

# Remedial Investigation Report Addendum

BOEING KENT SPACE CENTER FACILITY  
South 208<sup>th</sup> Street  
KENT, WASHINGTON

February 2018

Prepared by:

DALTON, OLMSTED, & FUGLEVAND  
1001 SW Klickitat Way, Suite 200B  
Seattle, Washington 98134

Prepared for:

THE BOEING COMPANY  
Seattle, Washington



# Table of Contents

<b>1.0</b>	<b>INTRODUCTION</b> .....	<b>1</b>
<b>2.0</b>	<b>SWMU 86 DESCRIPTION</b> .....	<b>1</b>
<b>3.0</b>	<b>SEDIMENT TRAP SAMPLING</b> .....	<b>1</b>
<b>4.0</b>	<b>SCREENING LEVELS</b> .....	<b>2</b>
<b>5.0</b>	<b>NATURE AND EXTENT OF CONTAMINATION</b> .....	<b>3</b>
<b>5.1</b>	<b>Sediment Trap Sample Results</b> .....	<b>3</b>
<b>5.2</b>	<b>Stormwater Conveyance System Conclusions</b> .....	<b>4</b>
<b>6.0</b>	<b>REFERENCES</b> .....	<b>4</b>
<b>7.0</b>	<b>CLOSING</b> .....	<b>4</b>

## **TABLES**

Table 1 – Stormwater Conveyance System Solids Results

Table 2 – Stormwater Results

## **FIGURES**

Figure 1 – SWMU-86 Stormwater Conveyance System Results

## **APPENDICIES**

Appendix A – Analytical Data

February 16, 2018

## 1.0 INTRODUCTION

This Remedial Investigation (RI) Addendum was prepared by Dalton, Olmsted, and Fuglevand (DOF) on behalf of the Boeing Company (Boeing). Boeing submitted a draft RI Report in December 2017, prior to receipt of results for sediment trap samples collected over the course of 2017 (DOF, 2017). Sediment trap sampling was a required task in the RI Work Plan (Landau, 2016), as part of investigation of Solid Waste Management Unit (SWMU) 86 – the stormwater conveyance system. Samples were to be collected at four manhole locations at the Boeing Kent Space Center (Site) shown in Figure 1. The sediment traps were set in late 2016 and monitored for accumulation throughout 2017; however, accumulations were low and therefore the traps were left in place a full year to increase the likelihood that sufficient solids would be available for analytical testing outlined in the RI Work Plan. This Addendum presents the results of this remaining data collection task.

## 2.0 SWMU 86 DESCRIPTION

Stormwater at the operational areas of the site either infiltrates into unpaved areas, or is captured by the stormwater conveyance system and discharged to Mill Creek via the North Detention Pond located at the northwest corner of the site, or via a series of detention ponds and outfalls along the eastern site boundary (Landau, 2016). The stormwater conveyance system receives runoff from the entire site, including the SWMUs, areas of concern, and other areas where Ecology determined that further investigation was warranted. Stormwater runoff at the Site is monitored in accordance with the existing stormwater permit; however, Ecology requested that stormwater also be addressed in the RI because the permit monitoring does not include all of the potential contaminants of concern (PCOCs) for the RI. Investigation of the stormwater conveyance system as a potential source of contamination was included in the RI to evaluate the potential pathway for hazardous substances to leave the site.

The objective of the stormwater conveyance system sampling conducted under the RI was to confirm that the historical data that was summarized as part of developing the RI Work Plan was still representative of current system conditions (Ecology, 2016). Therefore the RI included sampling of stormwater and solids from four manholes and three outfalls (Figure 1).

## 3.0 SEDIMENT TRAP SAMPLING

DOF deployed sediment trap samplers in the four manholes (20.237M, 20.235M, 16.12M, and 15.10M) on December 15, 2016, in cooperation with Boeing and their confined-space contractor Stericycle. Methods followed those described in the RI Work Plan and associated Sampling and Analysis Plan (Landau, 2016). Sediment trap samplers were Ecology-style open mouth bottle traps and were constructed and positioned per the 2009 Ecology Standard Operating Procedures for inline sediment traps, with some minor changes. Changes were made to mounting hardware in order to facilitate inspection and checking of accumulation levels in the bottles. The sediment traps were not bolted into place in the stormwater pipe, but were instead mounted to a stainless steel adjustable rod that was docked on a mounting plate near the top of the manhole. This allowed for a single confined space entry during installation with no confined space necessary for monitoring of the bottles.

Sediment traps were periodically checked over the course of the past year. During several inspections, the water level in the larger stormwater pipes (20.237 and 20.235) appeared to be at a level consistent

February 16, 2018

with the creek water level, indicating the water in the pipes is a mix of onsite stormwater and creek water whenever the site is not actively discharging.

Sediment traps were set so that the bottles were standing vertically with the rims of the sample bottles above the static water level, but were under water during storm events as per the Ecology guidance.

The RI Work Plan recommended pulling the traps for sample collection after six months; however, field checks showed very little accumulation in the trap samplers after the initial six months so the traps were lowered as deep as feasible to further promote sample accumulation and left in place to collect additional solids. DOF pulled the sediment trap samples on December 20, 2017 and sent available sample volume to the Analytical Resources Inc. (laboratory) to attempt analyses of as many of the RI Work Plan anticipated compounds as feasible.

Samples were collected following the field and analytical methods described in the RI Work Plan and associated Quality Assurance Project Plan (QAPP) (Landau, 2016). Once the laboratory produced reports and Electronic Data Deliverables (EDDs) for the data, the data were reviewed and validated, consistent with the QAPP by EcoChem, Inc. The analytical and data validation report for the sediment trap samples is included as Appendix A. Data will also be uploaded to Ecology's Electronic Information System (EIM), in accordance with the requirements of the Agreed Order. All data were found to be usable with only minor qualification required, as discussed in the data validation memoranda. Data validation flags are included in tabulated data summaries where data have been qualified.

## 4.0 SCREENING LEVELS

Screening levels used in the RI are protective of the pathways established in the Conceptual Site Model, including the following media exposure pathways for SWMU 86:

- Stormwater Conveyance System Solids – If contaminants at the site exceed screening levels and reach the waters or sediments of Mill Creek (e.g., through stormwater runoff), benthic organisms may be exposed to hazardous substances present in the biologically active zone of sediment or contaminated organisms may be ingested as prey, as well as incidental ingestion of contaminated sediment, by higher trophic-level organisms (e.g., foraging fish, aquatic birds, etc.).

As described in the RI Work Plan, there are no screening criteria under MTCA or Sediment Management Standards (SMS) for stormwater conveyance system solids. Given that stormwater at the site discharges to Mill Creek the screening levels used to evaluate these stormwater conveyance system data in the RI provide conservative values to use in evaluating potential sources of contamination to Mill Creek. For solids, the levels were based on the SMS, WAC 173-240 (which MTCA references) and consider:

- Freshwater sediment cleanup objectives (SCOs; WAC 173-204-340), the concentration below which effects to biological resources are unlikely.
- Freshwater sediment cleanup screening levels (CSL; WAC 173-204-53), the concentration above which minor adverse biological effects may be expected.

February 16, 2018

## 5.0 NATURE AND EXTENT OF CONTAMINATION

This section presents and compares the stormwater conveyance system solids analytical results to screening levels and within the context of other data reported as part of the draft RI Report (DOF, 2017). The results of this evaluation are also used to determine if data gaps exist or further action is warranted for the different areas of concern identified in the AO.

### 5.1 Results

The sediment trap samplers were removed on December 20, 2017 and submitted to the laboratory for analysis. At the time of sample collection the samples all showed at least a measurable amount of accumulation in the bottles, and more than observed during previous sampler checks. The laboratory reported that the volume was sufficient to allow for the following analyses (prioritized based on the RI Work Plan criteria).

- Manhole 20.237M – Polychlorinated Biphenyls (PCBs), Metals, Polycyclic Aromatic Hydrocarbons (PAHs), and Total Petroleum Hydrocarbons (TPH)
- Manhole 20.235M – PCBs
- Manhole 16.12M – None
- Manhole 15.10M – PCBs, Metals, PAHs, and TPH

Results of stormwater conveyance system sampling from the manholes and from the three outfall locations (Outfall 20/20B, Outfall 16, and the North Detention Pond) are shown in Tables 1 (solids) and 2 (stormwater), and Figure 1, along with data from historical studies provided for reference. These data show that results are consistent and in some cases lower than those anticipated by earlier studies, specifically:

- Petroleum hydrocarbons were detected slightly above the diesel screening level in two of the three sediment trap samples but both diesel and oil were only detected at low levels, below the screening levels, at outfall solids sampling locations. TPH was not detected above screening levels in any of the stormwater samples.
- PAHs were detected at low levels in the solids samples, below screening levels and at least an order of magnitude below concentrations detected in Mill Creek by King County in 2014. Similarly PAHs were below screening levels in stormwater samples.
- PCBs were detected in each sediment trap sample at concentrations ranging from 206.8 ug/kg to 1977 ug/kg. These concentrations are similar to the levels detected prior to cleaning of the stormwater conveyance system in 2002. PCBs were also detected in the solids sample collected from the North Detention Pond (189.5 ug/kg). Notably, PCBs were not detected in either of the solids samples collected from the two outfalls leading offsite (OF-20 and OF-16), nor in the stormwater samples collected at these outfalls.
- Similar to PCBs, metals concentrations were higher in the samples from sediment traps samples than in the outfall location solids samples. All metals results from the two outfall solids samples (OF-20 and OF-16) were below screening levels. The highest concentrations were detected in the sediment trap sample collected from Manhole 20.237M, upstream of Outfall OF-20. Several

February 16, 2018

metals were above screening levels in the stormwater samples but all were well below Washington industrial stormwater general permit (ISGP) benchmark values.

