

# TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

## ANALYTICAL REPORT

TestAmerica Laboratories, Inc.

TestAmerica Seattle  
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Tel: (253)922-2310

TestAmerica Job ID: 580-78968-1

Client Project/Site: Portland Harbor Pre-Remedial Design

For:

AECOM  
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Attn: Amy Dahl

*M. Elaine Walker*

Authorized for release by:  
8/10/2018 2:24:39 PM

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*This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.*

*Results relate only to the items tested and the sample(s) as received by the laboratory.*



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# Case Narrative

Client: AECOM  
Project/Site: Portland Harbor Pre-Remedial Design

TestAmerica Job ID: 580-78968-1

**Job ID: 580-78968-1**

**Laboratory: TestAmerica Seattle**

## Narrative

### SRM - EDD ERROR (TOO MANY CHARACTERS FOR LCSSRM

#### CASE NARRATIVE

Client: AECOM

Project: Portland Harbor Pre-Remedial Design

Report Number: 580-78968-1

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues.

It should be noted that samples with elevated Reporting Limits (RLs) resulting from a dilution may not be able to satisfy customer reporting limits in some cases. Such increases in the RLs are an unavoidable but acceptable consequence of sample dilution that enables quantification of target analytes within the calibration range of the instrument or that reduces the interferences thereby enabling the quantification of target analytes.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

## RECEIPT

One sample was received on 7/19/2018 9:51 AM; the sample arrived in good condition, properly preserved and, where required, on ice.

This sample is a requested standard reference material (SRM) sample (SRM 1944)

The Client requested metals and TOC be added to the SRM sample.

Note: All samples which require thermal preservation are considered acceptable if the arrival temperature is within 2C of the required temperature or method specified range. For samples with a specified temperature of 4C, samples with a temperature ranging from just above freezing temperature of water to 6C shall be acceptable. Samples that are hand delivered immediately following collection may not meet these criteria, however they will be deemed acceptable according to NELAC standards, if there is evidence that the chilling process has begun, such as arrival on ice, etc.

## SEMIVOLATILE ORGANIC COMPOUNDS - SELECTED ION MODE (SIM)

**Sample SRM 1944 (580-78968-1) was analyzed for semivolatile organic compounds - Selected Ion Mode (SIM) in accordance with SW846 8270D\_SIM.** The sample was prepared on 07/30/2018 and analyzed on 08/01/2018.

2-Methylnaphthalene and Naphthalene were detected in method blank MB 580-280386/1-A at levels exceeding the reporting limit. If the associated sample reported a result above the MDL and/or RL, the result has been flagged. Associated sample(s) were not re-extracted and/or re-analyzed because results were greater than 10X the value found in the method blank.

Several analytes were detected in method blank MB 580-280386/1-A at levels that were above the method detection limit but below the reporting limit. The values should be considered estimates, and have been flagged. If the associated sample reported a result above the MDL and/or RL, the result has been flagged. This target analyte concentration was less than ½ the reporting limit (RL); therefore, re-extraction and re-analysis of samples was not performed.

Sample SRM 1944 (580-78968-1)[50X] required dilution prior to analysis due to the nature of the sample matrix. The reporting limits have been adjusted accordingly.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

## METALS (ICPMS)

**Sample SRM 1944 (580-78968-1) was analyzed for Metals (ICPMS) in accordance with 6020A\_LL.** The sample was prepared and

## Case Narrative

Client: AECOM  
Project/Site: Portland Harbor Pre-Remedial Design

TestAmerica Job ID: 580-78968-1

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### Job ID: 580-78968-1 (Continued)

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#### Laboratory: TestAmerica Seattle (Continued)

analyzed on 07/23/2018.

The presence of the '4' qualifier indicates analytes where the concentration in the unspiked sample exceeded four times the spiking amount.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

#### **TOTAL MERCURY**

**Sample SRM 1944 (580-78968-1) was analyzed for total mercury in accordance with EPA SW-846 Method 7471A.** The sample was prepared and analyzed on 07/30/2018.

Sample SRM 1944 (580-78968-1)[20X] required dilution prior to analysis. The reporting limits have been adjusted accordingly.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

#### **TOTAL ORGANIC CARBON**

**Sample SRM 1944 (580-78968-1) was analyzed for total organic carbon in accordance with EPA SW-846 Method 9060.** The sample was analyzed on 07/24/2018.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

# Definitions/Glossary

Client: AECOM  
Project/Site: Portland Harbor Pre-Remedial Design

TestAmerica Job ID: 580-78968-1

## Qualifiers

### GC/MS Semi VOA

Qualifier	Qualifier Description
B	Compound was found in the blank and sample.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

## Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
α	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

# Client Sample Results

Client: AECOM  
Project/Site: Portland Harbor Pre-Remedial Design

TestAmerica Job ID: 580-78968-1

**Client Sample ID: SRM 1944**

**Date Collected: 07/19/18 00:01**

**Date Received: 07/19/18 09:51**

**Lab Sample ID: 580-78968-1**

**Matrix: Solid**

## Method: 8270D SIM - Semivolatile Organic Compounds (GC/MS SIM)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
2-Methylnaphthalene	420	B	48	4.3	ug/Kg	-	07/30/18 11:32	08/01/18 14:18	50
Acenaphthene	240		48	5.8	ug/Kg	-	07/30/18 11:32	08/01/18 14:18	50
Acenaphthylene	720		48	4.8	ug/Kg	-	07/30/18 11:32	08/01/18 14:18	50
Anthracene	870	B	48	5.8	ug/Kg	-	07/30/18 11:32	08/01/18 14:18	50
Benzo[a]anthracene	3600	B	48	7.3	ug/Kg	-	07/30/18 11:32	08/01/18 14:18	50
Benzo[a]pyrene	2300	B	48	3.8	ug/Kg	-	07/30/18 11:32	08/01/18 14:18	50
Benzo[b]fluoranthene	3900	B	48	5.7	ug/Kg	-	07/30/18 11:32	08/01/18 14:18	50
Benzo[g,h,i]perylene	2100	B	48	4.8	ug/Kg	-	07/30/18 11:32	08/01/18 14:18	50
Benzo[k]fluoranthene	1300	B	48	5.8	ug/Kg	-	07/30/18 11:32	08/01/18 14:18	50
Chrysene	4000	B	48	14	ug/Kg	-	07/30/18 11:32	08/01/18 14:18	50
Dibenz(a,h)anthracene	610	B	48	6.9	ug/Kg	-	07/30/18 11:32	08/01/18 14:18	50
Fluoranthene	6400	B	48	13	ug/Kg	-	07/30/18 11:32	08/01/18 14:18	50
Fluorene	250	B	48	4.8	ug/Kg	-	07/30/18 11:32	08/01/18 14:18	50
Indeno[1,2,3-cd]pyrene	1800	B	48	5.8	ug/Kg	-	07/30/18 11:32	08/01/18 14:18	50
Naphthalene	640	B	48	7.7	ug/Kg	-	07/30/18 11:32	08/01/18 14:18	50
Phenanthrene	3600	B	48	6.6	ug/Kg	-	07/30/18 11:32	08/01/18 14:18	50
Pyrene	6700	B	48	9.3	ug/Kg	-	07/30/18 11:32	08/01/18 14:18	50

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Terphenyl-d14	87		57 - 120	07/30/18 11:32	08/01/18 14:18	50

## Method: 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	17		0.21	0.042	mg/Kg	-	07/23/18 09:56	07/23/18 18:31	5
Cadmium	7.9		0.17	0.033	mg/Kg	-	07/23/18 09:56	07/23/18 18:31	5
Copper	340		0.42	0.093	mg/Kg	-	07/23/18 09:56	07/23/18 18:31	5
Lead	290		0.21	0.020	mg/Kg	-	07/23/18 09:56	07/23/18 18:31	5
Manganese	310		0.42	0.19	mg/Kg	-	07/23/18 09:56	07/23/18 18:31	5
Zinc	560		2.1	0.68	mg/Kg	-	07/23/18 09:56	07/23/18 18:31	5

## Method: 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	4.2		0.57	0.17	mg/Kg	-	07/30/18 09:20	07/30/18 14:09	20

## General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Organic Carbon - Duplicates	42000		2000	44	mg/Kg	-		07/24/18 14:25	1

