DEPARTMENT OF
ECOLOGY
State of Washington

Addendum 4 to Quality Assurance Project Plan

The Puget Sound Assessment and Monitoring Program: Port Gardner Sediment Monitoring Component

July 2012

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Publication Information

Addendum

This addendum is on the Department of Ecology's website at
https://fortress.wa.gov/ecy/publications/SummaryPages/1203113.html

This addendum is an addition to an original Quality Assurance Project Plan. It is not a correction (errata) to the original plan.

Original

Quality Assurance Project Plan: The Puget Sound Assessment and Monitoring Program: Sediment Monitoring Component.

Publication No. 09-03-121.
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Ecology's Activity Tracker Codes for this study are 13-053 and 01-900.

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DEPARTMENT OF ECOLOGY

Environmental Assessment Program

July 18, 2012

TO: Teresa Michelsen, Toxics Cleanup Program
Kathy Taylor, Unit Supervisor, Toxics Cleanup Program
Tim Nord, Section Manager, Toxics Cleanup Program

THROUGH: Dale Norton, Unit Supervisor, Environmental Assessment Program
Will Kendra, Section Manager, Environmental Assessment Program

FROM: Randy Coots, Environmental Assessment Program

SUBJECT: Addendum to Quality Assurance Project Plan for: The Puget Sound Assessment and Monitoring Program: Sediment Monitoring Component Port Gardner
Activity Tracker Codes: 13-053 and 01-900
Publication No: 12-03-113

Port Gardner East Waterway has been identified under the Washington State Department of Ecology's (Ecology) Toxics Cleanup Program's Puget Sound Initiative for sediment cleanup and source control. Previous investigations have documented sediment concentrations exceeding Sediment Management Standards. This data set will provide current conditions and information on dioxin/furans, PCB aroclors, BNAs, petroleum hydrocarbons, metals, and several conventionals.

Ecology makes efforts to coordinate sediment sampling for surveys in the same area when possible. Samples for this study will be collected by Ecology's Marine Sediment Monitoring Team. The team will collect samples in June 2012 as part of their annual Puget Sound Assessment and Monitoring Program (PSAMP) and Ecology's Urban Water's Initiative Monitoring Program. Sampling under these programs will be conducted in the vicinity of Port Gardner East Waterway. The last sampling in the project area occurred in 2008. Additional samples for this study will be collected to measure current levels of contaminants from selected areas within the Port Gardner East Waterway as a special project for Ecology's Toxics Cleanup Program.

This Addendum to the original Quality Assurance Project Plan (Dutch et al., 2009) presents details specific to this study not addressed in the original plan. Details include project organization and schedule, sample locations, quality assurance, analytical parameters and methods, and laboratory costs.

cc: Robert F. Cusimano, Section Manager for Project Study Area
Dean Momohara, Acting Director, Manchester Environmental Laboratory
Bill Kammin, Ecology Quality Assurance Officer

Study Purpose

This study will measure concentrations of the following parameters in the surface sediments of Port Gardner/East Waterway.

- 17 chlorinated dioxin and furan congeners
- polychlorinated biphenyls (PCBs)
- base/neutral/acids (BNAs)
- total petroleum hydrocarbons gas and diesel (TPH-gx and TPH-dx)
- SMS metals (arsenic, cadmium, chromium, copper, lead, mercury, silver, and zinc)
- total organic carbon (TOC)
- total volatile solids (TVS)
- ammonia
- total sulfides
- grain size

Results will establish current conditions and concentrations of target contaminants for Port Gardner and East Waterway and may direct decisions regarding further evaluations for cleanup or restoration.

Project Organization and Schedule

The following individuals listed below in Table 1 are involved in the project. All are employees of the Washington State Department of Ecology. Table 2 shows the proposed schedule for completing the field and laboratory work, data entry into EIM, and the data set.

Table 1. Organization of project staff and responsibilities.