## 5.2 Stormwater Conveyance System Conclusions

As presented in the draft RI Report, the data collected as part of the RI are generally consistent with regional and historical data, and with what might be expected for a similar industrial site that is well-maintained with underutilized parking and traffic. Results of the sediment trap samples do not change this conclusion. While PCBs and metals were detected in the solids samples onsite above the RI screening levels, the solids and stormwater sampling results do not indicate that concentrations or volumes present are transporting hazardous substances offsite or impacting soil or groundwater quality at the site.

The low accumulation in sediment traps over the course of a full year provide evidence that the site has low sediment loading, limiting the potential to contribute to contamination in downstream surface water bodies. Concentrations detected in stormwater samples discharging from the site are well below ISGP stormwater benchmarks. While the stormwater sample results did not meet surface water based screening levels in all cases, results do not indicate an unknown source of contamination and are at the low end of the typical range of results for industrial stormwater in this area of Washington. In addition, the Lower Mill Creek surface water body that the site discharges to has been assessed for quality in historical studies that have shown that the water would not meet Surface Water Quality standards for Washington, as discussed in the draft RI Report. Therefore, no additional investigation of SWMU 86 is recommended in order to complete the RI.

## 6.0 REFERENCES

DOF, 2017. Draft Remedial Investigation Report, Boeing Kent Space Center Facility, Kent, Washington, prepared for the Boeing Company, prepared by DOF, Seattle, Washington, December 28.

Ecology, 2016. Email from Byung Maeng, Ecology, to Nick Garson, Boeing RE: Boeing Kent Space Center – Response to Ecology Request for Storm Sewer Sampling, April 6.

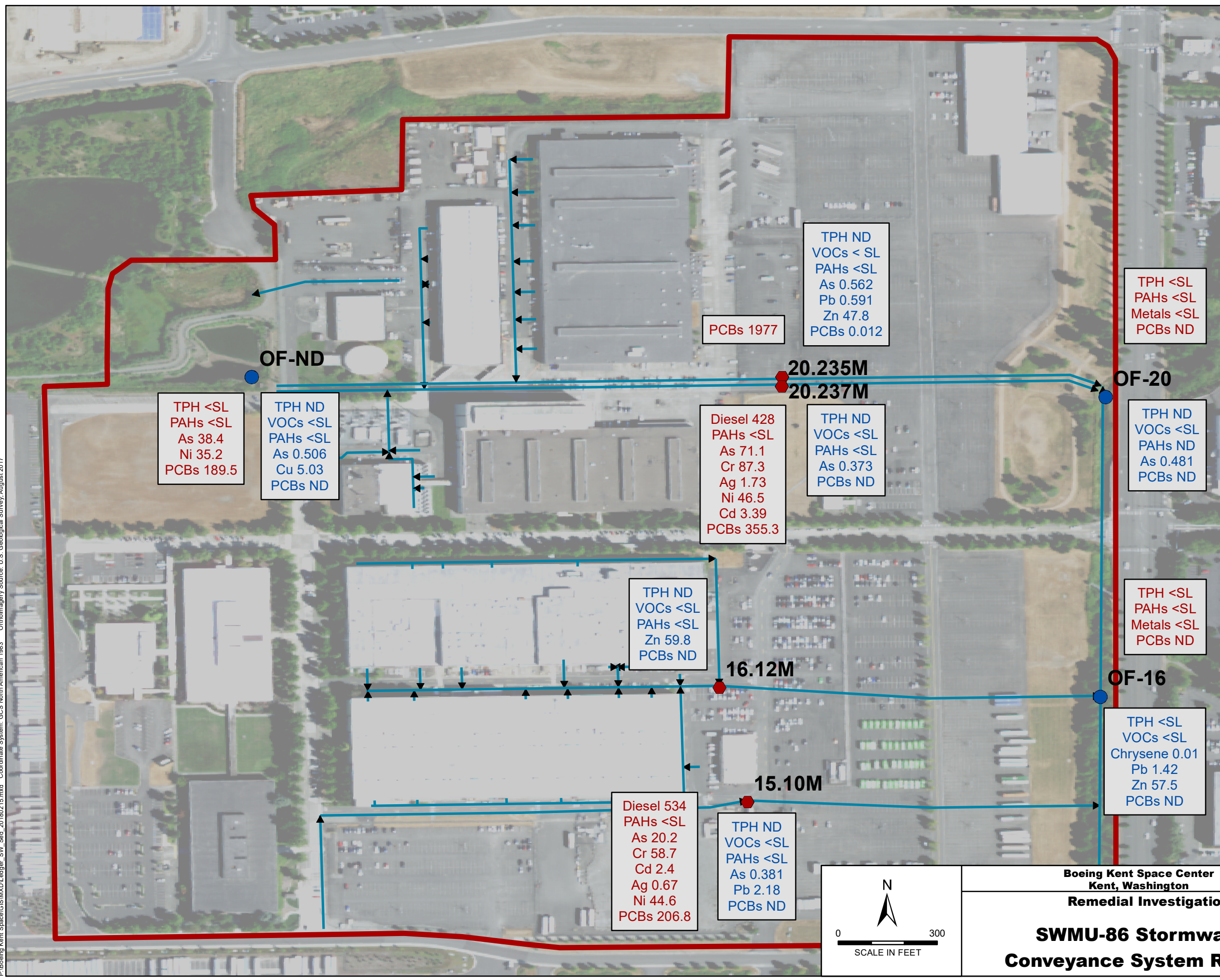
Landau, 2016. Final Remedial Investigation Work Plan, Boeing Kent Space Center Facility, Kent, Washington, prepared for the Boeing Company, prepared by Landau Associates, Edmonds, Washington, October 12.

## 7.0 CLOSING

The services described in this report were performed consistent with generally accepted professional consulting principles and practices. No other warranty, expressed or implied, is made. This report is solely for the use and information of our client unless otherwise noted. Any reliance on this report by a third party is at such party's sole risk.



P:\Boeing\_Kent\_Space\GIS\MXD\Ledger\_SW\_Sed\_20180216.mxd Coordinate System: GCS North American 1983 Orthoregistry Source: U.S. Geological Survey, August 2017

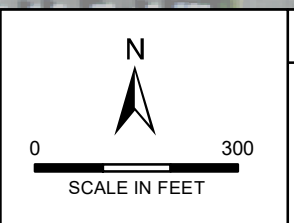


**Note:**  
Concentrations shown for constituents detected above screening levels

**Definitions:**  
 ND Non Detect  
 <SL Concentrations Below Screening Level  
 TPH Total Petroleum Hydrocarbons  
 PAHs Polycyclic Aromatic Hydrocarbons  
 PCBs Polychlorinated Biphenyls  
 VOCs Volatile Organic Compounds  
 Ag Silver  
 As Arsenic  
 Cr Chromium  
 Cd Cadmium  
 Ni Nickel  
 Pb Lead  
 Zn Zinc

**Legend**

- Stormwater Concentration
  - PAHs (ug/L)
  - Total Metals (ug/L)
  - PCBs (ug/L)
- Solids Concentration
  - TPH (mg/kg)
  - PAHs (ug/kg)
  - Metals (mg/kg)
  - PCBs (ug/kg)
- ID ◆ Manhole Sample Location
- ID ● Outfall Sample Location
- Stormwater Line
- Site Boundary



**Boeing Kent Space Center  
Kent, Washington**  
**Remedial Investigation**  
**SWMU-86 Stormwater  
Conveyance System Results**