# QC Sample Results

Client: AECOM  
Project/Site: Portland Harbor Pre-Remedial Design

TestAmerica Job ID: 580-78968-1

## Method: 8270D SIM - Semivolatile Organic Compounds (GC/MS SIM)

Lab Sample ID: MB 580-280386/1-A

Matrix: Solid

Analysis Batch: 280580

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 280386

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
2-Methylnaphthalene	2.13		1.0	0.090	ug/Kg		07/30/18 11:32	08/01/18 12:10	1
Acenaphthene	ND		1.0	0.12	ug/Kg		07/30/18 11:32	08/01/18 12:10	1
Acenaphthylene	ND		1.0	0.10	ug/Kg		07/30/18 11:32	08/01/18 12:10	1
Anthracene	0.171	J	1.0	0.12	ug/Kg		07/30/18 11:32	08/01/18 12:10	1
Benzo[a]anthracene	0.354	J	1.0	0.15	ug/Kg		07/30/18 11:32	08/01/18 12:10	1
Benzo[a]pyrene	0.384	J	1.0	0.080	ug/Kg		07/30/18 11:32	08/01/18 12:10	1
Benzo[b]fluoranthene	0.382	J	1.0	0.12	ug/Kg		07/30/18 11:32	08/01/18 12:10	1
Benzo[g,h,i]perylene	0.337	J	1.0	0.10	ug/Kg		07/30/18 11:32	08/01/18 12:10	1
Benzo[k]fluoranthene	0.431	J	1.0	0.12	ug/Kg		07/30/18 11:32	08/01/18 12:10	1
Chrysene	0.440	J	1.0	0.30	ug/Kg		07/30/18 11:32	08/01/18 12:10	1
Dibenz(a,h)anthracene	0.333	J	1.0	0.14	ug/Kg		07/30/18 11:32	08/01/18 12:10	1
Fluoranthene	0.351	J	1.0	0.28	ug/Kg		07/30/18 11:32	08/01/18 12:10	1
Fluorene	0.102	J	1.0	0.10	ug/Kg		07/30/18 11:32	08/01/18 12:10	1
Indeno[1,2,3-cd]pyrene	0.346	J	1.0	0.12	ug/Kg		07/30/18 11:32	08/01/18 12:10	1
Naphthalene	1.40		1.0	0.16	ug/Kg		07/30/18 11:32	08/01/18 12:10	1
Phenanthrene	0.293	J	1.0	0.14	ug/Kg		07/30/18 11:32	08/01/18 12:10	1
Pyrene	0.352	J	1.0	0.19	ug/Kg		07/30/18 11:32	08/01/18 12:10	1

Surrogate	MB %Recovery	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
Terphenyl-d14	91		57 - 120	07/30/18 11:32	08/01/18 12:10	1

Lab Sample ID: LCS 580-280386/2-A

Matrix: Solid

Analysis Batch: 280580

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 280386

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
2-Methylnaphthalene	200	200		ug/Kg		100	68 - 120
Acenaphthene	200	196		ug/Kg		98	68 - 120
Acenaphthylene	200	189		ug/Kg		94	68 - 120
Anthracene	200	215		ug/Kg		107	73 - 125
Benzo[a]anthracene	200	230		ug/Kg		115	66 - 120
Benzo[a]pyrene	200	222		ug/Kg		111	72 - 124
Benzo[b]fluoranthene	200	236		ug/Kg		118	63 - 121
Benzo[g,h,i]perylene	200	235		ug/Kg		117	63 - 120
Benzo[k]fluoranthene	200	232		ug/Kg		116	63 - 123
Chrysene	200	216		ug/Kg		108	69 - 120
Dibenz(a,h)anthracene	200	223		ug/Kg		111	70 - 125
Fluoranthene	200	217		ug/Kg		109	74 - 125
Fluorene	200	208		ug/Kg		104	73 - 120
Indeno[1,2,3-cd]pyrene	200	207		ug/Kg		103	65 - 121
Naphthalene	200	176		ug/Kg		88	70 - 120
Phenanthrene	200	200		ug/Kg		100	73 - 120
Pyrene	200	212		ug/Kg		106	70 - 120

Surrogate	LCS %Recovery	LCS Qualifier	Limits
Terphenyl-d14	81		57 - 120

TestAmerica Seattle

# QC Sample Results

Client: AECOM  
Project/Site: Portland Harbor Pre-Remedial Design

TestAmerica Job ID: 580-78968-1

## Method: 6020B - Metals (ICP/MS)

Lab Sample ID: MB 580-279768/22-A

Matrix: Solid

Analysis Batch: 279898

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 279768

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.25	0.050	mg/Kg		07/23/18 09:56	07/23/18 16:33	5
Cadmium	ND		0.20	0.039	mg/Kg		07/23/18 09:56	07/23/18 16:33	5
Copper	ND		0.50	0.11	mg/Kg		07/23/18 09:56	07/23/18 16:33	5
Lead	ND		0.25	0.024	mg/Kg		07/23/18 09:56	07/23/18 16:33	5
Manganese	ND		0.50	0.23	mg/Kg		07/23/18 09:56	07/23/18 16:33	5
Zinc	ND		2.5	0.81	mg/Kg		07/23/18 09:56	07/23/18 16:33	5

Lab Sample ID: LCS 580-279768/23-A

Matrix: Solid

Analysis Batch: 279898

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 279768

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Arsenic	200	189		mg/Kg		95	80 - 120
Cadmium	5.00	4.71		mg/Kg		94	80 - 120
Copper	25.0	23.2		mg/Kg		93	80 - 120
Lead	50.0	46.6		mg/Kg		93	80 - 120
Manganese	50.0	46.1		mg/Kg		92	80 - 120
Zinc	200	186		mg/Kg		93	80 - 120

Lab Sample ID: LCSD 580-279768/24-A

Matrix: Solid

Analysis Batch: 279898

Client Sample ID: Lab Control Sample Dup

Prep Type: Total/NA

Prep Batch: 279768

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Arsenic	200	190		mg/Kg		93	80 - 120	2	20
Cadmium	5.00	4.7		mg/Kg		93	80 - 120	1	20
Copper	25.0	24		mg/Kg		94	80 - 120	1	20
Lead	50.0	47		mg/Kg		94	80 - 120	1	20
Manganese	50.0	46		mg/Kg		92	80 - 120	0	20
Zinc	200	180		mg/Kg		90	80 - 120	3	20

## Method: 7471A - Mercury (CVAA)

Lab Sample ID: MB 580-280359/17-A

Matrix: Solid

Analysis Batch: 280406

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 280359

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.030	0.0090	mg/Kg		07/30/18 09:20	07/30/18 12:24	1

Lab Sample ID: LCS 580-280359/18-A

Matrix: Solid

Analysis Batch: 280406

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 280359

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Mercury	0.167	0.159		mg/Kg		96	80 - 120

TestAmerica Seattle



# QC Sample Results

Client: AECOM  
Project/Site: Portland Harbor Pre-Remedial Design

TestAmerica Job ID: 580-78968-1

## Method: 7471A - Mercury (CVAA) (Continued)

Lab Sample ID: LCSD 580-280359/19-A

Matrix: Solid

Analysis Batch: 280406

Client Sample ID: Lab Control Sample Dup

Prep Type: Total/NA

Prep Batch: 280359

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Mercury	0.167	0.159		mg/Kg		95	80 - 120	0	20

## Method: 9060\_PSEP - TOC (Puget Sound)

Lab Sample ID: MB 580-279996/3

Matrix: Solid

Analysis Batch: 279996

Client Sample ID: Method Blank

Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Organic Carbon - Duplicates	ND		2000	44	mg/Kg			07/24/18 14:17	1

Lab Sample ID: LCS 580-279996/4

Matrix: Solid

Analysis Batch: 279996

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Total Organic Carbon - Duplicates	4270	3990		mg/Kg		93	68 - 149		

Lab Sample ID: LCSD 580-279996/5

Matrix: Solid

Analysis Batch: 279996

Client Sample ID: Lab Control Sample Dup

Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Total Organic Carbon - Duplicates	4270	4120		mg/Kg		96	68 - 149	3	32

Lab Sample ID: 580-78968-1 MS

Matrix: Solid

Analysis Batch: 279996

Client Sample ID: SRM 1944

Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits		
Total Organic Carbon - Duplicates	42000		120000	154000		mg/Kg		93	68 - 149		

Lab Sample ID: 580-78968-1 MSD

Matrix: Solid

Analysis Batch: 279996

Client Sample ID: SRM 1944

Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Total Organic Carbon - Duplicates	42000		120000	153000		mg/Kg		92	68 - 149	1	32

Lab Sample ID: 580-78968-1 DU

Matrix: Solid

Analysis Batch: 279996

Client Sample ID: SRM 1944

Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Total Organic Carbon - Duplicates	42000			43400		mg/Kg				2	50

TestAmerica Seattle

# QC Sample Results

Client: AECOM  
Project/Site: Portland Harbor Pre-Remedial Design

TestAmerica Job ID: 580-78968-1

## Method: 9060\_PSEP - TOC (Puget Sound) (Continued)

Lab Sample ID: 580-78968-1 TRL

Matrix: Solid

Analysis Batch: 279996

Client Sample ID: SRM 1944

Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	TRL Result	TRL Qualifier	Unit	D	RSD	RSD Limit
Total Organic Carbon - Duplicates	42000		42800		mg/Kg	-	1	20

# Lab Chronicle

Client: AECOM  
Project/Site: Portland Harbor Pre-Remedial Design

TestAmerica Job ID: 580-78968-1

**Client Sample ID: SRM 1944**

**Date Collected: 07/19/18 00:01**

**Date Received: 07/19/18 09:51**

**Lab Sample ID: 580-78968-1**

**Matrix: Solid**

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3546			280386	07/30/18 11:32		TAL SEA
Total/NA	Analysis	8270D SIM		50	280580	08/01/18 14:18	T1W	TAL SEA
Total/NA	Prep	3050B			279768	07/23/18 09:56	T1H	TAL SEA
Total/NA	Analysis	6020B		5	279898	07/23/18 18:31	FCW	TAL SEA
Total/NA	Prep	7471A			280359	07/30/18 09:20	T1H	TAL SEA
Total/NA	Analysis	7471A		20	280406	07/30/18 14:09	FCW	TAL SEA
Total/NA	Analysis	9060_PSEP		1	279996	07/24/18 14:25	Z1T	TAL SEA

## Laboratory References:

TAL SEA = TestAmerica Seattle, 5755 8th Street East, Tacoma, WA 98424, TEL (253)922-2310

## Accreditation/Certification Summary

Client: AECOM

TestAmerica Job ID: 580-78968-1

Project/Site: Portland Harbor Pre-Remedial Design

### Laboratory: TestAmerica Seattle

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	EPA Region	Identification Number	Expiration Date
Alaska (UST)	State Program	10	17-024	01-19-19
ANAB	DoD ELAP		L2236	01-19-19
ANAB	ISO/IEC 17025		L2236	01-19-19
California	State Program	9	2901	11-05-18
Montana (UST)	State Program	8	N/A	04-30-20
Oregon	NELAP	10	WA100007	11-05-18
US Fish & Wildlife	Federal		LE058448-0	07-31-19
USDA	Federal		P330-14-00126	02-10-20
Washington	State Program	10	C553	02-17-19

## Sample Summary

Client: AECOM

Project/Site: Portland Harbor Pre-Remedial Design

TestAmerica Job ID: 580-78968-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
580-78968-1	SRM 1944	Solid	07/19/18 00:01	07/19/18 09:51

## SAFETY DATA SHEET

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1. SUBSTANCE AND SOURCE IDENTIFICATION

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**Product Identifier**

**SRM Number:** 1944  
**SRM Name:** New York/New Jersey Waterway Sediment  
**Other Means of Identification:** Not applicable.