Staff (all are EAP except client)	Title	Responsibilities
Teresa Michelsen Toxics Cleanup Program Phone: 360-407-6285	EAP Client	Clarifies scopes of the project. Provides internal review of the Addendum to the QAPP and approves the final.
Randy Coots Toxics Studies Unit Statewide Coordination Section Phone: 360-407-6690	Project Manager/ Principal Investigator	Writes the Addendum to the QAPP. Oversees field sampling and transportation of samples to the laboratory. Conducts QA review of data and analyzes and interprets data. Develops the draft and final report.
Dale Norton Toxics Studies Unit Statewide Coordination Section Phone: 360-407-6765	Unit Supervisor for the Project Manager	Provides internal review of the Addendum to the QAPP, approves the budget, and approves the final.
Will Kendra Statewide Coordination Section Phone: 360-407-6698	Section Manager for the Project Manager	Reviews the project scope and budget, tracks progress, reviews the draft QAPP, and approves the final QAPP.
Robert F. Cusimano Western Operations Section Phone: 360-407-6596	Section Manager for the Study Area	Reviews the project scope and budget, tracks progress, reviews the draft Addendum to the QAPP, and approves the final.
Dean Momohara Manchester Environmental Laboratory Phone: 360-871-8801	Acting Lab Director	Approves the final Addendum.
William R. Kammin Phone: 360-407-6964	Ecology Quality Assurance Officer	Reviews the draft Addendum to the QAPP and approves the final.

EAP: Environmental Assessment Program
EIM: Environmental Information Management database
QAPP: Quality Assurance Project Plan

Table 2. Proposed schedule for completing the Port Gardner/East Waterway Project.

Field and laboratory work	Due date	Lead staff
Field work completed	June 2012	Randy Coots
Laboratory analyses completed	September 2012	
Environmental Information System (EIM) database		
EIM user study ID	rcoo0013	
Product	Due date	Lead staff
EIM data loaded	February 2013	Michael Friese
EIM quality assurance	March 2013	Andy Bookter
EIM complete	April 2013	Michael Friese
Final report/Data Set		
Author lead	Randy Coots	
Schedule		
Draft due to supervisor	February 2013	
Draft due to client/peer reviewer	March 2013	
Final (all reviews done) due to publications coordinator	April 2013	
Final report due on web	May 2013	

Sample Locations

Figure 1 shows (in red) study sites where sediment will be collected for the project. Table 3 lists the locations and the latitude/longitude coordinates. Selection of sample sites was both targeted and random. The two locations nearest the shoreline, and in the vicinity of the current Dunlap Towing operations (sample locations 1 and 2), were placed to evaluate potential petroleum releases from former bulk petroleum storage facilities located in the adjacent upland area. The six other sites were selected based on a probabilistic random stratified sampling design (see Dutch et al., 2009). The green sites on Figure 1 are for the Urban Waters Initiative locations targeted for collection in Port Gardner and East Waterway. Under this plan six Puget Sound bays were selected that would benefit most from toxics investigations to protect natural resources and human health.

Table 3. Location of Port Gardner East Waterway Sediment Monitoring Stations (latitude/longitude).

Area	Site Number	Latitude[1]	Longitude
East Waterway	1	47.982519	-122.219380
East Waterway	2	47.982596	-122.219001
East Waterway	3	47.984890	-122.222320
East Waterway	4	47.982070	-122.221720
East Waterway	5	47.980551	-122.225682
East Waterway	6	47.979710	-122.227650
East Waterway	7	47.976620	-122.230800
East Waterway	8	47.976390	-122.234410

[1] NAD 83, decimal degrees.