**DOF** DALTON  
OLMSTED  
FUGLEVAND  
**FIGURE  
1**  
 February 16, 2018

**Table 1**  
**Stormwater Conveyance System Solids Results**  
Remedial Investigation  
Boeing Kent Space Center

Sample Date	Location	Sample Location ID	TPH		PAHs																	PCBs		Metals									
			Diesel	Oil	2-Methylnaphthalene	Acenaphthylene	Acenaphthene	Anthracene	Dibenzofuran	Naphthalene	Phenanthrene	Pyrene	Fluorene	Fluoranthene	Benzo(g,h,i)perylene	Benzo(a)anthracene	Benzo(a)pyrene	Indeno(1,2,3-cd)pyrene	Dibenzo(a,h)anthracene	Chrysene	Total Benzofluoranthenes	cPAH TEQ using TEF under WAC 173-340-708e	Total PCBs	Arsenic	Chromium	Silver	Copper	Lead	Nickel	Zinc	Cadmium	Selenium	Mercury
RI Screening Level			340	3600	17000																	110	14	72	0.57	400	360	26	3200	2.1	11	0.66	
Units			mg/kg	mg/kg	ug/kg																	ug/kg	mg/kg										
2017 RI Results																																	
12/20/2017	Manhole 20.237M	KSC-MH-20.237M-1217	428	2240	125 J	<136	<136	<136	78.4 J	179	393	723	<136	567	711	197	351	311	91.1 J	591	697	416.8	355.3	71.1	87.3	1.73 J	220	189	46.5	1200	3.39	<27.3	0.435
12/20/2017	Manhole 20.235M	KSC-MH-20.235M-1217	INSUFFICIENT VOLUME																			1977	INSUFFICIENT VOLUME										
12/20/2017	Manhole 16.12M	KSC-MH-16.12M-1217	INSUFFICIENT VOLUME																														
12/20/2017	Manhole 15.10M	KSC-MH-15.10M-1217	534	2570	76.2 J	<144	<144	<144	<144	141 J	412	809	<144	557	618	158	214	250	<144	432	497	259.1	206.8 J	20.2	58.7	0.67 J	157	93.4	44.6	1390	2.4	<11.4	0.217
6/29/2017	Outfall-Mill Creek 20/20B	OF-20	9.72	20.8	<4.87	<4.87	2.46 J	<4.87	<4.87	3.42 J	10.6	14.6	3.37 J	13.8	5.53	5.5	5.11	4.06 J	<4.87	9.01	9.95	6.6	<18.3	3.8	13.2	0.05 J	21.9	9.85	11.4	44.1	0.13	0.71 J	0.04481
5/4/2017	Outfall- East Drainage Ditch 16	KSC-OF-16-0.3	19.7	89	2.38 J	<4.72	<4.72	6.04	<4.72	<4.72	33.6	101	3.14 J	113	87.9	47.6	62.3	70.5	16.8	97.3	158	76.8	<17.6	3.01	18.7	0.08 J	29.2	9.02	15.7	109	0.31	0.94	<0.02258
5/4/2017	Outfall-North Detention Pond	OF-DP-0.3	20.8	103	4.99	5.01	<4.94	3.92 J	3.43 J	9.02	23	41.7	3.57 J	38.1	61	13.8	21	29.4	8.47	42.6	66.6	26.6	189.5	38.4	45.1	0.29 J	195	50.5	35.2	415	1.41	1.59	0.1721
Historical Storm System Sample Results																																	
9/17/2002	Catch basin	CB 14.12C	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1400	--	--	--	--	--	--	--	--	--	--
9/17/2002		CB 14.7C	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<130	--	--	--	--	--	--	--	--	--
9/17/2002		CB 16.5C	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	180	--	--	--	--	--	--	--	--	--
9/17/2002		CB 20.156C	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<6	--	--	--	--	--	--	--	--	--
9/17/2002		CB 16.21C	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ND	--	--	--	--	--	--	--	--	--
9/17/2002		CB 16.19C	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<14	--	--	--	--	--	--	--	--	--
9/17/2002		CB 17.6C	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	320	--	--	--	--	--	--	--	--	--
9/17/2002		CB 20.169C	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	180	--	--	--	--	--	--	--	--	--
9/17/2002		CB 17.9C	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	66	--	--	--	--	--	--	--	--	--
9/17/2002		CB 18.13C	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	970	--	--	--	--	--	--	--	--	--
Feb 2014	Off-Site	DT318	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5117	74.4	--	--	--	--	--	--	--	--	--	
Feb 2014		FS318	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2878	51.8	--	--	--	--	--	--	--	--	
Feb 2014		CS318	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	8396	128	--	--	--	--	--	--	--	--	
11/1/2011	North Detention Pond	NDP-1(0-0.5)	<89	<180	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	21	49	--	295	132	--	400	1.7	--	0.33
11/1/2011		NDP-2(0-1)	<50	<100	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10.1	21.3	--	63.4	27.8	--	147	0.7	--	0.06
11/1/2011		NDP-2(1-2)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5.2 J	--	--	--	--	--	--	--	--	--
11/1/2011		NDP-3(0-1)	<50	<100	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.7	17.9	--	62.7	36.6	--	122	0.6	--	0.07
11/1/2011		NDP-4(0-1)	<50	<100	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	13.2	20.5	--	51.6	27.1	--	144	0.5	--	0.07
11/1/2011		NDP-4(1-2)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4.2	--	--	--	--	--	--	--	--	
11/1/2011		NDP-5(0-1)	<50	<100	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.6	19.5	--	40.4	15.8	--	67	0.2	--	0.07
11/1/2011		NDP-5(1-2)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5.8	--	--	--	--	--	--	--	--	
11/1/2011		NDP-6(0-1)	<50	<100	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10.8	17	--	50.3	26.7	--	87	0.2	--	0.05
11/1/2011		NDP-6(1-2)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4	--	--	--	--	--	--	--	--	
11/1/2011		NDP-7(0-1)	<50	<100	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.6	17.4	--	45.7	14.2	--	65	0.3	--	0.09
11/1/2011		NDP-8(0-1)	<50	<100	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.4	20.3	--	42.3	12	--	57	<0.1	--	0.05
11/1/2011		NDP-9(0-1)	<50	<100	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5.9	15.7	--	30.6	66.8 J	--	62	0.2	--	0.04
11/1/2011	NDP-10(0-1)	<50	<100	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7	17	--	30.7	9.8	--	54	<0.2	--	0.05	
11/1/2011	NDP-11(0-1)	<50	<100	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.7	16.7	--	29.4	88.3	--	50	0.2	--	0.05	
11/1/2011	NDP-12(0-1)	<50	<100	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5.7	22.4	--	20.5	7.3	--	40	<0.1	--	<0.02	

**Notes and Abbreviations**

**Bolded values** are above Remedial Investigation Screening Level

Only detected PAHs shown

TPH = Total petroleum hydrocarbons

PAHs = Polynuclear Aromatic Hydrocarbons

PCBs = Polychlorinated Biphenyls

ug/kg = micrograms per kilogram

mg/kg = milligrams per kilogram

< = compound was not detected greater than the reporting limit shown

J = The result value is qualified as estimated

Draft results - data are unvalidated





**Table 2**  
**Stormwater Results**  
Remedial Investigation  
Boeing Kent Space Center

Sample Date	Location	Sample Location ID	TPH-Gasoline (ug/L)	TPH-Diesel (mg/L)	TPH-Oil (mg/L)	Detected VOCs (ug/L)	PAHs (ug/L)						PCBs (ug/L)	Total Metals (ug/L)										Dissolved Metals (ug/L)													
							Acetone	Naphthalene	Phenanthrene	Pyrene	Fluoranthene	Chrysene		Total Benzofluoranthenes	Total	Arsenic	Chromium	Silver	Copper	Lead	Nickel	Zinc	Cadmium	Selenium	Mercury	Arsenic	Chromium	Silver	Copper	Lead	Nickel	Zinc	Cadmium	Selenium	Mercury		
<b>WA Industrial Stormwater Benchmarks</b>			--	<b>10</b>		--	--	--	--	--	--	--	<b>150</b>	--	<b>3.8</b>	<b>14</b>	<b>81.6</b>	--	<b>117</b>	<b>2.1</b>	<b>5</b>	<b>1.4</b>	<b>150</b>	--	<b>3.8</b>	<b>14</b>	<b>81.6</b>	--	<b>117</b>	<b>2.1</b>	<b>5</b>	<b>1.4</b>					
<b>RI Screening Level</b>			<b>800/1000</b>	<b>0.5</b>	<b>0.5</b>	--	<b>4700</b>	--	<b>20</b>	<b>20</b>	<b>0.003</b>	--	<b>0.00006</b>	<b>0.02</b>	<b>57</b>	<b>0.32</b>	<b>3.5</b>	<b>0.54</b>	<b>49</b>	<b>32</b>	<b>0.25</b>	<b>3.1</b>	<b>0.01</b>	<b>0.02</b>	<b>57</b>	<b>0.32</b>	<b>3.5</b>	<b>0.54</b>	<b>49</b>	<b>32</b>	<b>0.25</b>	<b>3.1</b>	<b>0.01</b>				
1/18/2017	Manhole	MH-20.237-W	<100	<0.1	<0.2	5.22	0.012	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<b>0.373</b>	<0.5	<0.2	2.92	0.503	0.608	25.1	<0.1	<2.0	<0.1	<b>0.257</b>	<0.5	<0.2	2	<0.1	<0.5	19	<0.1	<0.5	<0.1				
1/18/2017	Manhole	MH-20.235-W	<100	<0.1	<0.2	6.27	0.011	0.013	<0.01	<0.01	<0.01	<0.01	<b>0.012</b>	<b>0.562</b>	0.571	<0.2	3.47	<b>0.591</b>	0.501	<b>47.8</b>	<0.1	<2.0	<0.1	<b>0.462</b>	<0.5	<0.2	2.25	0.11	<0.5	<b>37.2</b>	<0.1	<0.5	<0.1				
1/18/2017	Manhole	MH-16.12-W	<100	<0.1	<0.2	8.18	0.012	0.012	<0.01	<0.01	<0.01	<0.01	<0.01	<0.2	<0.5	<0.2	2.46	0.229	<0.5	<b>59.8</b>	<0.1	<2.0	<0.1	<0.2	<0.5	<0.2	1.77	0.182	<0.5	<b>50.5</b>	<0.1	<0.5	<0.1				
1/18/2017	Manhole	MH-15.10-W	<100	<0.1	<0.2	5.67	<0.01	0.013	0.013	<0.01	<0.01	<0.01	<0.01	<b>0.381</b>	0.844	<0.2	2.85	<b>2.18</b>	<0.5	21.4	<0.1	<2.0	<0.1	<b>0.272</b>	0.601	<0.2	1.6	0.155	<0.5	8.46	<0.1	<0.5	<0.1				
1/20/2017	Outfall-Mill Creek 20/20B	OF-20-W	<100	<0.1	<0.2	5.33	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<b>0.481</b>	<0.5	<0.2	2.29	0.329	0.59	12.4	<0.1	<2	<0.1	<b>0.33</b>	<0.5	<0.2	1.61	0.117	<0.5	9.41	<0.1	<0.5	<0.1				
1/18/2017	Outfall- East Drainage Ditch 16	OF-16-W	<100	<0.1	0.219	20.2	0.017	0.034	0.020	0.018	<b>0.010</b>	0.011	<0.01	<0.2	0.632	<0.2	3.21	<b>1.42</b>	0.555	<b>57.5</b>	<0.1	<2	<0.1	<0.2	<0.5	<0.2	0.945	<0.1	<0.5	<b>37.7</b>	<0.1	<0.5	<0.1				
1/18/2017	Outfall-North Detention Pond	OF-NDP-W	<100	<0.1	<0.2	5.72	0.014	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<b>0.506</b>	0.606	<0.2	<b>5.03</b>	0.358	0.713	15.9	<0.1	<2	<0.1	<b>0.356</b>	<0.5	<0.2	2.02	<0.1	<0.5	9.88	<0.1	<0.5	<0.1				
<b>Historical Storm System Sample Results</b>																																					
11/7/2002	Mill Creek Offsite	B317	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	52				
1/21/2003		B317	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	35.3				
1/22/2003		B317	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	34.6				
11/17/2003		B317	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	29.6					
Aug 2005		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.94-13.6	--	--	5-105	--	--	--	--	--	--	--	--	--	--	0.75-10.8	--	--	4-100		
Sept 2005		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.89-14.1	--	--	6-88.7	--	--	--	--	--	--	--	--	--	--	0.67-10.4	--	--	5.7-79.3			
Dec 2005		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.23-6.01	--	--	19-75.9	--	--	--	--	--	--	--	--	--	0.74-3.14	--	--	18.3-58.4				