**Recommended Use of This Material and Restrictions of Use**

Standard Reference Material (SRM) 1944 is a mixture of marine sediment collected near urban areas in New York and New Jersey. SRM 1944 is intended for use in evaluating analytical methods for the determination of selected polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyl (PCB) congeners, chlorinated pesticides, and trace elements in marine sediment and similar matrices. All of the constituents for which certified, reference, and information values are provided in SRM 1944 were naturally present in the sediment before processing. A unit of SRM 1944 consists of a bottle containing 50 g of radiation-sterilized, freeze-dried sediment.

**Company Information**

National Institute of Standards and Technology  
Standard Reference Materials Program  
100 Bureau Drive, Stop 2300  
Gaithersburg, Maryland 20899-2300

Telephone: 301-975-2200  
FAX: 301-948-3730  
E-mail: SRMMSDS@nist.gov  
Website: <http://www.nist.gov/srm>

Emergency Telephone ChemTrec:  
1-800-424-9300 (North America)  
+1-703-527-3887 (International)

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2. HAZARDS IDENTIFICATION

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**Classification**

**Physical Hazard:** Not classified.  
**Health Hazard:** Not classified.

**Label Elements**

**Symbol**  
No Symbol/Pictogram

**Signal Word**  
Not applicable.

**Hazard Statement(s):** Not applicable.

**Precautionary Statement(s):** Not applicable.

**Hazards Not Otherwise Classified:** Not applicable.

**Ingredients(s) with Unknown Acute Toxicity:** Not applicable.



580-78968 Chain of Custody

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3. COMPOSITION AND INFORMATION ON HAZARDOUS INGREDIENTS

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**Substance:** Waterway sediment

**Other Designations:** Sediment.

This material is naturally occurring marine sediment collected near urban areas. The material contains trace amounts of polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyl (PCB) congeners, chlorinated pesticides, and trace elements. Components are listed in compliance with OSHA's 29 CFR 1910.1200; for the actual values see the Certificate of Analysis.

**Engineering Controls:** Provide local exhaust or process enclosure ventilation system. Ensure compliance with applicable exposure limits.

**Personal Protection:** In accordance with OSHA 29 CFR 1910.132, subpart I, wear appropriate Personal Protective Equipment (PPE) to minimize exposure to this material.

**Respiratory Protection:** If workplace conditions warrant a respirator, a respiratory protection program that meets OSHA 29CFR 1910.134 must be followed. Refer to NIOSH 42 CFR 84 for applicable certified respirators.

**Eye/Face Protection:** Wear splash resistant safety goggles with a face shield. An eye wash station should be readily available near areas of use.

**Skin and Body Protection:** Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. Chemical-resistant gloves should be worn at all times when handling chemicals.

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## 9. PHYSICAL AND CHEMICAL PROPERTIES

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### Descriptive Properties:

Appearance (physical state, color, etc.):	amorphous powder
Molecular Formula:	not applicable
Molar Mass (g/mol):	not applicable
Odor:	not available
Odor threshold:	not available
pH:	not available
Evaporation rate:	not applicable
Melting point/freezing point (°C):	not available
Specific Gravity (water=1)	not available
Vapor Pressure (mmHg):	not applicable
Vapor Density (air = 1):	not applicable
Viscosity (cP):	not applicable
Solubility(ies):	not available
Partition coefficient (n-octanol/water):	not available
Particle Size:	not available

### Thermal Stability Properties:

Autoignition Temperature (°C):	not available
Thermal Decomposition (°C):	not available
Initial boiling point and boiling range (°C):	not available
Explosive Limits, LEL (Volume %):	not available
Explosive Limits, UEL (Volume %):	not available
Flash Point (°C):	not available
Flammability (solid, gas):	not available

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## 10. STABILITY AND REACTIVITY

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**Reactivity:** Stable at normal temperatures and pressure.

**Stability:**   X   Stable        Unstable

**Possible Hazardous Reactions:** None listed.

**Conditions to Avoid:** Avoid generating dust.

**Incompatible Materials:** None listed.

**Fire/Explosion Information:** See Section 5, "Fire Fighting Measures".

**Hazardous Decomposition:** Thermal decomposition will produce oxides of carbon.

**Hazardous Polymerization:**        Will Occur   X   Will Not Occur

OSHA Process Safety (29 CFR 1910.119): Not regulated.

SARA Title III Sections 311/312 Hazardous Categories (40 CFR 370.21):

ACUTE HEALTH:	No.
CHRONIC HEALTH:	No.
FIRE:	No.
REACTIVE:	No.
PRESSURE:	No.

**State Regulations:**

California Proposition 65: Not listed.

**U.S. TSCA Inventory:** Not listed.

**TSCA 12(b), Export Notification:** Not listed.

**Canadian Regulations:**

WHMIS Information: Not provided for this material.

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## 16. OTHER INFORMATION

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**Issue Date:** 17 February 2017

**Sources:** 29 CFR Occupational Health and Safety Office (OSHA) 1910.1000, *Limits for Air Contaminants*, Table Z-1; available at [http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=STANDARDS&p\\_id=9992](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9992) (accessed Feb 2017).

Center for Disease Control (CDC) NIOSH Pocket Guide to Chemical Hazards, *Particulates not otherwise regulated*; available at <http://www.cdc.gov/niosh/npgd/npgd0480.html> (accessed Feb 2017).

**Key of Acronyms:**

ACGIH	American Conference of Governmental Industrial Hygienists	NRC	Nuclear Regulatory Commission
ALI	Annual Limit on Intake	NTP	National Toxicology Program
CAS	Chemical Abstracts Service	OSHA	Occupational Safety and Health Administration
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act	PEL	Permissible Exposure Limit
CFR	Code of Federal Regulations	RCRA	Resource Conservation and Recovery Act
DOT	Department of Transportation	REL	Recommended Exposure Limit
EC50	Effective Concentration, 50 %	RM	Reference Material
EINECS	European Inventory of Existing Commercial Chemical Substances	RQ	Reportable Quantity
EPCRA	Emergency Planning and Community Right-to-Know Act	RTECS	Registry of Toxic Effects of Chemical Substances
IARC	International Agency for Research on Cancer	SARA	Superfund Amendments and Reauthorization Act
IATA	International Air Transport Association	SCBA	Self-Contained Breathing Apparatus
IDLH	Immediately Dangerous to Life and Health	SRM	Standard Reference Material
LC50	Lethal Concentration, 50 %	STEL	Short Term Exposure Limit
LD50	Lethal Dose, 50 %	TLV	Threshold Limit Value
LEL	Lower Explosive Limit	TPQ	Threshold Planning Quantity
MSDS	Material Safety Data Sheet	TSCA	Toxic Substances Control Act
NFPA	National Fire Protection Association	TWA	Time Weighted Average
NIOSH	National Institute for Occupational Safety and Health	UEL	Upper Explosive Limit
NIST	National Institute of Standards and Technology	WHMIS	Workplace Hazardous Materials Information System

**Disclaimer:** Physical and chemical data contained in this SDS are provided only for use in assessing the hazardous nature of the material. The SDS was prepared carefully, using current references; however, NIST does not certify the data in the SDS. The certified values for this material are given in the NIST Certificate of Analysis.

Users of this SRM should ensure that the SDS in their possession is current. This can be accomplished by contacting the SRM Program: telephone (301) 975-2200; fax (301) 948-3730; e-mail [srmmsds@nist.gov](mailto:srmmsds@nist.gov); or via the Internet at <http://www.nist.gov/srm>.





# National Institute of Standards & Technology

## Certificate of Analysis

### Standard Reference Material® 1944

#### New York/New Jersey Waterway Sediment

Standard Reference Material (SRM) 1944 is a mixture of marine sediment collected near urban areas in New York and New Jersey. SRM 1944 is intended for use in evaluating analytical methods for the determination of selected polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyl (PCB) congeners, chlorinated pesticides, and trace elements in marine sediment and similar matrices. Reference values are also provided for selected polybrominated diphenyl ether (PBDE) congeners, selected dibenzo-*p*-dioxin and dibenzofuran congeners, total organic carbon, total extractable material, and particle size characteristics. Information values are provided for selected polychlorinated naphthalenes (PCNs) and hexabromocyclododecanes (HBCDs). All of the constituents for which certified, reference, and information values are provided in SRM 1944 were naturally present in the sediment before processing. A unit of SRM 1944 consists of a bottle containing 50 g of radiation-sterilized, freeze-dried sediment.