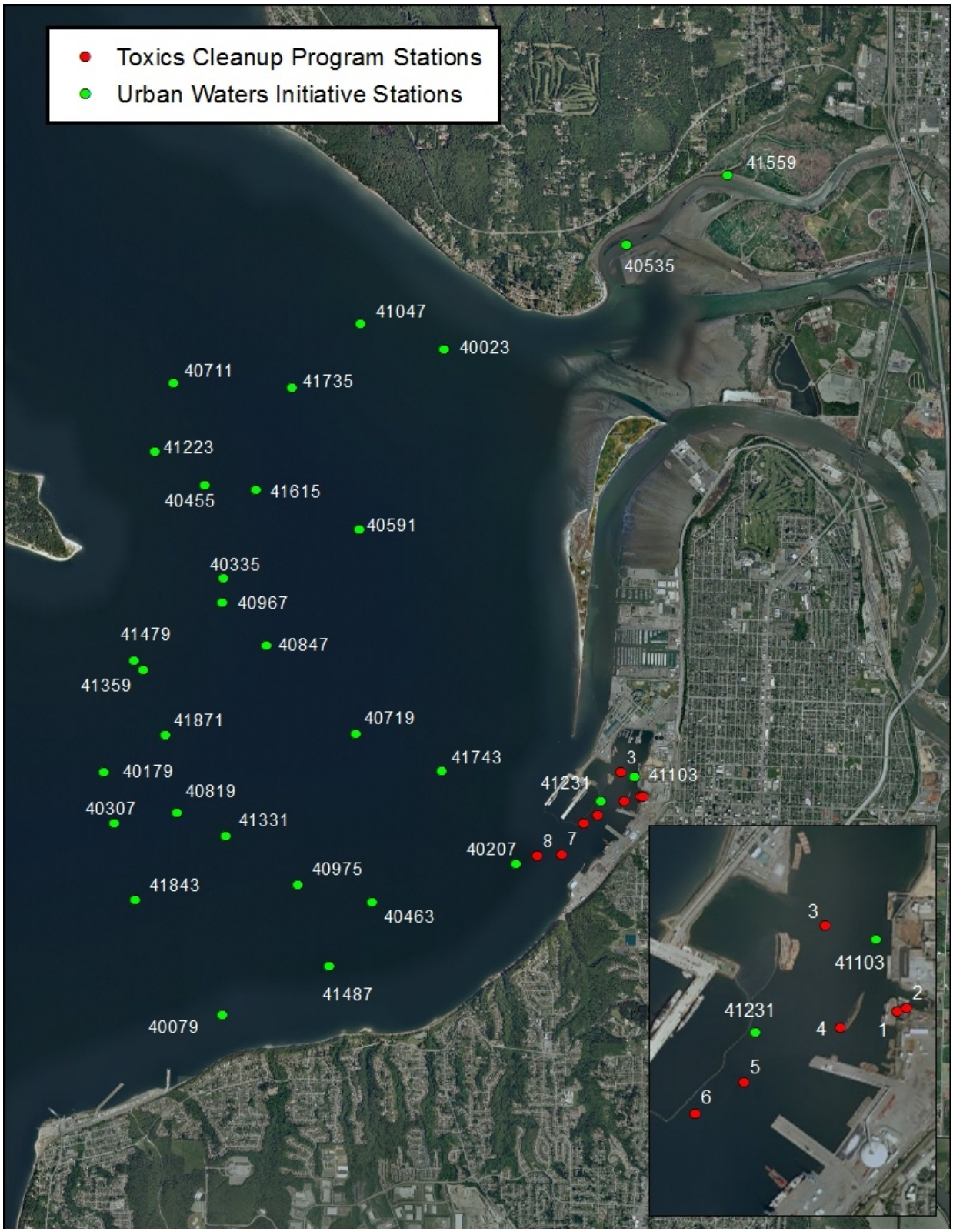

Figure 1. Port Gardner/East Waterway and Urban Waters Initiative Sediment Monitoring Stations.

Quality Objectives

Laboratory Quality Assurance

Manchester Environmental Laboratory (MEL) and their contractors are expected to meet quality assurance requirements of selected methods. Table 4 shows the quality objectives for the methods selected for sediment analysis.

The lowest concentrations of interest in Table 4 are reporting limits MEL and their contractors have reported for sediment analyses from other studies.

Table 4. Laboratory Quality Objectives for Port Gardner East Waterway Sediment Samples.

Parameter	LCS or SRM[1] (% Recovery)	Duplicate Samples (RPD[2])	Matrix Spike (% Recovery)	Matrix Spike Duplicates (RPD)	Surrogate Recoveries (% Recovery)	Lowest Concentration of Interest
Dioxin/Furans	Varies[3]	≤50%	NA	NA	Labeled Congeners-Recovery criteria vary per compound	0.2 ng/Kg, dry
PCB Aroclors	25 - 150%	≤50%	NA	NA	25 - 150%	0.1 *u*g/Kg
BNA (Semivolatiles)	40 - 150%	≤50%	40 - 150%	40%	10 - 150%	1 *u*g/Kg
TPH-dx	35 - 150%	≤50%	25 - 150%	50%	35 - 150%	50 mg/kg
TPH-gx	35 - 150%	≤50%	25 - 150%	50%	35 - 150%	20 mg/Kg
SMS Total Metals[4]	85 - 115%	≤20%	75 - 125%	20%	NA	1 - 150 mg/Kg
Mercury	85 - 115%	≤20%	85 – 115%	20%	NA	0.005 mg/Kg
Total Organic Carbon	80 - 120%	≤20%	75 - 125%	20%	NA	0.1 *u*g/Kg
Total Volatile Solids	80 - 120%	≤35%[5]	NA	NA	NA	0.10%
Total Sulfides	65 - 135%	≤35%[5]	65 - 135%	NA	NA	10 mg/Kg
Ammonia	80 - 120%	≤35%[5]	75 - 125%	NA	NA	0.1 mg/Kg
Grain size	80 - 120%	≤35%[5]	NA	NA	NA	1%

