In addition to the CR-16 form, EPA expects that ARI's QA manual, ORELAP accreditation certificate, and the relevant laboratory SOP reference will be appended to the final QAPP. Feel free to reach out with any questions.

Thanks,

****
Davis Zhen, Manager
Site Cleanup Unit 2
Office of Environmental Cleanup
1200 Sixth Avenue Suite 155
M/S ECL – 122, Seattle, WA 98101
Tel: (206) 553-7660
Cell: (206) 437-5826
****

From: Zhen, Davis <Zhen.Davis@epa.gov>
Sent: Thursday, August 30, 2018 6:48 PM
To: ken.tyrrell@aecom.com
Cc: Coffey, Scott <CoffeySE@cdmsmith.com>; Young, Howard S. <younghs@cdmsmith.com>; Vickstrom, Kyle E. <vickstromke@cdmsmith.com>
Subject: RE: Change Request CR16 - Analyzing Pentachlorophenol in Surface Water

Ken,

Per our conversation earlier today and your email below, Pre-RD Group/AECOM has selected ARI to process your samples analyzing pentachlorophenol using methods consistent with EPA Method 8041A. EPA will review your request for consistency with EPA Method 8041A and determine whether your proposed lab meets requirement set forth by the method. Because of potential holding time exceedance of the samples, I am conditionally approving your change request. This conditional approval only applies to surface water samples as described in your Change Request. Should EPA disapprove the change request, analyses and results for all analyzed samples in this change request will be deemed unacceptable to the EPA.

Please let me know if you have any questions.

Thanks,

****
Davis Zhen, Manager
Site Cleanup Unit 2
Office of Environmental Cleanup
1200 Sixth Avenue Suite 155
M/S ECL – 122, Seattle, WA 98101
Tel: (206) 553-7660
Cell: (206) 437-5826
****

From: Tyrrell, Ken [mailto:ken.tyrrell@aecom.com]
Sent: Thursday, August 30, 2018 3:44 PM
To: Zhen, Davis <Zhen.Davis@epa.gov>
Cc: Scott Coffey <coffeyse@cdmsmith.com>; younghs@cdmsmith.com; Vickstrom, Kyle E. <vickstromke@cdmsmith.com>
Subject: Change Request CR16 - Analyzing Pentachlorophenol in Surface Water

Davis,

Pls consider this Change Request (CR16), attached. With apologies, this is a time sensitive decision and we would greatly appreciate feedback today.

Surface water samples will be submitted to Analytical Resources Inc. (ARI) located in Tukwila, WA for analysis for pentachlorophenol by EPA Method 8041A. ARI is NELAP accredited for this test method via their ORELAP accreditation. The method detection limit (MDL) and quantitation limit for pentachlorophenol in surface water will be revised from 0.005 ug/L to 0.014 ug/L and 0.04 ug/L to 0.025 ug/L, respectively.

At the time of QAPP development, the 8270D-SIM method developed by ALS-Kelso and presented in the QAPP was the only GCMS method and the only laboratory capable of achieving the ROD cleanup level (CUL) for pentachlorophenol in water. However, ALS-Kelso can no longer support the method, and a check of other laboratories that use a similar method (GCMS 8270 based) indicated similar MDLs and quantitation limits to ALS-Kelso's 8270D-LL method. However, the MDL and quantitation limit achievable under method 8270D-LL is above the ROD CUL. The MDL and quantitation limit using method 8041A, a GC only method, can achieve the ROD CUL. ARI is the only local laboratory that can support this method and the low detection levels. The laboratories that are currently conducting laboratory work on the project do not support the 8041A method and alternate methods were not able to achieve the ROD cleanup level.

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