**Certified Mass Fraction Values:** Certified values for mass fractions of PAHs, PCB congeners, chlorinated pesticides, and trace elements are provided in Tables 1 through 4. A NIST certified value is a value for which NIST has the highest confidence in its accuracy in that all known or suspected sources of bias have been investigated or taken into account [1]. The certified values for the PAHs, PCB congeners, and chlorinated pesticides are based on the agreement of results obtained at NIST using two or more chemically independent analytical techniques. The certified values for the trace elements are based on NIST measurements by one technique and additional results from several collaborating laboratories.

**Reference Mass Fraction Values:** Reference values are provided for mass fractions of additional PAHs (some in combination) in Tables 5 and 6, additional PCB congeners and chlorinated pesticides in Table 7, PBDE congeners in Table 8, and additional inorganic constituents in Tables 9 and 10. Reference values are provided in Table 11 for the 2,3,7,8-substituted polychlorinated dibenzo-*p*-dioxin and dibenzofuran congeners and total tetra-, penta-, hexa-, and hepta-congeners of polychlorinated dibenzo-*p*-dioxin and dibenzofuran. Reference values for particle size characteristics are provided in Table 12 and 13. Reference values for total organic carbon and percent extractable mass are provided in Table 14. Reference values are noncertified values that are the best estimate of the true value; however, the values do not meet the NIST criteria for certification and are provided with associated uncertainties that may reflect only measurement precision, may not include all sources of uncertainty, or may reflect a lack of sufficient statistical agreement among multiple analytical methods [1].

**Information Mass Fraction Values:** Information values are provided in Table 15 for mass fractions of additional trace elements, in Table 16 for PCN congeners (some in combination), and in Table 17 for HBCD isomers. An information value is considered to be a value that will be of interest and use to the SRM user, but insufficient information is available to assess the uncertainty associated with the value or only a limited number of analyses were performed [1]. Information values cannot be used to establish metrological traceability.

**Expiration of Certification:** The certification of **SRM 1944** is valid, within the measurement uncertainty specified, until **31 March 2027**, provided the SRM is handled and stored in accordance with the instructions given in this certificate (see "Instructions for Handling, Storage, and Use"). The certification is nullified if the SRM is damaged, contaminated, or otherwise modified.

Carlos A. Gonzalez, Chief  
Chemical Sciences Division

Gaithersburg, MD 20899  
Certificate Issue Date: 17 February 2017  
Certificate Revision History on Page 20

Steven J. Choquette, Director  
Office of Reference Materials

## PREPARATION AND ANALYSIS<sup>(1)</sup>

**Sample Collection and Preparation:** The sediment used to prepare this SRM was collected from six sites in the vicinity of New York Bay and Newark Bay in October 1994. Site selection was based on contaminant levels measured in previous samples from these sites and was intended to provide relatively high concentrations for a variety of chemical classes of contaminants. The sediment was collected using an epoxy-coated modified Van Veen-type grab sampler designed to sample the sediment to a depth of 10 cm. A total of approximately 2100 kg of wet sediment was collected from the six sites. The sediment was freeze-dried, sieved (nominally 250  $\mu\text{m}$  to 61  $\mu\text{m}$ ), homogenized in a cone blender, radiation sterilized at an estimated minimum dose of 32 kilograys ( $^{60}\text{Co}$ ), and then packaged in screw-capped amber glass bottles.

**Conversion to Dry-Mass Basis:** The results for the constituents in SRM 1944 are reported on a dry-mass basis; however, the material as received contains residual moisture. The amount of moisture in SRM 1944 was determined by measuring the mass loss after freeze drying test portions of 1.6 g to 2.5 g for five days at 1 Pa with a  $-10\text{ }^{\circ}\text{C}$  shelf temperature and a  $-50\text{ }^{\circ}\text{C}$  condenser temperature. The mass fraction of moisture in SRM 1944 at the time of the certification analyses was  $1.25\% \pm 0.03\%$  (95 % confidence level).

**Polycyclic Aromatic Hydrocarbons:** The general approach used for the value assignment of the PAHs in SRM 1944 consisted of combining results from analyses using various combinations of different extraction techniques and solvents, cleanup/isolation procedures, and chromatographic separation and detection techniques [2]. Techniques and solvents involved were Soxhlet extraction and pressurized fluid extraction (PFE) using dichloromethane (DCM) or a hexane/acetone mixture, clean up of the extracts using solid-phase extraction (SPE), or normal-phase liquid chromatography (LC), followed by analysis using the following techniques: (1) reversed-phase liquid chromatography with fluorescence detection (LC-FL) analysis of the total PAH fraction, (2) reversed-phase LC-FL analysis of isomeric PAH fractions isolated by normal-phase LC (i.e., multidimensional LC), (3) gas chromatography/mass spectrometry (GC/MS) analysis of the PAH fraction on four stationary phases of different selectivity, i.e., a 5 % (mole fraction) phenyl-substituted methylpolysiloxane phase, a 50 % phenyl-substituted methylpolysiloxane phase, a proprietary non-polar polysiloxane phase, and a smectic liquid crystalline stationary phase.

Seven sets of GC/MS results, designated as GC/MS (I), GC/MS (II), GC/MS (III), GC/MS (IV), GC/MS (V), GC/MS (VI), and GC/MS (Sm), were obtained using four columns with different selectivities for the separation of PAHs. For GC/MS (I) analyses, duplicate test portions of 1 g from eight bottles of SRM 1944 were Soxhlet extracted for 24 h with DCM. Copper powder was added to the extract to remove elemental sulfur. The concentrated extract was passed through a silica SPE cartridge and eluted with 2 % DCM in hexane. (All extraction and LC solvent compositions are expressed as volume fractions unless otherwise noted.) The processed extract was then analyzed by GC/MS using a 0.25 mm i.d.  $\times$  60 m fused silica capillary column with a 5 % phenyl-substituted methylpolysiloxane phase (0.25  $\mu\text{m}$  film thickness) (DB-5 MS, J&W Scientific, Folsom, CA). The GC/MS (II) analyses were performed using 1 g to 2 g test portions from three bottles of SRM 1944 and 2 g to 3 g test portions from three bottles of SRM 1944 that had been mixed with a similar amount of water (i.e., a wetted sediment). These test portions were Soxhlet extracted with DCM and processed through the silica SPE as described above; however, the extract was further fractionated using normal-phase LC on a semi-preparative aminopropylsilane column to isolate the PAH fraction. The PAH fraction was then analyzed using the same column as described above for GC/MS (I); however, the test portions were extracted, processed, and analyzed as part of three different sample sets at different times using different calibrations for each set. For the GC/MS (III), 1 g to 2 g test portions from six bottles of SRM 1944 were Soxhlet extracted for 18 h with 250 mL of a mixture of 50 % hexane/50 % acetone. The extracts were then processed and analyzed as described for GC/MS (II). For GC/MS (IV) analyses, 1 g to 2 g test portions from six bottles of SRM 1944 were extracted using PFE with a mixture of 50 % hexane/50 % acetone, and the extracts were processed as described above for GC/MS (II). The GC/MS (V) results were obtained by analyzing three of the same PAH fractions that were analyzed in GC/MS (III) and three of the PAH fractions that were analyzed in GC/MS (IV) using a 50 % (mole fraction) phenyl-substituted methylpolysiloxane stationary phase (0.25 mm i.d.  $\times$  60 m, 0.25  $\mu\text{m}$  film thickness) (DB-17MS, J&W Scientific, Folsom, CA). For GC/MS (VI) analyses, three test portions of 0.7 g from one bottle of SRM 1944 were Soxhlet extracted for 24 h with DCM. Copper powder was added to the extract to remove elemental sulfur. The concentrated extract was passed through an aminopropyl SPE cartridge and eluted with 20 % DCM in hexane. The processed extract was then analyzed by GC/MS using a 0.25 mm i.d.  $\times$  60 m fused silica capillary column with a proprietary non-polar polysiloxane phase (0.25  $\mu\text{m}$  film thickness) (DB-XLB, J&W Scientific). For GC/MS (Sm) 1 g to 2 g test portions from six bottles of SRM 1944 were Soxhlet extracted for 24 h

<sup>(1)</sup>Certain commercial equipment, instruments, or materials are identified in this report to adequately specify the experimental procedure. Such identification does not imply recommendation or endorsement by the National Institute of Standards and Technology, nor does it imply that the materials or equipment identified are necessarily the best available for the purpose.

Three sets of results were obtained by GC/MS. For GC/MS (I), 1 g to 2 g test portions from six bottles were Soxhlet extracted with a mixture of 50 % hexane/50 % acetone. Copper powder was added to the extract to remove elemental sulfur. The concentrated extract was passed through a silica SPE cartridge and eluted with 10 % DCM in hexane. The extract was then analyzed by GC/MS using a 0.25 mm × 60 m fused silica capillary column with a 5 % phenyl-substituted methylpolysiloxane phase (0.25 µm film thickness). The GC/MS (II) results were obtained in the same manner as the GC/MS (I) analyses except that the six test portions were extracted using PFE. The GC/MS (III) analyses were performed on the same extract fractions analyzed in GC-ECD (II) using the 5 % phenyl-substituted methylpolysiloxane phase describe above for GC/MS (I). For both the GC-ECD and GC/MS analyses, two PCB congeners that are not significantly present in the sediment extract (PCB 103 and PCB 198 [3]), and 4,4'-DDT-*d*<sub>8</sub> were added to the sediment prior to extraction for use as internal standards for quantification purposes.