[1] Laboratory control standard or standard reference material.
[2] Relative percent difference.
[3] Recovery varies, compound specific.
[4] Total recoverable analysis for metals. Metals = arsenic, cadmium, chromium, copper, lead, silver, and zinc.
[5] Relative standard deviation (RSD) is used for triplicates.

Field Quality Control

Field quality control will be implemented through collection and analysis of replicate samples and field staff being familiar and following established protocols and standard operating procedures.

Field replicates assess the overall sample and analysis process. Replicate samples will be made from a new set of grabs. For this study, field replicates will be defined as one sample collected immediately after the other, at the same location and as close to the same time as possible. Replicate samples should be collected within 25 feet of the initial sample to be considered on site. Remaining homogenate from the first sample will be discarded before collecting the replicate.

Field quality control replicates for all analytes except total petroleum hydrocarbons (TPH) gas and diesel will be collected at a rate of 13%, or one quality control (QC) sample per eight field samples. The TPH gas and diesel will have a single field replicate for the two sites, a 50% replication rate.

Sample Containers, Preservation, and Holding

The study parameters, sample and container sizes, preservation required, and maximum holding time of samples are listed in Table 5.

Table 5. Study Parameters, Sample and Container Size, Preservation, and Holding Times.

Parameter	Sample Size (grams)	Container type	Preservation	Holding
Dioxin/Furans	25	8 oz. Amber wide/ Teflon lined lid	Cool to 4°C or Freeze -18°C	1 year to extraction, 1 year to analysis
PCB Aroclors	250	8 oz. wide/ Teflon lined lid	Cool to 4°C or Freeze -18°C	1 year to extraction, 1 year to analysis
BNAs	250	8 oz. wide/ Teflon lined lid	Cool to 4°C or Freeze -18°C	14 days to extraction, 1 year frozen -18°C
TPH-dx	250	8 oz. wide/ Teflon lined lid	Cool to 4°C	14 days to extraction, 40 days to analysis
TPH-gx	100	2 oz. wide/ Teflon lined & septum	Cool to 4°C	14 days collection to analysis
SMS metals - Ag, As, Cd, Cr, Cu, Pb, Zn	100	8 oz. wide/ Teflon lined lid	Cool to 4°C or Freeze -18°C	6 months 4°C / 2 yrs frozen -18°C
Mercury	100	8 oz. wide/ Teflon lined lid	Cool to 4°C	28 days
Grain size	150	8 oz. wide plastic jar	Cool to 4°C	6 months – Do not freeze
TOC	25	2 oz. wide/ Teflon lined lid	Cool to 4°C or Freeze -18°C	6 months frozen -18°C, 14 days cooled
TVS	50	2 oz. wide/ Teflon lined lid	Freeze -18°C	6 months frozen -18°C
Ammonia	50	2 oz. wide/ Teflon lined & septum	Cool to 4°C	7 day holding, cooled
Total Sulfides	50	2 oz. wide/ Teflon lined & septum	Freeze -18°C	6 months frozen -18°C

Laboratory Requirements and Reporting

Table 6 below shows the parameters to be analyzed for the study, and includes ranges of expected results, extraction cleanup and analysis methods, and expected reporting limits.

Table 6. Expected Range of Results, Extraction and Cleanup Methods, and Reporting Limits.