**Notes and Abbreviations**

**Bolded values** are above Remedial Investigation Screening Level  
< = compound was not detected greater than the reporting limit shown  
Only detected VOCs and PAHs shown  
TPH = Total petroleum hydrocarbons  
VOCs = Volatile Organic Compounds  
PAHs = Polynuclear Aromatic Hydrocarbons  
PCBs = Polychlorinated Biphenyls  
ug/L = micrograms per liter  
mg/L = milligrams per liter  
Final Industrial Stormwater General Permit – January 2, 2015



**Appendix A**  
**Analytical Data**



10 January 2018

Lindsey Mahrt  
The Boeing Company  
P.O. Box 3707 MS 1W-12  
Seattle, WA 98124

RE: Boeing Kent Sediments

Please find enclosed sample receipt documentation and analytical results for samples from the project referenced above.

Sample analyses were performed according to ARI's Quality Assurance Plan and any provided project specific Quality Assurance Plan. Each analytical section of this report has been approved and reviewed by an analytical peer, the appropriate Laboratory Supervisor or qualified substitute, and a technical reviewer.

Should you have any questions or problems, please feel free to contact us at your convenience.

Associated Work Order(s)  
17L0370

Associated SDG ID(s)  
N/A

-----

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed in the enclosed Narrative. ARI, an accredited laboratory, certifies that the report results for which ARI is accredited meets all the requirements of the accrediting body. A list of certified analyses, accreditations, and expiration dates is included in this report.

Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or his/her designee, as verified by the following signature.

Analytical Resources, Inc.

*The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.*



# Chain of Custody Record & Laboratory Analysis Request

**Analytical Resources, Incorporated**  
 Analytical Chemists and Consultants  
 4611 South 134th Place, Suite 100  
 Tukwila, WA 98168  
 206-695-6200 206-695-6201 (fax)  
 www.arilabs.com



Page: 1 of 1  
 Date: 12/20/17  
 No. of Coolers: \_\_\_\_\_  
 Cooler Temps: \_\_\_\_\_  
 Ice Present? \_\_\_\_\_  
 Analysis Requested: \_\_\_\_\_

Turn-around Requested: NORMAL  
 Phone: 206-660-3466  
 Client Company: DOF/BOEING  
 Client Contact: TASYA GOAY  
 Client Project Name: KENT SPACE CENTER  
 Client Project #: B-002  
 Samplers: COOPER

Sample ID	Date	Time	Matrix	No. Containers
KSC-MH-20.23SM-1217	12/20/17	1250	SUGGESTED SOLIDS	1
KSC-MH-20.237M-1217		1257		1
KSC-MH-15.10M-1217		1305		1
KSC-MH-16.12M-1217		1405		1

Analysis Requested	Notes/Comments
① PCBs ② METALS As, Cd, Cr, Cu, Pb, Hg, Ni, Se, Zn ③ TPH-DX ④ NMPH-DX ⑤ PHTs ⑥ EPA 820-SM	① → ④ LISTED IN ORGAN OF AVAILABILITY TABLE ON VOLUME OF SAMPLE AVAILABLE.
X	
X	
X	
X	

Comments/Special Instructions: PLEASE CONTACT US WITH ANY CONTRACT US WITH POTENTIAL POSSIBILITIES FOR ANALYSES

Relinquished by: (Signature) <u>[Signature]</u> Printed Name: <u>Brandon Fisk</u> Company: <u>ARI</u> Date & Time: <u>12/20/17 1440</u>	Received by: (Signature) <u>[Signature]</u> Printed Name: <u>Brandon Fisk</u> Company: <u>ARI</u> Date & Time: <u>12/20/17 1440</u>
--	--

**Limits of Liability:** ARI will perform all requested services in accordance with appropriate methodology following ARI Standard Operating Procedures and the ARI Quality Assurance Program. This program meets standards for the industry. The total liability of ARI, its officers, agents, employees, or successors, arising out of or in connection with the requested services, shall not exceed the invoiced amount for said services. The acceptance by the client of a proposal for services by ARI release ARI from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order or co-signed agreement between ARI and the Client.

**Sample Retention Policy:** All samples submitted to ARI will be appropriately discarded no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alternate retention schedules have been established by work-order or contract.





# Cooler Receipt Form

ARI Client: DoF/Boeing  
 COC No(s): \_\_\_\_\_ NA  
 Assigned ARI Job No: \_\_\_\_\_

Project Name: \_\_\_\_\_  
 Delivered by: Fed-Ex UPS Courier Hand Delivered Other: \_\_\_\_\_  
 Tracking No: \_\_\_\_\_ NA

**Preliminary Examination Phase:**

Were intact, properly signed and dated custody seals attached to the outside of to cooler? YES  NO  
 Were custody papers included with the cooler? ..... YES  NO  
 Were custody papers properly filled out (ink, signed, etc.) ..... YES  NO

Temperature of Cooler(s) (°C) (recommended 2.0-6.0 °C for chemistry)  
 Time: 5.9

Temp Gun ID#: 2002666

If cooler temperature is out of compliance fill out form 00070F  
 Cooler Accepted by: BF Date: 12/20/17 Time: 1440

*Complete custody forms and attach all shipping documents*

**Log-In Phase:**

Was a temperature blank included in the cooler? ..... YES  NO  
 What kind of packing material was used? ... Bubble Wrap Wet Ice Gel Packs Baggies Foam Block Paper Other: \_\_\_\_\_  
 Was sufficient ice used (if appropriate)? ..... NA  YES  NO  
 Were all bottles sealed in individual plastic bags? ..... YES  NO  
 Did all bottles arrive in good condition (unbroken)? ..... YES  NO  
 Were all bottle labels complete and legible? ..... YES  NO  
 Did the number of containers listed on COC match with the number of containers received? ..... YES  NO  
 Did all bottle labels and tags agree with custody papers? ..... YES  NO  
 Were all bottles used correct for the requested analyses? ..... YES  NO  
 Do any of the analyses (bottles) require preservation? (attach preservation sheet, excluding VOCs)... NA  YES  NO  
 Were all VOC vials free of air bubbles? ..... NA  YES  NO  
 Was sufficient amount of sample sent in each bottle? ..... YES  NO  
 Date VOC Trip Blank was made at ARI ..... NA  
 Was Sample Split by ARI :  NA YES Date/Time: \_\_\_\_\_ Equipment: \_\_\_\_\_ Split by: \_\_\_\_\_

Samples Logged by: BF Date: 12/20/17 Time: 1505 1502  
 \*\* Notify Project Manager of discrepancies or concerns \*\*  
BF 12/20/17

Sample ID on Bottle	Sample ID on COC	Sample ID on Bottle	Sample ID on COC

Additional Notes, Discrepancies, & Resolutions:  
 By: \_\_\_\_\_ Date: \_\_\_\_\_

<p>Small Air Bubbles = 2mm</p>	<p>Peabubbles 2-4 mm</p>	<p>LARGE Air Bubbles &gt; 4 mm</p>	Small → "sm" (< 2 mm) Peabubbles → "pb" (2 to < 4 mm) Large → "lg" (4 to < 6 mm) Headspace → "hs" (> 6 mm)
------------------------------------	------------------------------	--	---



# Materials Testing & Consulting, Inc.

Geotechnical Engineering • Special Inspection • Materials Testing • Environmental Consulting



**Project:** 17L0370  
**Project #:** 17T001-085  
**Client:** Analytical Resources, Inc.  
**Source:** Multiple  
**MTC Sample#:** Multiple

**Date Received:** December 21, 2017  
**Sampled By:** Others  
**Date Tested:** December 21, 2017  
**Tested By:** B. Goble

## CASE NARRATIVE

1. Four samples were submitted for separation of solids by means of centrifuging according to modified Corp of Engineers draft interim guide lines. Each sample was submitted in 5 500mL bottles with one sample being submitted in triplicate. The samples were centrifuged in a pre-cooled centrifuge (4°C) at 1,000 x g for 30 minutes. The solid sample was spooned into 4 oz sample jars and weighed. The liquid sample was decanted into 1 liter glass Amber bottles.

2. All of the centrifuge bottles and equipment were decontaminated prior to sample preparation.

3. There were no anomalies in this project.

All results apply only to actual locations and materials tested. As a mutual protection to clients, the public and ourselves, all reports are submitted as the confidential property of clients, and authorization for publication of statements, conclusions or extracts from or regarding our reports is reserved pending our written approval.