In addition to the analyses performed at NIST, SRM 1944 was used in an interlaboratory comparison exercise in 1995 as part of the NIST Intercomparison Exercise Program for Organic Contaminants in the Marine Environment [4]. Results from nineteen laboratories that participated in this exercise were used as the eighth data set in the determination of the certified values for PCB congeners and chlorinated pesticides in SRM 1944. The laboratories participating in this exercise used the analytical procedures routinely used in their laboratories to measure PCB congeners and chlorinated pesticides.

**Polybrominated Diphenyl Ethers:** Value assignment of the concentrations of eight PBDE congeners was based on the means of results from two interlaboratory studies [5,6] and two sets of data from NIST. The laboratories participating in the interlaboratory exercises (see Appendix A) employed the analytical procedures routinely used in their laboratories to measure PBDEs. For the two methods used at NIST, six test portions (between 1 g and 2 g) were extracted using PFE at 100 °C with DCM. The extracts were cleaned up using an alumina column (5 % deactivated) SPE column. Size exclusion chromatography (SEC) on a divinylbenzene-polystyrene column (10 µm particle size, 10 nm (100 angstrom) pore size, 7.5 mm i.d. × 300 mm, PL-Gel, Polymer Labs, Inc.) was then used to remove the sulfur. The PBDEs, as well as PCBs and pesticides, were quantified using GC/MS in the electron impact mode on a 0.18 mm i.d. × 30 m fused silica capillary column with a 5 % (mole fraction) phenyl methylpolysiloxane phase (0.18 µm film thickness; DB-5MS, Agilent Technologies). The PBDEs were also quantified using GC/MS in the negative chemical ionization mode on a 0.18 mm i.d. × 10 m fused silica capillary column with a 5 % (mole fraction) phenyl methylpolysiloxane phase (0.18 µm film thickness; DB-5MS, Agilent Technologies). Selected Carbon-13 labeled PBDE and PCB congeners were added to the sediment prior to extraction for use as internal standards for quantification purposes.

**Polychlorinated Dibenzo-*p*-dioxins and Dibenzofurans:** Value assignment of the concentrations of the polychlorinated dibenzo-*p*-dioxin and dibenzofuran congeners and the total tetra- through hepta- substituted polychlorinated dibenzo-*p*-dioxins and dibenzofurans was accomplished by combining results from the analysis of SRM 1944 by fourteen laboratories that participated in an interlaboratory comparison study (see Appendix B). Each laboratory analyzed three test portions (typically 1 g) of SRM 1944 using their routine analytical procedures and high resolution gas chromatography with high resolution mass spectrometry detection (GC-HRMS). The analytical procedures used by all of the laboratories included spiking with <sup>13</sup>C-labeled surrogates (internal standards); Soxhlet extraction with toluene; sample extract cleanup with acid/base silica, alumina, and carbon columns; and finally analysis of the cleaned up extract with GC-HRMS. Most of the laboratories used a 5 % phenyl-substituted methylpolysiloxane phase capillary column (DB-5), and about half of the laboratories confirmed 2,3,7,8-tetrachlorodibenzofuran using a 50 % cyanopropylphenyl-substituted methylpolysiloxane (DB-225, J&W Scientific, Folsom, CA) capillary column.

**Analytical Approach for Inorganic Constituents:** Value assignment for the concentrations of selected trace elements was accomplished by combining results of the analyses of SRM 1944 from NIST, NRCC, IAEA, and seven laboratories that participated in an interlaboratory comparison exercise coordinated by NRCC [7] (see Appendix C). The analytical methods used for the determination of each element are summarized in Table 18. For the certified concentration values listed in Table 4, results were combined from: (1) analyses at NIST using isotope dilution inductively coupled plasma mass spectrometry (ID-ICPMS) or instrumental neutron activation analysis (INAA), (2) analyses at NRCC using ID-ICPMS, graphite furnace atomic absorption spectrometry (GFAAS), and/or inductively coupled plasma optical emission spectroscopy (ICPOES), (3) analyses at IAEA using INAA, and (4) the mean of the results from seven laboratories that participated in the NRCC interlaboratory comparison exercise. The reference mass fraction values in Table 9 were determined by combining results from (1) analyses performed at NIST using INAA; (2) analyses at NRCC using ID-ICPMS, GFAAS, ICPOES, and/or cold vapor atomic absorption spectroscopy (CVAAS); (3) analyses at IAEA using INAA; and (4) the mean of the results from five to seven laboratories that participated in the NRCC interlaboratory comparison exercise. The information concentration values in Table 15 were determined by INAA at NIST and IAEA.

**HBCDs:** Value assignment of the concentrations of three HBCD isomers was accomplished by combining results from the analysis of SRM 1944 in two sets from NIST and one set from Virginia Institute of Marine Science. For the two sets analyzed at NIST, the second fraction from an acidified silica SPE clean-up was analyzed by LC/MS/MS for the HBCDs using both electrospray ionization (ESI) and atmospheric pressurized photoionization (APPI). A C18 column (3.0 mm × 150 mm × 3.5 µm column, Eclipse Plus, Agilent Technologies) and YMC Carotenoid S5 C30 column (4.6 mm × 250 mm × 5 µm column) were used with a solvent gradient using 2.5 mmol/L ammonium acetate in 12.5 % water in methanol and acetonitrile at a flow rate of 0.3 mL/min. Carbon-13 labeled HBCDs were added to the sediment prior to solvent extraction for use as internal standards for quantification purposes.

The measurands for certified values are the total concentrations of the analytes listed in Tables 1-4. Metrological traceability is to the SI derived units for mass fraction, expressed as milligrams per kilogram, micrograms per kilogram or percentage, respectively.

Table 1. Certified Mass Fraction Values for Selected PAHs in SRM 1944 (Dry-Mass Basis)

	Mass Fraction <sup>(a,b)</sup> (mg/kg)		
Phenanthrene <sup>(c,d,e,f,g)</sup>	5.27	±	0.22
Fluoranthene <sup>(c,d,e,f,g)</sup>	8.92	±	0.32
Pyrene <sup>(c,d,e,f,g)</sup>	9.70	±	0.42
Benzo[ <i>c</i> ]phenanthrene <sup>(c,d,e,f,h)</sup>	0.76	±	0.10
Benz[ <i>a</i> ]anthracene <sup>(c,d,e,f,g,h)</sup>	4.72	±	0.11
Chrysene <sup>(h,k)</sup>	4.86	±	0.10 <sup>(i)</sup>
Triphenylene <sup>(h,k)</sup>	1.04	±	0.27
Benzo[ <i>b</i> ]fluoranthene <sup>(g,h,i)</sup>	3.87	±	0.42
Benzo[ <i>j</i> ]fluoranthene <sup>(h,j)</sup>	2.09	±	0.44
Benzo[ <i>k</i> ]fluoranthene <sup>(c,d,e,f,g,h,j)</sup>	2.30	±	0.20
Benzo[ <i>a</i> ]fluoranthene <sup>(c,d,e,f,h,j)</sup>	0.78	±	0.12
Benzo[ <i>e</i> ]pyrene <sup>(c,d,e,f,h,j)</sup>	3.28	±	0.11
Benzo[ <i>a</i> ]pyrene <sup>(c,d,e,f,g,h,j)</sup>	4.30	±	0.13
Perylene <sup>(c,d,e,f,g,h,j)</sup>	1.17	±	0.24
Benzo[ <i>ghi</i> ]perylene <sup>(c,d,e,f,j,k)</sup>	2.84	±	0.10
Indeno[1,2,3- <i>cd</i> ]pyrene <sup>(c,d,e,f,j,k)</sup>	2.78	±	0.10
Dibenz[ <i>a,j</i> ]anthracene <sup>(c,d,e,f,j,k)</sup>	0.500	±	0.044
Dibenz[ <i>a,c</i> ]anthracene <sup>(j,k)</sup>	0.335	±	0.013
Dibenz[ <i>a,h</i> ]anthracene <sup>(i,k)</sup>	0.424	±	0.069
Pentaphene <sup>(c,d,e,f,j,k)</sup>	0.288	±	0.026
Benzo[ <i>b</i> ]chrysene <sup>(c,d,e,f,j,k,h)</sup>	0.63	±	0.10
Picene <sup>(c,d,e,f,j,k)</sup>	0.518	±	0.093

<sup>(a)</sup> Mass fractions are reported on dry-mass basis; material as received contains approximately 1.3 % moisture.

<sup>(b)</sup> Each certified value is a mean of the means from two or more analytical methods, weighted as described in Paule and Mandel [10].

Each uncertainty, computed according to the Comité International des Poids et Mesures (CIPM) approach as described in the ISO/JCGM Guide [11,12], is an expanded uncertainty at the 95 % level of confidence, which includes random sources of uncertainty within each analytical method as well as uncertainty due to the drying study. The expanded uncertainty defines a range of values within which the true value is believed to lie, at a level of confidence of approximately 95 %.

<sup>(c)</sup> Gas chromatography/mass spectrometry (GC/MS) (I) on 5 % phenyl-substituted methylpolysiloxane phase after Soxhlet extraction with DCM.

<sup>(d)</sup> GC/MS (II) on 5 % phenyl-substituted methylpolysiloxane phase after Soxhlet extraction with DCM.