Parameter	Expected Range of Results	Extraction Method	Cleanup Method	Analysis Method	Instrument/ Technique	Required Reporting Limit
Dioxins/Furans	0.01 - 50 ng/Kg, dry	Soxhlet	Silica Gel	USEPA 1613B	HRGC/HRMS	1 - 10 ng/Kg
PCB Aroclors	1 - 4000 ppb	USEPA 3541	USEPA 3620 / USEPA 3665	SW-846 Method 8082	GC-DDC/EDC	10 *u*g/Kg, dry
Base/Neutral/Acid Compounds (BNAs)	0.1 - 55,000 ppb	USEPA 3541	USEPA 3630	SW-846 Method 8270	Capillary GC/MS	20 ug/Kg, dry (≥50% solids)
TPH-dx	50 - 200 mg/Kg dry	NA	NA	Ecology Pub. No. 97-602	GC/FID	50 mg/Kg (diesel)
TPH-gx	20 - 200 mg/Kg dry	NA	NA	Ecology Pub. No. 97-602	PT/GC/FID	20 mg/Kg (gas)
SMS Metals-Ag, As, Cd, Cr, Cu, Pb, Zn	<0.1 - 500 ppm (up to 1500 for zinc)	USEPA 3050B	NA	USEPA 200.8	ICP/MS	0.1 mg/Kg, dry (0.5 for Cr and 5.0 for Zn)
Mercury	0.001 - 10 ppm	USEPA 245.5	NA	USEPA 245.5	CVAA	0.14 mg/Kg dry
Total Organic Carbon (TOC)	0.01 - 15.0%	Dry sediment material	NA	PSEP, 1997 (70^{o}C)	Determination of CO_2 by non-dispersive infrared spectroscopy	0.1%
Total Volatile Solids (TVS)	0.5 - 50 mg/Kg	NA	NA	PSEP, 1997	Loss after combustion (550^{0}C)	0.1%
Ammonia	5 - 60 mg/Kg dry	NA	NA	USEPA 350.1	Automated phenate	0.10 mg/Kg, dry
Total Sulfides	10 - 1000 mg/Kg dry	NA	NA	Plumb, 1981	Spectrophotometric	10 mg/Kg, dry
Grain size	<20% - >80% silt+clay	NA	NA	Modified ASTM with Hydrometer	sieve-pipette	1.0%

Collection Procedures

Sediment will be collected to a depth of 10 cm. The upper 10 cm will be collected to comply with SMS procedures to determine whether sediments have been impacted within the biological active zone.

To avoid volatilization ammonia, total sulfides, and TPH-gx will be collected directly into appropriate sample containers. For these parameters no homogenization or mixing will occur. Head space will be avoided and sample jars will include a septum for expansion.

Once the vessel is positioned on site ammonia, total sulfides, and TPH-gx samples will be collected from the first acceptable grab prior to removal of sample aliquots. For these samples sediment will be removed from the Van Veen grab with care to avoid disturbance. A rounded stainless steel scoop will be used to collect to a depth of 10 cm.

Laboratory Budget

Table 7 below lists the proposed sample count and laboratory budget for the project. The total laboratory cost for the proposed sampling is estimated at $17,653. Analyses except dioxin/furans, ammonia, and total sulfides are conducted at Manchester Environmental Laboratory. The cost estimate reflects a 50% discount for analyses conducted by MEL.

Table 7. Proposed Sample Count and Laboratory Budget for the Project.

Parameter	Samples	QA Samples[1]	Cost/ Sample ($)	Subtotal ($)
Dioxin/Furans[2]	8	2	600	6,000
PCB Aroclors	8	2	119	1,190
BNAs	8	2	352	3,520
TPH-dx	2	1	160	480
TPH-gx	2	1	117	351
SMS Metals (As,Ag,Cd,Cr,Cu,Pb,Zn)	8	2	147	1,470
Mercury	8	2	53	530
Grain Size	8	1	100	900
TOC	8	1	45	405
TVS	8	1	24	216
Ammonia[2]	8	1	21	189
Sulfides[2]	8	1	76	684
			Subtotal	$15,935
			25% contracting	$1,718
			Total Laboratory	$17,653

[1] For two QA samples one is a matrix spike, laboratory control sample, or a standard reference material and the other a field replicate. Single QA samples are field replicates.
[2] Contract analysis.