Reviewed by: *B. Goble*

**Corporate ~ 777 Chrysler Drive • Burlington, WA 98233 • Phone (360) 755-1990 • Fax (360) 755-1980**  
**Regional Offices:** Olympia ~ 360.534.9777    Bellingham ~ 360.647.6111    Silverdale ~ 360.698.6787    Tukwila ~ 206.241.1974  
Visit our website: [www.mtc-inc.net](http://www.mtc-inc.net)

# Materials Testing & Consulting, Inc.

Geotechnical Engineering • Special Inspection • Materials Testing • Environmental Consulting



**Project:** 17L0370  
**Project #:** 17T001-085  
**Date Received:** December 21, 2017  
**Date Tested:** December 21, 2017

**Client:** Analytical Resources, Inc.  
**Sampled by:** Others  
**Tested by:** B. Goble

## Mass of Centrifuged Solids

Sample Identification	Mass (g)
17L0370-01	14.72
17L0370-02	42.73
17L0370-03	38.31
17L0370-04	2.32

*B. Goble*  
**Reviewed by:** \_\_\_\_\_

**Corporate ~ 777 Chrysler Drive • Burlington, WA 98233 • Phone (360) 755-1990 • Fax (360) 755-1980**  
**Regional Offices:** Olympia ~ 360.534.9777    Bellingham ~ 360.647.6111    Silverdale ~ 360.698.6787    Tukwila ~ 206.241.1974  
Visit our website: [www.mtc-inc.net](http://www.mtc-inc.net)



# Cooler Receipt Form

ARI Client: MTC/  
 COC No(s): \_\_\_\_\_ NA  
 Assigned ARI Job No: \_\_\_\_\_

Project Name: 17L0370  
 Delivered by: Fed-Ex UPS Courier Hand Delivered Other: \_\_\_\_\_  
 Tracking No: \_\_\_\_\_ NA

**Preliminary Examination Phase:**

Were intact, properly signed and dated custody seals attached to the outside of to cooler? YES NO  
 Were custody papers included with the cooler? YES NO  
 Were custody papers properly filled out (ink, signed, etc.) YES NO  
 Temperature of Cooler(s) (°C) (recommended 2.0-6.0 °C for chemistry) 5.3  
 Time: \_\_\_\_\_  
 If cooler temperature is out of compliance fill out form 00070F Temp Gun ID#: 2002565

Cooler Accepted by: BF Date: 12/21/17 Time: 1049

*Complete custody forms and attach all shipping documents*

**Log-In Phase:**

Was a temperature blank included in the cooler? YES NO  
 What kind of packing material was used? ... Bubble Wrap Wet Ice Gel Packs Baggies Foam Block Paper Other: \_\_\_\_\_  
 Was sufficient ice used (if appropriate)? NA YES NO  
 Were all bottles sealed in individual plastic bags? YES NO  
 Did all bottles arrive in good condition (unbroken)? YES NO  
 Were all bottle labels complete and legible? YES NO  
 Did the number of containers listed on COC match with the number of containers received? YES NO  
 Did all bottle labels and tags agree with custody papers? YES NO  
 Were all bottles used correct for the requested analyses? YES NO  
 Do any of the analyses (bottles) require preservation? (attach preservation sheet, excluding VOCs)... NA YES NO  
 Were all VOC vials free of air bubbles? NA YES NO  
 Was sufficient amount of sample sent in each bottle? YES NO  
 Date VOC Trip Blank was made at ARI: NA  
 Was Sample Split by ARI : NA YES Date/Time: \_\_\_\_\_ Equipment: \_\_\_\_\_ Split by: \_\_\_\_\_

Samples Logged by: BF Date: 12/21/17 Time: 1105

**\*\* Notify Project Manager of discrepancies or concerns \*\***

Sample ID on Bottle	Sample ID on COC	Sample ID on Bottle	Sample ID on COC

*Additional Notes, Discrepancies, & Resolutions:*

By: \_\_\_\_\_ Date: \_\_\_\_\_

			Small → "sm" (< 2 mm)
			Peabubbles → "pb" (2 to < 4 mm)
			Large → "lg" (4 to < 6 mm)
			Headspace → "hs" (> 6 mm)



The Boeing Company  
P.O. Box 3707 MS 1W-12  
Seattle WA, 98124

Project: Boeing Kent Sediments  
Project Number: Boeing Kent Sediments  
Project Manager: Lindsey Mahrt

Reported:  
10-Jan-2018 07:31

**ANALYTICAL REPORT FOR SAMPLES**

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
KSC-MH-20.235M-1217	17L0370-01	Solid	20-Dec-2017 12:50	20-Dec-2017 14:41
KSC-MH-20.237M-1217	17L0370-02	Solid	20-Dec-2017 12:57	20-Dec-2017 14:41
KSC-MH-15.10M-1217	17L0370-03	Solid	20-Dec-2017 13:05	20-Dec-2017 14:41
KSC-MH-16.12M-1217	17L0370-04	Solid	20-Dec-2017 14:05	20-Dec-2017 14:41
KSC-MH-20.235M-1217	17L0370-05	Water	20-Dec-2017 12:50	20-Dec-2017 14:41
KSC-MH-20.237M-1217	17L0370-06	Solid	20-Dec-2017 12:57	20-Dec-2017 14:41
KSC-MH-15.10M-1217	17L0370-07	Water	20-Dec-2017 13:05	20-Dec-2017 14:41
KSC-MH-16.12M-1217	17L0370-08	Solid	20-Dec-2017 14:05	20-Dec-2017 14:41



The Boeing Company  
P.O. Box 3707 MS 1W-12  
Seattle WA, 98124

Project: Boeing Kent Sediments  
Project Number: Boeing Kent Sediments  
Project Manager: Lindsey Mahrt

Reported:  
10-Jan-2018 07:31

## Case Narrative

### **PCB Aroclors - EPA Method SW8082A**

The sample(s) were extracted and analyzed within the recommended holding times.

Initial and continuing calibrations were within method requirements.

Internal standard areas were within limits.

The surrogate percent recoveries were within control limits.

The method blank(s) were clean at the reporting limits.

The LCS percent recoveries were within control limits.

Sample 17L0370-04 was not analyzed due to lack of sample volume.

### **Polynuclear Aromatic Hydrocarbons (PAH) - EPA Method SW8270D-SIM**

The sample(s) were extracted and analyzed within the recommended holding times.

Initial and continuing calibrations were within method requirements.

Internal standard areas were within limits.

The surrogate percent recoveries were within control limits.

The method blank(s) were clean at the reporting limits.

The LCS percent recoveries were within control limits.

Samples 17L0370-01 and 17L0370-04 were not analyzed due to lack of sample volume.

### **Diesel/Heavy Oil Range Organics - WA-Ecology Method NW-TPHDx (Ac/Si cleaned)**

The sample(s) were extracted and analyzed within the recommended holding times.

Initial and continuing calibrations were within method requirements.

The surrogate percent recoveries were within control limits.

The method blank(s) were clean at the reporting limits.





The Boeing Company  
P.O. Box 3707 MS 1W-12  
Seattle WA, 98124

Project: Boeing Kent Sediments  
Project Number: Boeing Kent Sediments  
Project Manager: Lindsey Mahrt

Reported:  
10-Jan-2018 07:31

The LCS percent recoveries were within control limits.

Samples 17L0370-01 and 17L0370-04 were not analyzed due to lack of sample volume.

**Total Metals - EPA Method 6020A and 7471B**

The sample(s) were digested and analyzed within the recommended holding times.

Initial and continuing calibrations were within method requirements.

The method blank(s) were clean at the reporting limits.

The LCS percent recoveries were within control limits.

Samples 17L0370-01 and 17L0370-04 were not analyzed due to lack of sample volume.

**Wet Chemistry**

The sample(s) were prepared and analyzed within the recommended holding times.

Initial and continuing calibrations were within method requirements.

The method blank(s) were clean at the reporting limits.

Sample 17L0370-04 was not analyzed due to lack of sample volume.



The Boeing Company  
P.O. Box 3707 MS 1W-12  
Seattle WA, 98124

Project: Boeing Kent Sediments  
Project Number: Boeing Kent Sediments  
Project Manager: Lindsey Mahrt

Reported:  
10-Jan-2018 07:31

**KSC-MH-20.235M-1217**  
**17L0370-01 (Solid)**

**Aroclor PCB**

Method: EPA 8082A  
Instrument: ECD7

Sampled: 12/20/2017 12:50  
Analyzed: 03-Jan-2018 15:24

Sample Preparation:	Preparation Method: EPA 3546 (Microwave) Preparation Batch: BFL0587 Prepared: 26-Dec-2017	Sample Size: 11.4 g (wet) Final Volume: 2 mL	Dry Weight: 1.33 g % Solids: 11.67
Sample Cleanup:	Cleanup Method: Silica Gel Cleanup Batch: CFL0178 Cleaned: 29-Dec-2017	Initial Volume: 2 mL Final Volume: 2 mL	
Sample Cleanup:	Cleanup Method: Sulfuric Acid Cleanup Batch: CFL0176 Cleaned: 29-Dec-2017	Initial Volume: 2 mL Final Volume: 2 mL	
Sample Cleanup:	Cleanup Method: Sulfur Cleanup Batch: CFL0177 Cleaned: 29-Dec-2017	Initial Volume: 2 mL Final Volume: 2 mL	

Analyte	CAS Number	Dilution	Detection Limit	Reporting Limit	Result	Units	Notes
Aroclor 1016	12674-11-2	5	60.1	150	ND	ug/kg	U
Aroclor 1221	11104-28-2	5	60.1	150	ND	ug/kg	U
Aroclor 1232	11141-16-5	5	60.1	150	ND	ug/kg	U
Aroclor 1242	53469-21-9	5	60.1	150	ND	ug/kg	U
Aroclor 1248	12672-29-6	5	376	376	ND	ug/kg	Y1, U
Aroclor 1254	11097-69-1	5	60.1	150	1480	ug/kg	D
Aroclor 1260	11096-82-5	5	69.7	150	497	ug/kg	D
<i>Surrogate: Decachlorobiphenyl</i>					40-133 %	97.4 %	
<i>Surrogate: Tetrachlorometaxylene</i>					53-120 %	84.5 %	
<i>Surrogate: Decachlorobiphenyl [2C]</i>					40-133 %	86.3 %	
<i>Surrogate: Tetrachlorometaxylene [2C]</i>					53-120 %	85.0 %	