<sup>(e)</sup> GC/MS (III) on 5 % phenyl-substituted methylpolysiloxane phase after Soxhlet extraction with 50 % hexane/50 % acetone mixture.

<sup>(f)</sup> GC/MS (IV) on 5 % phenyl-substituted methylpolysiloxane phase after PFE with 50 % hexane/50 % acetone mixture.

<sup>(g)</sup> LC-FL of total PAH fraction after Soxhlet extraction with 50 % hexane/50 % acetone mixture.

<sup>(h)</sup> GC/MS (Sm) using a smectic liquid crystalline phase after Soxhlet extraction with DCM.

<sup>(i)</sup> The uncertainty interval for chrysene was widened in accordance with expert consideration of the analytical procedures, along with the analysis of the data as a whole, which suggests that the half-widths of the expanded uncertainties should not be less than 2 %.

<sup>(j)</sup> GC/MS (V) on 50 % phenyl-substituted methylpolysiloxane phase of extracts from GC/MS (III) and GC/MS (IV).

<sup>(k)</sup> LC-FL of isomeric PAH fractions after Soxhlet extraction with 50 % hexane/50 % acetone mixture.



Table 3. Certified Mass Fraction Values for Selected Chlorinated Pesticides in SRM 1944 (Dry-Mass Basis)

	Mass Fraction <sup>(a,b)</sup> ( $\mu\text{g/kg}$ )		
Hexachlorobenzene <sup>(e,f,g,h,i,j)</sup>	6.03	$\pm$	0.35
<i>cis</i> -Chlordane ( $\alpha$ -Chlordane) <sup>(c,d,e,f,g,h,i,j)</sup>	16.51	$\pm$	0.83
<i>trans</i> -Nonachlor <sup>(c,d,e,f,g,h,i,j)</sup>	8.20	$\pm$	0.51

<sup>(a)</sup> Mass fractions are reported on dry-mass basis; material as received contains approximately 1.3 % moisture.

<sup>(b)</sup> Each certified value is a mean of the means from two or more analytical methods, weighted as described in Paule and Mandel [10].

Each uncertainty, computed according to the CIPM approach as described in the ISO/JCGM Guide [11,12], is an expanded uncertainty at the 95 % level of confidence, which includes random sources of uncertainty within each analytical method as well as uncertainty due to the drying study. The expanded uncertainty defines a range of values within which the true value is believed to lie, at a level of confidence of approximately 95 %.

<sup>(c)</sup> GC-ECD (IA) on 5 % phenyl-substituted methylpolysiloxane phase after Soxhlet extraction with DCM.

<sup>(d)</sup> GC-ECD (IB) on the 50 % octadecyl (C-18) methylpolysiloxane phase; same extracts analyzed as in GC-ECD (IA).

<sup>(e)</sup> GC-ECD (IIA) on 5 % phenyl-substituted methylpolysiloxane phase after Soxhlet extraction with DCM.

<sup>(f)</sup> GC-ECD (IIB) on the 50 % octadecyl (C-18) methylpolysiloxane phase; same extracts analyzed as in GC-ECD (IIA).

<sup>(g)</sup> GC/MS (I) on 5 % phenyl-substituted methylpolysiloxane phase after Soxhlet extraction with 50 % hexane/50 % acetone mixture.

<sup>(h)</sup> GC/MS (II) on 5 % phenyl-substituted methylpolysiloxane phase after PFE extraction with 50 % hexane/50 % acetone mixture.

<sup>(i)</sup> GC/MS (III) on 5 % phenyl-substituted methylpolysiloxane phase; same extracts analyzed as in GC-ECD (IIA).

<sup>(j)</sup> Results from nineteen laboratories participating in an interlaboratory comparison exercise.

Table 4. Certified Mass Fraction Values for Selected Elements in SRM 1944 (Dry-Mass Basis)

	Degrees of Freedom	Mass Fractions <sup>(a,b)</sup> (%)		
Aluminum <sup>(c,d,e)</sup>	4	5.33	$\pm$	0.49
Iron <sup>(c,d,e)</sup>	6	3.53	$\pm$	0.16

  

		Mass Fractions <sup>(a,b)</sup> (mg/kg)		
Arsenic <sup>(c,d,e,f,g)</sup>	10	18.9	$\pm$	2.8
Cadmium <sup>(c,f,h,i)</sup>	6	8.8	$\pm$	1.4
Chromium <sup>(c,d,f,g,i)</sup>	9	266	$\pm$	24
Lead <sup>(c,h,i)</sup>	5	330	$\pm$	48
Manganese <sup>(c,d,e)</sup>	8	505	$\pm$	25
Nickel <sup>(c,g,h,i)</sup>	6	76.1	$\pm$	5.6
Zinc <sup>(c,d,e,g,i)</sup>	9	656	$\pm$	75

<sup>(a)</sup> The certified value is the mean of four results: (1) the mean of NIST INAA or ID-ICPMS analyses, (2) the mean of two methods performed at NRCC, and (3) the mean of results from seven selected laboratories participating in the NRCC intercomparison exercise, and (4) the mean results from INAA analyses at IAEA. The expanded uncertainty in the certified value is equal to  $U = k u_c$  where  $u_c$  is the combined standard uncertainty and  $k$  is the coverage factor, both calculated according to the ISO/JCGM Guide [11,12]. The value of  $u_c$  is intended to represent at the level of one standard deviation the combined effect of all the uncertainties in the certified value. Here  $u_c$  accounts for both possible method biases, within-method variation, and material inhomogeneity. The coverage factor,  $k$ , is the Student's  $t$ -value for a 95 % confidence interval with the corresponding degrees of freedom. Because of the material inhomogeneity, the variability among the measurements of multiple samples can be expected to be greater than that due to measurement variability alone.

<sup>(b)</sup> Mass fractions are reported on dry-mass basis; material as received contains approximately 1.3 % moisture.

<sup>(c)</sup> Results from five to seven laboratories participating in the NRCC interlaboratory comparison exercise.

<sup>(d)</sup> Measured at NIST using INAA.

<sup>(e)</sup> Measured at NRCC using ICPOES.

<sup>(f)</sup> Measured at NRCC using GFAAS.

<sup>(g)</sup> Measured at IAEA using INAA.

<sup>(h)</sup> Measured at NIST using ID-ICPMS.

<sup>(i)</sup> Measured at NRCC using ID-ICPMS.

Table 6. Reference Mass Fractions for Selected PAHs of  
Relative Molecular Mass 300 and 302 in SRM 1944 (Dry-Mass Basis)

	Mass Fraction <sup>(a,b,c)</sup> (mg/kg)		
Coronene	0.53	±	0.04
Dibenzo[ <i>b,e</i> ]fluoranthene	0.076	±	0.008
Naphtho[1,2- <i>b</i> ]fluoranthene	0.70	±	0.06
Naphtho[1,2- <i>k</i> ]fluoranthene and Naphtho[2,3- <i>j</i> ]fluoranthene	0.66	±	0.05
Naphtho[2,3- <i>b</i> ]fluoranthene	0.21	±	0.01
Dibenzo[ <i>b,k</i> ]fluoranthene	0.75	±	0.06
Dibenzo[ <i>a,k</i> ]fluoranthene	0.22	±	0.02
Dibenzo[ <i>j,l</i> ]fluoranthene	0.56	±	0.03
Dibenzo[ <i>a,l</i> ]pyrene	0.12	±	0.02
Naphtho[2,3- <i>k</i> ]fluoranthene	0.11	±	0.01
Naphtho[2,3- <i>e</i> ]pyrene	0.33	±	0.02
Dibenzo[ <i>a,e</i> ]pyrene	0.67	±	0.05
Naphtho[2,1- <i>a</i> ]pyrene	0.76	±	0.05
Dibenzo[ <i>e,l</i> ]pyrene	0.28	±	0.02
Naphtho[2,3- <i>a</i> ]pyrene	0.23	±	0.01
Benzo[ <i>b</i> ]perylene	0.43	±	0.04
Dibenzo[ <i>a,i</i> ]pyrene	0.30	±	0.03
Dibenzo[ <i>a,h</i> ]pyrene	0.11	±	0.01

<sup>(a)</sup> Mass fractions are reported on dry-mass basis; material as received contains approximately 1.3 % moisture.

<sup>(b)</sup> Reference values are the means of results obtained by NIST using one analytical technique. The expanded uncertainty,  $U$ , is calculated as  $U = k u_c$ , where  $u_c$  is one standard deviation of the analyte mean, and the coverage factor,  $k$ , is determined from the Student's  $t$ -distribution corresponding to the associated degrees of freedom ( $df = 2$ ) and 95 % confidence level for each analyte.

<sup>(c)</sup> GC/MS on 50 % phenyl-substituted methylpolysiloxane phase after PFE with DCM.