Parameter List

17 Dioxin/Furan Compounds Analyzed By Method 1613B and PCB Aroclors by SW-846 Method 8082

Congeners	MDL (ng/Kg, dry)
Dioxins	
2,3,7,8-TCDD	0.2 - 0.5
1,2,3,7,8-PeCDD	0.2 - 0.5
1,2,3,4,7,8-HxCDD	1 to 5
1,2,3,6,7,8-HxCDD	1 to 5
1,2,3,7,8,9-HxCDD	1 to 5
1,2,3,4,6,7,8-HpCDD	1 to 5
OCDD	10
Total Tetra-Dioxins (TCDD)	0.2 - 0.5
Total Penta-Dioxins (PeCDD)	1 to 5
Total Hexa-Dioxins (HxCDD)	1 to 5
Total Hepta-Dioxins (HpCDD)	1 to 5
Furans	1 to 5
2,3,7,8-TCDF	1 to 5
1,2,3,7,8-PeCDF	1 to 5
2,3,4,7,8-PeCDF	1 to 5
1,2,3,4,7,8-HxCDF	1 to 5
1,2,3,6,7,8-HxCDF	1 to 5
2,3,4,6,7,8-HxCDF	1 to 5
1,2,3,7,8,9-HxCDF	1 to 5
1,2,3,4,6,7,8-HpCDF	1 to 5
1,2,3,4,7,8,9-HpCDF	1 to 5
OCDF	10
Total Tetra-Furans (TCDF)	0.2 - 0.5
Total Penta-Furans (PeCDF)	1 to 5
Total Hexa-Furans (HxCDF)	1 to 5
Total Hepta-Furans (HpCDF)	1 to 5

PCB Aroclors
PCB-1016
PCB-1221
PCB-1232
PCB-1242
PCB-1248
PCB-1254
PCB-1260

MDL variable from 5 – 1000 *u*g/Kg

Analyte List for BNA (Semivolatile) Analysis by EPA Method 8270

Phenol
Bis(2-Chloroethyl)Ether
2-Chlorophenol
1,3-Dichlorobenzene
1,4-Dichlorobenzene
1,2-Dichlorobenzene
Benzyl Alcohol
2-Methylphenol
Bis(2-chloro-1-methylethyl) ether
N-Nitrosodi-n-propylamine
4-Methylphenol
Hexachloroethane
Nitrobenzene
Isophorone
2-Nitrophenol
2,4-Dimethylphenol
Bis(2-Chloroethoxy)Methane
Benzoic Acid
2,4-Dichlorophenol
1,2,4-Trichlorobenzene
Naphthalene
4-Chloroaniline
Hexachlorobutadiene
4-Chloro-3-Methylphenol
2-Methylnaphthalene
1-Methylnaphthalene
Hexachlorocyclopentadiene
2,4,6-Trichlorophenol
2,4,5-Trichlorophenol
2-Chloronaphthalene
2-Nitroaniline
Dimethyl phthalate
2,6-Dinitrotoluene
Acenaphthylene
3-Nitroaniline
Acenaphthene
2,4-Dinitrophenol
4-Nitrophenol
Dibenzofuran
2,4-Dinitrotoluene
Diethyl phthalate
Fluorene
4-Chlorophenyl-Phenylether
4-Nitroaniline
4,6-Dinitro-2-Methylphenol
N-Nitrosodiphenylamine
1,2-Diphenylhydrazine
Triethyl citrate
4-Bromophenyl phenyl ether
Hexachlorobenzene
Tris(2-chloroethyl) phosphate (TCEP)
Pentachlorophenol
Phenanthrene
Anthracene
Caffeine
4-nonylphenol
Carbazole
Di-N-Butylphthalate
Triclosan
Fluoranthene
Pyrene
Bisphenol A
Retene
Butyl benzyl phthalate
Benz[a]anthracene
3,3'-Dichlorobenzidine
Chrysene
Bis(2-Ethylhexyl) Phthalate
Di-N-Octyl Phthalate
Benzo(b)fluoranthene
Benzo(k)fluoranthene
Benzo(a)pyrene
3B-Coprostanol
Cholesterol
Indeno(1,2,3-cd)pyrene
Dibenzo(a,h)anthracene
Benzo(ghi)perylene
2-Fluorophenol

Surrogates

Phenol-D5
2-Chlorophenol-D4
Bis(2-Chloroethyl)Ether-D8
1,2-Dichlorobenzene-D4
4-Methylphenol-D8
Nitrobenzene-D5
2-Nitrophenol-D4
2,4-Dichlorophenol-D3
4-Chloroaniline-D4
2-Fluorobiphenyl
Dimethylphthalate-D6
Acenaphthylene-D8
4-Nitrophenol-D4
Fluorene-D10
4,6-Dinitro-2-methylphenol-D2
Anthracene-D10
Pyrene-D10
Terphenyl-D14
Benzo(a)pyrene-D12
1,4-Dichlorobenzene-D4
Naphthalene-D8
Acenaphthene-D10
Phenanthrene-D10
Chrysene-D12
Perylene-D12

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