The Boeing Company  
P.O. Box 3707 MS 1W-12  
Seattle WA, 98124

Project: Boeing Kent Sediments  
Project Number: Boeing Kent Sediments  
Project Manager: Lindsey Mahrt

Reported:  
10-Jan-2018 07:31

**KSC-MH-20.235M-1217**  
**17L0370-01 (Solid)**

**Wet Chemistry**

Method: SM 2540 G-97  
Instrument: BAL2

Sampled: 12/20/2017 12:50  
Analyzed: 21-Dec-2017 15:47

Sample Preparation: Preparation Method: No Prep Wet Chem  
Preparation Batch: BFL0549 Sample Size: 10 g (wet) Dry Weight: 1.17 g  
Prepared: 21-Dec-2017 Final Volume: 10 g % Solids: 11.67

Analyte	CAS Number	Dilution	Reporting Limit	Result	Units	Notes
Total Solids		1	0.04	<b>11.67</b>	%	



The Boeing Company  
P.O. Box 3707 MS 1W-12  
Seattle WA, 98124

Project: Boeing Kent Sediments  
Project Number: Boeing Kent Sediments  
Project Manager: Lindsey Mahrt

Reported:  
10-Jan-2018 07:31

**KSC-MH-20.237M-1217**  
**17L0370-02 (Solid)**

**Semivolatile Organic Compounds - SIM**

Method: EPA 8270D-SIM  
Instrument: NT8

Sampled: 12/20/2017 12:57  
Analyzed: 04-Jan-2018 14:46

Sample Preparation: Preparation Method: EPA 3546 (Microwave)  
Preparation Batch: BGA0035 Sample Size: 5.04 g (wet) Dry Weight: 0.37 g  
Prepared: 03-Jan-2018 Final Volume: 0.5 mL % Solids: 7.30

Sample Cleanup: Cleanup Method: Silica Gel  
Cleanup Batch: CGA0021 Initial Volume: 0.5 mL  
Cleaned: 04-Jan-2018 Final Volume: 0.5 mL

Sample Cleanup: Cleanup Method: Sulfur  
Cleanup Batch: CGA0020 Initial Volume: 0.5 mL  
Cleaned: 04-Jan-2018 Final Volume: 0.5 mL

Analyte	CAS Number	Dilution	Detection Limit	Reporting Limit	Result	Units	Notes
Naphthalene	91-20-3	1	34.7	136	179	ug/kg	
2-Methylnaphthalene	91-57-6	1	30.0	136	125	ug/kg	J
1-Methylnaphthalene	90-12-0	1	10.9	136	ND	ug/kg	U
Acenaphthylene	208-96-8	1	29.5	136	ND	ug/kg	U
Acenaphthene	83-32-9	1	15.5	136	ND	ug/kg	U
Dibenzofuran	132-64-9	1	37.5	136	78.4	ug/kg	J
Fluorene	86-73-7	1	17.2	136	ND	ug/kg	U
Phenanthrene	85-01-8	1	19.5	136	393	ug/kg	
Anthracene	120-12-7	1	23.7	136	ND	ug/kg	U
Fluoranthene	206-44-0	1	12.8	136	567	ug/kg	
Pyrene	129-00-0	1	17.0	136	723	ug/kg	
Benzo(a)anthracene	56-55-3	1	22.4	136	197	ug/kg	
Chrysene	218-01-9	1	28.6	136	591	ug/kg	
Benzo(a)fluoranthene, Total		1	81.8	272	697	ug/kg	
Benzo(a)pyrene	50-32-8	1	16.7	136	351	ug/kg	
Indeno(1,2,3-cd)pyrene	193-39-5	1	28.5	136	311	ug/kg	
Dibenzo(a,h)anthracene	53-70-3	1	24.2	136	91.1	ug/kg	J
Benzo(g,h,i)perylene	191-24-2	1	28.9	136	711	ug/kg	
Surrogate: 2-Methylnaphthalene-d10					32-120 %	49.4 %	
Surrogate: Dibenzo[a,h]anthracene-d14					21-133 %	73.3 %	
Surrogate: Fluoranthene-d10					36-134 %	64.4 %	



The Boeing Company  
P.O. Box 3707 MS 1W-12  
Seattle WA, 98124

Project: Boeing Kent Sediments  
Project Number: Boeing Kent Sediments  
Project Manager: Lindsey Mahrt

Reported:  
10-Jan-2018 07:31

**KSC-MH-20.237M-1217**  
**17L0370-02 (Solid)**

**Petroleum Hydrocarbons**

Method: NWTPH-Dx  
Instrument: FID4

Sampled: 12/20/2017 12:57  
Analyzed: 02-Jan-2018 17:02

Sample Preparation: Preparation Method: EPA 3546 (Microwave)  
Preparation Batch: BGA0007 Sample Size: 10.08 g (wet) Dry Weight: 0.74 g  
Prepared: 02-Jan-2018 Final Volume: 5 mL % Solids: 7.30

Sample Cleanup: Cleanup Method: Silica Gel  
Cleanup Batch: CGA0008 Initial Volume: 5 mL  
Cleaned: 02-Jan-2018 Final Volume: 5 mL

Sample Cleanup: Cleanup Method: Sulfuric Acid  
Cleanup Batch: CGA0007 Initial Volume: 5 mL  
Cleaned: 02-Jan-2018 Final Volume: 5 mL

Analyte	CAS Number	Dilution	Detection Limit	Reporting Limit	Result	Units	Notes
Diesel Range Organics (C12-C24) HC ID: DRO		1	159	340	<b>428</b>	mg/kg	
Motor Oil Range Organics (C24-C38) HC ID: MOTOR OIL		1	203	680	<b>2240</b>	mg/kg	
Surrogate: <i>o</i> -Terphenyl				50-150 %	86.4	%	





The Boeing Company  
P.O. Box 3707 MS 1W-12  
Seattle WA, 98124

Project: Boeing Kent Sediments  
Project Number: Boeing Kent Sediments  
Project Manager: Lindsey Mahrt

Reported:  
10-Jan-2018 07:31

**KSC-MH-20.237M-1217**  
**17L0370-02 (Solid)**

**Aroclor PCB**

Method: EPA 8082A  
Instrument: ECD7

Sampled: 12/20/2017 12:57  
Analyzed: 04-Jan-2018 03:18

Sample Preparation: Preparation Method: EPA 3546 (Microwave)  
Preparation Batch: BFL0613 Sample Size: 14.08 g (wet) Dry Weight: 1.03 g  
Prepared: 27-Dec-2017 Final Volume: 1 mL % Solids: 7.30

Sample Cleanup: Cleanup Method: Sulfuric Acid  
Cleanup Batch: CGA0003 Initial Volume: 1 mL  
Cleaned: 02-Jan-2018 Final Volume: 1 mL

Sample Cleanup: Cleanup Method: Sulfur  
Cleanup Batch: CGA0004 Initial Volume: 1 mL  
Cleaned: 02-Jan-2018 Final Volume: 1 mL

Analyte	CAS Number	Dilution	Detection Limit	Reporting Limit	Result	Units	Notes
Aroclor 1016	12674-11-2	1	7.8	19.5	ND	ug/kg	U
Aroclor 1221	11104-28-2	1	7.8	19.5	ND	ug/kg	U
Aroclor 1232	11141-16-5	1	7.8	19.5	ND	ug/kg	U
Aroclor 1242	53469-21-9	1	7.8	19.5	ND	ug/kg	U
Aroclor 1248	12672-29-6	1	7.8	19.5	<b>84.6</b>	ug/kg	
Aroclor 1254	11097-69-1	1	7.8	19.5	<b>199</b>	ug/kg	
Aroclor 1260	11096-82-5	1	9.0	19.5	<b>71.7</b>	ug/kg	
<i>Surrogate: Decachlorobiphenyl</i>					40-133 %	65.9 %	
<i>Surrogate: Tetrachlorometaxylene</i>					53-120 %	62.3 %	
<i>Surrogate: Decachlorobiphenyl [2C]</i>					40-133 %	59.6 %	
<i>Surrogate: Tetrachlorometaxylene [2C]</i>					53-120 %	60.1 %	



The Boeing Company  
P.O. Box 3707 MS 1W-12  
Seattle WA, 98124

Project: Boeing Kent Sediments  
Project Number: Boeing Kent Sediments  
Project Manager: Lindsey Mahrt

Reported:  
10-Jan-2018 07:31

**KSC-MH-20.237M-1217**  
**17L0370-02 (Solid)**

**Metals and Metallic Compounds**

Method: EPA 6020A  
Instrument: ICPMS2

Sampled: 12/20/2017 12:57  
Analyzed: 30-Dec-2017 19:57

Sample Preparation: Preparation Method: SWN EPA 3050B  
Preparation Batch: BFL0628 Sample Size: 1.005 g (wet) Dry Weight: 0.07 g  
Prepared: 29-Dec-2017 Final Volume: 50 mL % Solids: 7.30

Analyte	CAS Number	Dilution	Detection Limit	Reporting Limit	Result	Units	Notes
Arsenic	7440-38-2	20	0.41	2.73	71.1	mg/kg	
Cadmium	7440-43-9	20	0.10	1.36	3.39	mg/kg	
Chromium	7440-47-3	20	0.93	6.82	87.3	mg/kg	
Copper	7440-50-8	20	0.51	6.82	220	mg/kg	
Lead	7439-92-1	20	0.11	1.36	189	mg/kg	
Nickel	7440-02-0	20	0.23	6.82	46.5	mg/kg	
Selenium	7782-49-2	20	5.33	27.3	ND	mg/kg	U
Silver	7440-22-4	20	0.04	2.73	1.73	mg/kg	J
Zinc	7440-66-6	20	3.1	54.5	1200	mg/kg	