Table 8. Reference Mass Fraction Values for Selected PBDEs in SRM 1944 (Dry-Mass Basis)

	Mass Fractions <sup>(a)</sup> (µg/kg)
PBDE 47 (2,2',4,4'-Tetrabromodiphenyl ether) <sup>(c,d,e,f)</sup>	1.72 ± 0.28 <sup>(b)</sup>
PBDE 99 (2,2',4,4',5-Pentabromodiphenyl ether) <sup>(c,d,f)</sup>	1.98 ± 0.26 <sup>(b)</sup>
PBDE 100 (2,2',4,4',6-Pentabromodiphenyl ether) <sup>(c,d)</sup>	0.447 ± 0.027 <sup>(b)</sup>
PBDE 153 (2,2',4,4',5,5'-Hexabromodiphenyl ether) <sup>(c,d,e,f)</sup>	6.44 ± 0.37 <sup>(b)</sup>
PBDE 154 (2,2',4,4',5,6'-Hexabromodiphenyl ether) <sup>(c,d,f)</sup>	1.06 ± 0.08 <sup>(b)</sup>
PBDE 183 (2,2',3,4,4',5',6-Heptabromodiphenyl ether) <sup>(c,d,e,f)</sup>	31.8 ± 0.1 <sup>(b)</sup>
PBDE 206 (2,2',3,3',4,4',5,5',6-Nonabromodiphenyl ether) <sup>(d,e)</sup>	6.2 ± 1.0 <sup>(b)</sup>
PBDE 209 (Decabromodiphenyl ether) <sup>(c,d,e,f)</sup>	93.5 ± 4.4 <sup>(b)</sup>

<sup>(a)</sup> Mass fractions are reported on dry-mass basis; material as received contains approximately 1.3 % moisture.

<sup>(b)</sup> Reference values are weighted means of the results from two to four analytical methods [14]. The uncertainty listed with each value is an expanded uncertainty about the mean, with coverage factor 2 (approximately 95 % confidence), calculated by combining a between-method variance incorporating inter-method bias with a pooled within-source variance following the ISO/JCGM/NIST Guide to the Expression of Uncertainty in Measurements [11,12].

<sup>(c)</sup> Results from ten laboratories participating in an interlaboratory study for PBDEs in sediment [12].

<sup>(d)</sup> Results from four laboratories participating in the 2007 interlaboratory study [13].

<sup>(e)</sup> NIST participation in the 2007 interlaboratory study using GC/MS.

<sup>(f)</sup> Data set from NIST for PBDEs using GC/MS following PFE with alumina SPE and SEC clean-up.

Table 9. Reference Mass Fraction Values for Selected Elements in SRM 1944 (Dry-Mass Basis)

	Degrees of Freedom	Mass Fraction <sup>(a,b)</sup> (%)
Silicon <sup>c,d</sup>	81	31 ± 3
		Mass Fraction <sup>(a,b)</sup> (mg/kg)
Antimony <sup>(c,e,f,g)</sup>	18	4.6 ± 0.9
Beryllium <sup>(c,h)</sup>	17	1.6 ± 0.3
Copper <sup>(c,d,f)</sup>	101	380 ± 40
Mercury <sup>(c,i)</sup>	18	3.4 ± 0.5
Selenium <sup>(c,e,f)</sup>	24	1.4 ± 0.2
Silver <sup>(c,d,e,g)</sup>	8	6.4 ± 1.7
Thallium <sup>(c,f)</sup>	12	0.59 ± 0.1
Tin <sup>(c,f)</sup>	22	42 ± 6

<sup>(a)</sup> The reference value is the equally weighted mean of available results from: (1) NIST INAA analyses, (2) two methods performed at NRCC, (3) results from seven selected laboratories participating in the NRCC intercomparison exercise, and (4) results from INAA analyses at IAEA. The expanded uncertainty in the reference value is equal to  $U = k u_c$  where  $u_c$  is the combined standard uncertainty and  $k$  is the coverage factor, both calculated according to the ISO/JCGM Guide [11,12]. The value of  $u_c$  is intended to represent at the level of one standard deviation the uncertainty in the value. Here  $u_c$  accounts for possible method differences, within-method variation, and material inhomogeneity. The coverage factor,  $k$ , is the Student's  $t$ -value for a 95 % confidence interval with the corresponding degrees of freedom. Because of material inhomogeneity, the variability among the measurements of multiple test portions can be expected to be greater than that due to measurement variability alone.

<sup>(b)</sup> Mass fractions are reported on dry-mass basis; material as received contains approximately 1.3 % moisture.

<sup>(c)</sup> Results from five to seven laboratories participating in the NRCC interlaboratory comparison exercise.

<sup>(d)</sup> Measured at NRCC using GFAAS.

<sup>(e)</sup> Measured at NIST using INAA.

<sup>(f)</sup> Measured at NRCC using ID-ICPMS.

<sup>(g)</sup> Measured at IAEA using INAA.

<sup>(h)</sup> Measured at NRCC using ICPOES.

<sup>(i)</sup> Measured at NRCC using cold vapor atomic absorption spectroscopy (CVAAS).

Table 11. Reference Mass Fraction Values for  
Selected Dibenzo-*p*-Dioxin and Dibenzofuran Congeners in SRM 1944 (Dry-Mass Basis)

	Mass Fraction <sup>(a,b)</sup> (µg/kg)		
2,3,7,8-Tetrachlorodibenzo- <i>p</i> -dioxin	0.133	±	0.009
1,2,3,7,8-Pentachlorodibenzo- <i>p</i> -dioxin	0.019	±	0.002
1,2,3,4,7,8-Hexachlorodibenzo- <i>p</i> -dioxin	0.026	±	0.003
1,2,3,6,7,8-Hexachlorodibenzo- <i>p</i> -dioxin	0.056	±	0.006
1,2,3,7,8,9-Hexachlorodibenzo- <i>p</i> -dioxin	0.053	±	0.007
1,2,3,4,6,7,8-Heptachlorodibenzo- <i>p</i> -dioxin	0.80	±	0.07
Octachlorodibenzo- <i>p</i> -dioxin	5.8	±	0.7
2,3,7,8-Tetrachlorodibenzofuran <sup>(c)</sup>	0.039	±	0.015 <sup>(d)</sup>
1,2,3,7,8-Pentachlorodibenzofuran	0.045	±	0.007
2,3,4,7,8-Pentachlorodibenzofuran	0.045	±	0.004
1,2,3,4,7,8-Hexachlorodibenzofuran	0.22	±	0.03
1,2,3,6,7,8-Hexachlorodibenzofuran	0.09	±	0.01
2,3,4,6,7,8-Hexachlorodibenzofuran	0.054	±	0.006 <sup>(e)</sup>
1,2,3,4,6,7,8-Heptachlorodibenzofuran	1.0	±	0.1
1,2,3,4,7,8,9-Heptachlorodibenzofuran	0.040	±	0.006 <sup>(e)</sup>
Octachlorodibenzofuran	1.0	±	0.1
Total Toxic Equivalents (TEQ) <sup>(f)</sup>	0.25	±	0.01
Total Tetrachlorodibenzo- <i>p</i> -dioxins	0.25	±	0.05 <sup>(e)</sup>
Total Pentachlorodibenzo- <i>p</i> -dioxins	0.19	±	0.06
Total Hexachlorodibenzo- <i>p</i> -dioxins	0.63	±	0.09
Total Heptachlorodibenzo- <i>p</i> -dioxins	1.8	±	0.2
Total Tetrachlorodibenzofurans	0.7	±	0.2
Total Pentachlorodibenzofurans	0.74	±	0.07
Total Hexachlorodibenzofurans	1.0	±	0.1
Total Heptachlorodibenzofurans	1.5	±	0.1
Total Dibenzo- <i>p</i> -dioxins <sup>(g)</sup>	8.7	±	0.9
Total Dibenzofurans <sup>(g)</sup>	5.0	±	0.5

<sup>(a)</sup> Each reference value is the mean of the results from up to fourteen laboratories participating in an interlaboratory exercise. The expanded uncertainty in the reference value is equal to  $U = ku_c$  where  $u_c$  is the combined standard uncertainty calculated according to the ISO/JCGM Guide [11,12] and  $k$  is the coverage factor. The value of  $u_c$  is intended to represent at the level of one standard deviation the combined effect of all the uncertainties in the reference value. Here  $u_c$  is the uncertainty in the mean arising from the variation among the laboratory results. The degrees of freedom is equal to the number of available results minus one (13 unless noted otherwise). The coverage factor,  $k$ , is the value from a Student's *t*-distribution for a 95 % confidence interval.

<sup>(b)</sup> Mass fractions are reported on dry-mass basis; material as received contains approximately 1.3 % moisture.

<sup>(c)</sup> Confirmation results using a 50 % cyanopropyl phenyl polysiloxane or 90 % *bis*-cyanopropyl 10 % cyanopropylphenyl polysiloxane phase columns.

<sup>(d)</sup> Degrees of freedom = 7 for this compound.

<sup>(e)</sup> Degrees of freedom = 12 for this compound.

<sup>(f)</sup> TEQ is the sum of the products of each of the 2,3,7,8-substituted congeners multiplied by their individual toxic equivalency factors (TEFs) recommended by the North Atlantic Treaty Organization (NATO) [15]. With regard to 2,3,7,8-tetrachlorodibenzofuran, the results of the confirmation column were used when available to calculate the TEQ.

<sup>(g)</sup> Total of tetra- through octachlorinated congeners.



Table 14. Reference Values for Total Organic Carbon and Percent Extractable Mass in SRM 1944

	Mass Fraction (%)		
Total Organic Carbon (TOC) <sup>(a,b)</sup>	4.4	±	0.3
Extractable Mass <sup>(c,d)</sup>	1.15	±	0.04

<sup>(a)</sup> Mass fraction is reported on a dry-mass basis; material as received contains approximately 1.3 % moisture.

<sup>(b)</sup> The reference value for total organic carbon is an equally weighted mean value from routine measurements made by three laboratories. Each uncertainty, computed according to the CIPM approach as described in the ISO/JCGM Guide [11,12], is an expanded uncertainty at the 95 % level of confidence, which includes random sources of uncertainty. The expanded uncertainty defines a range of values for the reference value within which the true value is believed to lie, at a level of confidence of 95 %.

<sup>(c)</sup> Extractable mass as determined from Soxhlet extraction using DCM.

<sup>(d)</sup> The reference value for extractable mass is the mean value of six measurements. Each uncertainty, computed according to the CIPM approach as described in the ISO/JCGM Guide [11,12], is an expanded uncertainty at the 95 % level of confidence, which includes random sources of uncertainty. The expanded uncertainty defines a range of values for the reference value within which the true value is believed to lie, at a level of confidence of 95 %.

Table 15. Information Mass Fraction Values for Selected Elements in SRM 1944 as Determined by INAA (Dry-Mass Basis)

	Mass Fraction <sup>(a)</sup> (%)
Magnesium <sup>(b)</sup>	1.0

	Mass Fraction <sup>(a)</sup> (mg/kg)
Cerium <sup>(b)</sup>	65
Europium <sup>(b)</sup>	1.3
Gold <sup>(b)</sup>	0.10
Lanthanum <sup>(b)</sup>	39
Thorium <sup>(b)</sup>	13
Uranium <sup>(b)</sup>	3.1

<sup>(a)</sup> Mass fraction is reported on a dry-mass basis; material as received contains approximately 1.3 % moisture.

<sup>(b)</sup> Measured at IAEA using INAA

Table 18. Analytical Methods Used for the Measurement of Elements in SRM 1944

Elements	Analytical Methods
Aluminum	FAAS, ICPOES, INAA, XRF
Antimony	GFAAS, HGAAS, ICP-MS, ID-ICPMS, INAA
Arsenic	GFAAS, HGAAS, ICPMS, INAA, XRF
Beryllium	GFAAS, ICP-AES, ICPMS
Bromine	INAA
Cadmium	FAAS, GFAAS, ICPMS, ID-ICPMS
Calcium	INAA
Cerium	INAA
Cesium	INAA
Chlorine	INAA
Chromium	FAAS, GFAAS, ICPMS, ID-ICPMS, INAA, XRF
Cobalt	INAA
Copper	FAAS, GFAAS, ICPOES, ICPMS, ID-ICPMS, XRF
Europium	INAA
Gold	INAA
Iron	FAAS, ICPOES, ICPMS, ID-ICPMS, INAA, XRF
Lanthanum	INAA
Lead	FAAS, GFAAS, ICPMS, ID-ICPMS, XRF
Magnesium	INAA
Manganese	FAAS, ICPOES, ICPMS, INAA, XRF
Mercury	CVAAS, ICPMS
Nickel	GFAAS, ICPOES, ICPMS, ID-ICPMS, INAA, XRF
Potassium	INAA
Rubidium	INAA
Scandium	INAA
Selenium	GFAAS, HGAAS, ICPMS, INAA
Silicon	FAAS, ICPOES, XRF
Silver	FAAS, GFAAS, ICPMS, INAA
Sodium	INAA
Thallium	GFAAS, ICPOES, ICPMS, ID-ICPMS,
Thorium	INAA
Tin	GFAAS, ICPMS, ID-ICPMS
Titanium	INAA
Uranium	INAA
Vanadium	INAA
Zinc	FAAS, ICPOES, ICPMS, ID-ICPMS, XRF, INAA
<b>Methods</b>	
CVAAS	Cold vapor atomic absorption spectrometry
FAAS	Flame atomic absorption spectrometry
GFAAS	Graphite furnace atomic absorption spectrometry
HGAAS	Hydride generation atomic absorption spectrometry
ICPOES	Inductively coupled plasma optical emission spectrometry
ICPMS	Inductively coupled plasma mass spectrometry
ID-ICPMS	Isotope dilution inductively coupled plasma mass spectrometry
INAA	Instrumental neutron activation analysis
XRF	X-ray fluorescence spectrometry

## APPENDIX A

The analysts and laboratories listed below participated in the interlaboratory comparison exercise for the determination of PBDEs in SRM 1944 [4].

D. Hoover and C. Hamilton, AXYS Analytical, Sidney, BC, Canada  
S. Klosterhaus and J. Baker, Chesapeake Biological Laboratory, Solomons, MD, USA  
S. Backus, Environment Canada, Ecosystem Health Division, Burlington, ON, Canada  
E. Sverko, Environment Canada, Canada Centre for Inland Waters, Burlington, ON, Canada  
P. Lepom, Federal Environmental Agency, Berlin, Germany  
R. Hites and L. Zhu, Indiana University, Bloomington, IN, USA  
G. Jiang, Research Center for Eco-Environmental Sciences, Beijing, China  
H. Takada, Tokyo University of Agriculture and Technology, Tokyo, Japan  
A. Covaci and S. Vorspoels, University of Antwerp, Antwerp, Belgium  
A. Li, University of Illinois at Chicago, Chicago, IL, USA

## APPENDIX B

The analysts and laboratories listed below participated in the interlaboratory comparison exercise for the determination of polychlorinated dibenzo-*p*-dioxins and dibenzofurans in SRM 1944.

W.J. Luksemburg, Alta Analytical Laboratory, Inc., El Dorado Hills, CA, USA  
L. Phillips, AXYS Analytical Services Ltd., Sidney, British Columbia, Canada  
M.J. Armbruster, Battelle Columbus Laboratories, Columbus, OH, USA  
G. Reuel, Canviro Analytical Laboratories Ltd., Waterloo, Ontario, Canada  
C. Brochu, Environment Québec, Laval, Québec, Canada  
G. Poole, Environment Canada Environmental Technology Centre, Ottawa, Ontario, Canada  
B. Henkelmann, GSF National Research Center for Environment and Health, Neuherberg, Germany  
R. Anderson, Institute of Environmental Chemistry, Umeå University, Umeå, Sweden  
C. Lastoria, Maxxam Analytics Inc., Mississauga, Ontario, Canada  
E. Reiner, Ontario Ministry of Environment and Energy, Etobicoke, Ontario, Canada  
J. Macaulay, Research and Productivity Council, Fredericton, New Brunswick, Canada  
T.L. Wade, Texas A&M University, College Station, TX, USA  
C. Tashiro, Wellington Laboratories, Guelph, Ontario, Canada  
T.O. Tiernan, Wright State University, Dayton, OH, USA

## APPENDIX C

The analysts and laboratories listed below participated in the interlaboratory comparison exercise for the determination of trace elements in SRM 1944.

A. Abbg, Applied Marine Research Laboratory, Old Dominion University, Norfolk, VA, USA  
A. Scott, Australian Government Analytical Laboratories, Pymble, Australia  
H. Mawhinney, Animal Research Institute, Queensland Department of Primary Industries, Queensland, Australia  
E. Crecelius, Battelle Pacific Northwest, Sequim, WA, USA  
M. Stephenson, California Department of Fish and Game, Moss Landing, CA, USA  
B. Presley, Department of Oceanography, Texas A&M University, College Station, TX, USA  
K. Elrick, U.S. Geological Survey, Atlanta, GA, USA



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SRM/RM Lot Number:		
SRM/RM Serial Number:		
Purchased directly from NIST?	Yes <input type="checkbox"/>	No <input type="checkbox"/>
CUSTOMER INFORMATION		
User First Name:		
User Surname:		
Organization/Company:		
Address:		
Address (continued):		
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## Login Sample Receipt Checklist

Client: AECOM

Job Number: 580-78968-1

Login Number: 78968

List Source: TestAmerica Seattle

List Number: 1

Creator: Gall, Brandon A

Question	Answer	Comment
Radioactivity wasn't checked or is $\leq$ background as measured by a survey meter.	N/A	Lab does not accept radioactive samples.
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 (excluding tests with immediate HTs)	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.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is $<6\text{mm}$ (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

## Walker, M Elaine

---

**From:** Dahl, Amy <amy.dahl@aecom.com>  
**Sent:** Thursday, July 19, 2018 7:11 PM  
**To:** Walker, M Elaine  
**Cc:** Cook, Chelsey  
**Subject:** FW: TestAmerica sample confirmation files from 580-78968-1 Portland Harbor Pre-Remedial Design  
**Attachments:** SampleLoginAck\_580-78968-1 [Std\_Tal\_Login\_Ack].pdf; COC 580-78968 (201807191011).pdf

**Original Email:**

---

Hi Elaine, is it possible to add on TOC and metals (Mn, As, Cd, Cu, Pb, Zn, Hg)?

Thank you,

**Amy Dahl, PhD**  
Chemist, Environment, Pacific Northwest  
D +1-206-438-2261  
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**AECOM**  
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**From:** Walker, Elaine [<mailto:elaine.walker@testamericainc.com>]  
**Sent:** Thursday, July 19, 2018 10:26 AM  
**To:** Dahl, Amy; Cook, Chelsey  
**Subject:** TestAmerica sample confirmation files from 580-78968-1 Portland Harbor Pre-Remedial Design

Hello,

Attached please find the sample confirmation files for job 580-78968-1; Portland Harbor Pre-Remedial Design.

This is the login for SRM 1944, logged for 8270D SIM PAH analysis only. Please confirm.

Please feel free to contact me if you have any questions.

Thank you.

Please let us know if we met your expectations by rating the service you received from TestAmerica on this project by visiting our website at: [Project Feedback](#)

**ELAINE M WALKER**  
Project Manager