The Boeing Company  
P.O. Box 3707 MS 1W-12  
Seattle WA, 98124

Project: Boeing Kent Sediments  
Project Number: Boeing Kent Sediments  
Project Manager: Lindsey Mahrt

Reported:  
10-Jan-2018 07:31

**KSC-MH-20.237M-1217**  
**17L0370-02 (Solid)**

**Metals and Metallic Compounds**

Method: EPA 7471B  
Instrument: CETAC

Sampled: 12/20/2017 12:57  
Analyzed: 29-Dec-2017 17:07

Sample Preparation: Preparation Method: SMM EPA 7471B  
Preparation Batch: BFL0629 Sample Size: 0.236 g (wet) Dry Weight: 0.02 g  
Prepared: 29-Dec-2017 Final Volume: 50 mL % Solids: 7.30

Analyte	CAS Number	Dilution	Detection Limit	Reporting Limit	Result	Units	Notes
Mercury	7439-97-6	1	0.0244	0.290	<b>0.435</b>	mg/kg	



The Boeing Company  
P.O. Box 3707 MS 1W-12  
Seattle WA, 98124

Project: Boeing Kent Sediments  
Project Number: Boeing Kent Sediments  
Project Manager: Lindsey Mahrt

**Reported:**  
10-Jan-2018 07:31

**KSC-MH-20.237M-1217**  
**17L0370-02 (Solid)**

**Wet Chemistry**

Method: SM 2540 G-97  
Instrument: BAL2

Sampled: 12/20/2017 12:57  
Analyzed: 26-Dec-2017 16:34

Sample Preparation: Preparation Method: Plumb 1981  
Preparation Batch: BFL0601 Sample Size: 10 g (wet) Dry Weight: 0.73 g  
Prepared: 26-Dec-2017 Final Volume: 10 g % Solids: 7.30

Analyte	CAS Number	Dilution	Reporting Limit	Result	Units	Notes
Total Solids		1	0.04	<b>7.30</b>	%	



The Boeing Company  
P.O. Box 3707 MS 1W-12  
Seattle WA, 98124

Project: Boeing Kent Sediments  
Project Number: Boeing Kent Sediments  
Project Manager: Lindsey Mahrt

Reported:  
10-Jan-2018 07:31

**KSC-MH-15.10M-1217**  
**17L0370-03 (Solid)**

**Semivolatile Organic Compounds - SIM**

Method: EPA 8270D-SIM  
Instrument: NT8

Sampled: 12/20/2017 13:05  
Analyzed: 04-Jan-2018 15:12

Sample Preparation:	Preparation Method: EPA 3546 (Microwave) Preparation Batch: BGA0035 Prepared: 03-Jan-2018	Sample Size: 10.08 g (wet) Final Volume: 2.5 mL	Dry Weight: 1.73 g % Solids: 17.18
Sample Cleanup:	Cleanup Method: Silica Gel Cleanup Batch: CGA0021 Cleaned: 04-Jan-2018	Initial Volume: 0.5 mL Final Volume: 0.5 mL	
Sample Cleanup:	Cleanup Method: Sulfur Cleanup Batch: CGA0020 Cleaned: 04-Jan-2018	Initial Volume: 0.5 mL Final Volume: 0.5 mL	

Analyte	CAS Number	Dilution	Detection Limit	Reporting Limit	Result	Units	Notes
Naphthalene	91-20-3	1	36.8	144	141	ug/kg	J
2-Methylnaphthalene	91-57-6	1	31.9	144	76.2	ug/kg	J
1-Methylnaphthalene	90-12-0	1	11.6	144	ND	ug/kg	U
Acenaphthylene	208-96-8	1	31.3	144	ND	ug/kg	U
Acenaphthene	83-32-9	1	16.5	144	ND	ug/kg	U
Dibenzofuran	132-64-9	1	39.8	144	ND	ug/kg	U
Fluorene	86-73-7	1	18.2	144	ND	ug/kg	U
Phenanthrene	85-01-8	1	20.7	144	412	ug/kg	
Anthracene	120-12-7	1	25.2	144	ND	ug/kg	U
Fluoranthene	206-44-0	1	13.6	144	557	ug/kg	
Pyrene	129-00-0	1	18.1	144	809	ug/kg	
Benzo(a)anthracene	56-55-3	1	23.8	144	158	ug/kg	
Chrysene	218-01-9	1	30.4	144	432	ug/kg	
Benzo(a)fluoranthene, Total		1	86.9	289	497	ug/kg	
Benzo(a)pyrene	50-32-8	1	17.7	144	214	ug/kg	
Indeno(1,2,3-cd)pyrene	193-39-5	1	30.3	144	250	ug/kg	
Dibenzo(a,h)anthracene	53-70-3	1	25.7	144	ND	ug/kg	U
Benzo(g,h,i)perylene	191-24-2	1	30.8	144	618	ug/kg	
<i>Surrogate: 2-Methylnaphthalene-d10</i>					32-120 %	47.6 %	
<i>Surrogate: Dibenzo[a,h]anthracene-d14</i>					21-133 %	70.7 %	
<i>Surrogate: Fluoranthene-d10</i>					36-134 %	56.5 %	



The Boeing Company  
P.O. Box 3707 MS 1W-12  
Seattle WA, 98124

Project: Boeing Kent Sediments  
Project Number: Boeing Kent Sediments  
Project Manager: Lindsey Mahrt

Reported:  
10-Jan-2018 07:31

**KSC-MH-15.10M-1217**  
**17L0370-03 (Solid)**

**Petroleum Hydrocarbons**

Method: NWTPH-Dx  
Instrument: FID4

Sampled: 12/20/2017 13:05  
Analyzed: 02-Jan-2018 17:22

Sample Preparation:	Preparation Method: EPA 3546 (Microwave) Preparation Batch: BGA0007 Prepared: 02-Jan-2018	Sample Size: 10.06 g (wet) Final Volume: 5 mL	Dry Weight: 1.73 g % Solids: 17.18
Sample Cleanup:	Cleanup Method: Silica Gel Cleanup Batch: CGA0008 Cleaned: 02-Jan-2018	Initial Volume: 5 mL Final Volume: 5 mL	
Sample Cleanup:	Cleanup Method: Sulfuric Acid Cleanup Batch: CGA0007 Cleaned: 02-Jan-2018	Initial Volume: 5 mL Final Volume: 5 mL	

Analyte	CAS Number	Dilution	Detection Limit	Reporting Limit	Result	Units	Notes
Diesel Range Organics (C12-C24) HC ID: DRO		1	67.7	145	534	mg/kg	
Motor Oil Range Organics (C24-C38) HC ID: MOTOR OIL		1	86.5	289	2570	mg/kg	
Surrogate: <i>o</i> -Terphenyl				50-150 %	90.4	%	





The Boeing Company  
P.O. Box 3707 MS 1W-12  
Seattle WA, 98124

Project: Boeing Kent Sediments  
Project Number: Boeing Kent Sediments  
Project Manager: Lindsey Mahrt

Reported:  
10-Jan-2018 07:31

**KSC-MH-15.10M-1217**  
**17L0370-03 (Solid)**

**Aroclor PCB**

Method: EPA 8082A  
Instrument: ECD7

Sampled: 12/20/2017 13:05  
Analyzed: 04-Jan-2018 03:40

Sample Preparation: Preparation Method: EPA 3546 (Microwave)  
Preparation Batch: BFL0613 Sample Size: 6.01 g (wet) Dry Weight: 1.03 g  
Prepared: 27-Dec-2017 Final Volume: 1 mL % Solids: 17.18

Sample Cleanup: Cleanup Method: Sulfuric Acid  
Cleanup Batch: CGA0003 Initial Volume: 1 mL  
Cleaned: 02-Jan-2018 Final Volume: 1 mL

Sample Cleanup: Cleanup Method: Sulfur  
Cleanup Batch: CGA0004 Initial Volume: 1 mL  
Cleaned: 02-Jan-2018 Final Volume: 1 mL

Analyte	CAS Number	Dilution	Detection Limit	Reporting Limit	Result	Units	Notes
Aroclor 1016	12674-11-2	1	7.7	19.4	ND	ug/kg	U
Aroclor 1221	11104-28-2	1	7.7	19.4	ND	ug/kg	U
Aroclor 1232	11141-16-5	1	7.7	19.4	ND	ug/kg	U
Aroclor 1242	53469-21-9	1	7.7	19.4	ND	ug/kg	U
Aroclor 1248	12672-29-6	1	48.4	48.4	ND	ug/kg	Y1, U
Aroclor 1254	11097-69-1	1	7.7	19.4	<b>126</b>	ug/kg	
Aroclor 1260	11096-82-5	1	9.0	19.4	<b>80.8</b>	ug/kg	P1
<i>Surrogate: Decachlorobiphenyl</i>					<i>40-133 %</i>	<i>77.4 %</i>	
<i>Surrogate: Tetrachlorometaxylene</i>					<i>53-120 %</i>	<i>57.0 %</i>	
<i>Surrogate: Decachlorobiphenyl [2C]</i>					<i>40-133 %</i>	<i>55.0 %</i>	
<i>Surrogate: Tetrachlorometaxylene [2C]</i>					<i>53-120 %</i>	<i>56.0 %</i>	



The Boeing Company  
P.O. Box 3707 MS 1W-12  
Seattle WA, 98124

Project: Boeing Kent Sediments  
Project Number: Boeing Kent Sediments  
Project Manager: Lindsey Mahrt

Reported:  
10-Jan-2018 07:31

**KSC-MH-15.10M-1217**  
**17L0370-03 (Solid)**

**Metals and Metallic Compounds**

Method: EPA 6020A  
Instrument: ICPMS2

Sampled: 12/20/2017 13:05  
Analyzed: 30-Dec-2017 20:02

Sample Preparation: Preparation Method: SWN EPA 3050B  
Preparation Batch: BFL0628 Sample Size: 1.024 g (wet) Dry Weight: 0.18 g  
Prepared: 29-Dec-2017 Final Volume: 50 mL % Solids: 17.18

Analyte	CAS Number	Dilution	Detection Limit	Reporting Limit	Result	Units	Notes
Arsenic	7440-38-2	20	0.17	1.14	<b>20.2</b>	mg/kg	
Cadmium	7440-43-9	20	0.04	0.57	<b>2.40</b>	mg/kg	
Chromium	7440-47-3	20	0.39	2.84	<b>58.7</b>	mg/kg	
Copper	7440-50-8	20	0.21	2.84	<b>157</b>	mg/kg	
Lead	7439-92-1	20	0.05	0.57	<b>93.4</b>	mg/kg	
Nickel	7440-02-0	20	0.10	2.84	<b>44.6</b>	mg/kg	
Selenium	7782-49-2	20	2.22	11.4	ND	mg/kg	U
Silver	7440-22-4	20	0.02	1.14	<b>0.67</b>	mg/kg	J
Zinc	7440-66-6	20	1.3	22.7	<b>1390</b>	mg/kg	



The Boeing Company  
P.O. Box 3707 MS 1W-12  
Seattle WA, 98124

Project: Boeing Kent Sediments  
Project Number: Boeing Kent Sediments  
Project Manager: Lindsey Mahrt

**Reported:**  
10-Jan-2018 07:31

**KSC-MH-15.10M-1217**  
**17L0370-03 (Solid)**

**Metals and Metallic Compounds**

Method: EPA 7471B  
Instrument: CETAC

Sampled: 12/20/2017 13:05  
Analyzed: 29-Dec-2017 17:09

Sample Preparation: Preparation Method: SMM EPA 7471B  
Preparation Batch: BFL0629 Sample Size: 0.228 g (wet) Dry Weight: 0.04 g  
Prepared: 29-Dec-2017 Final Volume: 50 mL % Solids: 17.18

Analyte	CAS Number	Dilution	Detection Limit	Reporting Limit	Result	Units	Notes
Mercury	7439-97-6	1	0.0107	0.128	<b>0.217</b>	mg/kg	



The Boeing Company  
P.O. Box 3707 MS 1W-12  
Seattle WA, 98124

Project: Boeing Kent Sediments  
Project Number: Boeing Kent Sediments  
Project Manager: Lindsey Mahrt

Reported:  
10-Jan-2018 07:31

**KSC-MH-15.10M-1217**  
**17L0370-03 (Solid)**

**Wet Chemistry**

Method: SM 2540 G-97  
Instrument: BAL2

Sampled: 12/20/2017 13:05  
Analyzed: 26-Dec-2017 16:34

Sample Preparation: Preparation Method: Plumb 1981  
Preparation Batch: BFL0601 Sample Size: 10 g (wet) Dry Weight: 1.72 g  
Prepared: 26-Dec-2017 Final Volume: 10 g % Solids: 17.18

Analyte	CAS Number	Dilution	Reporting Limit	Result	Units	Notes
Total Solids		1	0.04	<b>17.18</b>	%	



The Boeing Company  
P.O. Box 3707 MS 1W-12  
Seattle WA, 98124

Project: Boeing Kent Sediments  
Project Number: Boeing Kent Sediments  
Project Manager: Lindsey Mahrt

Reported:  
10-Jan-2018 07:31

Semivolatile Organic Compounds - SIM - Quality Control

Batch BGA0035 - EPA 3546 (Microwave)

Instrument: NT8 Analyst: JZ

QC Sample/Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
<b>Blank (BGA0035-BLK1)</b>											
						Prepared: 03-Jan-2018 Analyzed: 04-Jan-2018 13:52					
Naphthalene	ND	1.28	5.00	ug/kg							U
2-Methylnaphthalene	ND	1.10	5.00	ug/kg							U
1-Methylnaphthalene	ND	0.40	5.00	ug/kg							U
Acenaphthylene	ND	1.08	5.00	ug/kg							U
Acenaphthene	ND	0.57	5.00	ug/kg							U
Dibenzofuran	ND	1.38	5.00	ug/kg							U
Fluorene	ND	0.63	5.00	ug/kg							U
Phenanthrene	ND	0.72	5.00	ug/kg							U
Anthracene	ND	0.87	5.00	ug/kg							U
Fluoranthene	ND	0.47	5.00	ug/kg							U
Pyrene	ND	0.63	5.00	ug/kg							U
Benzo(a)anthracene	ND	0.82	5.00	ug/kg							U
Chrysene	ND	1.05	5.00	ug/kg							U
Benzo(a)anthracenes, Total	ND	3.01	10.0	ug/kg							U
Benzo(a)pyrene	ND	0.61	5.00	ug/kg							U
Indeno(1,2,3-cd)pyrene	ND	1.05	5.00	ug/kg							U
Dibenzo(a,h)anthracene	ND	0.89	5.00	ug/kg							U
Benzo(g,h,i)perylene	ND	1.07	5.00	ug/kg							U
Surrogate: 2-Methylnaphthalene-d10	71.3			ug/kg	150		47.5	32-120			
Surrogate: Dibenzo[a,h]anthracene-d14	104			ug/kg	150		69.1	21-133			
Surrogate: Fluoranthene-d10	99.2			ug/kg	150		66.1	36-134			

LCS (BGA0035-BS1)

Prepared: 03-Jan-2018 Analyzed: 04-Jan-2018 14:19

Naphthalene	77.7	1.28	5.00	ug/kg	150		51.8	36-120			
2-Methylnaphthalene	77.4	1.10	5.00	ug/kg	150		51.6	35-120			
1-Methylnaphthalene	75.2	0.40	5.00	ug/kg	150		50.2	39-120			
Acenaphthylene	75.0	1.08	5.00	ug/kg	150		50.0	35-120			
Acenaphthene	79.2	0.57	5.00	ug/kg	150		52.8	39-120			
Dibenzofuran	83.6	1.38	5.00	ug/kg	150		55.7	38-120			
Fluorene	90.9	0.63	5.00	ug/kg	150		60.6	41-120			
Phenanthrene	102	0.72	5.00	ug/kg	150		68.0	46-120			
Anthracene	93.0	0.87	5.00	ug/kg	150		62.0	36-120			
Fluoranthene	110	0.47	5.00	ug/kg	150		73.5	46-120			
Pyrene	111	0.63	5.00	ug/kg	150		73.8	49-120			
Benzo(a)anthracene	112	0.82	5.00	ug/kg	150		74.4	42-120			



The Boeing Company  
P.O. Box 3707 MS 1W-12  
Seattle WA, 98124

Project: Boeing Kent Sediments  
Project Number: Boeing Kent Sediments  
Project Manager: Lindsey Mahrt

Reported:  
10-Jan-2018 07:31

Semivolatile Organic Compounds - SIM - Quality Control

Batch BGA0035 - EPA 3546 (Microwave)

Instrument: NT8 Analyst: JZ

QC Sample/Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
<b>LCS (BGA0035-BS1)</b>						Prepared: 03-Jan-2018 Analyzed: 04-Jan-2018 14:19					
Chrysene	114	1.05	5.00	ug/kg	150		75.8	48-120			
Benzo(a)fluoranthenes, Total	326	3.01	10.0	ug/kg	450		72.4	46-120			
Benzo(a)pyrene	95.7	0.61	5.00	ug/kg	150		63.8	36-120			
Indeno(1,2,3-cd)pyrene	119	1.05	5.00	ug/kg	150		79.2	40-120			
Dibenzo(a,h)anthracene	121	0.89	5.00	ug/kg	150		80.7	38-120			
Benzo(g,h,i)perylene	121	1.07	5.00	ug/kg	150		80.6	38-120			
Surrogate: 2-Methylnaphthalene-d10	68.7			ug/kg	150		45.8	32-120			
Surrogate: Dibenzo[a,h]anthracene-d14	106			ug/kg	150		70.8	21-133			
Surrogate: Fluoranthene-d10	96.3			ug/kg	150		64.2	36-134			





The Boeing Company  
P.O. Box 3707 MS 1W-12  
Seattle WA, 98124

Project: Boeing Kent Sediments  
Project Number: Boeing Kent Sediments  
Project Manager: Lindsey Mahrt

Reported:  
10-Jan-2018 07:31

**Petroleum Hydrocarbons - Quality Control**

**Batch BGA0007 - EPA 3546 (Microwave)**

Instrument: FID4 Analyst: ML

QC Sample/Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
<b>Blank (BGA0007-BLK1)</b>						Prepared: 02-Jan-2018 Analyzed: 02-Jan-2018 16:22					
Diesel Range Organics (C12-C24)	ND	2.34	5.00	mg/kg							U
Motor Oil Range Organics (C24-C38)	ND	2.99	10.0	mg/kg							U
Surrogate: <i>o</i> -Terphenyl	20.7			mg/kg	22.5		91.9	50-150			
<b>LCS (BGA0007-BS1)</b>						Prepared: 02-Jan-2018 Analyzed: 02-Jan-2018 16:42					
Diesel Range Organics (C12-C24)	141	2.34	5.00	mg/kg	150		94.0	63-120			
Surrogate: <i>o</i> -Terphenyl	21.4			mg/kg	22.5		95.1	50-150			



The Boeing Company  
P.O. Box 3707 MS 1W-12  
Seattle WA, 98124

Project: Boeing Kent Sediments  
Project Number: Boeing Kent Sediments  
Project Manager: Lindsey Mahrt

Reported:  
10-Jan-2018 07:31

**Aroclor PCB - Quality Control**

**Batch BFL0587 - EPA 3546 (Microwave)**

Instrument: ECD7 Analyst: JR

QC Sample/Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
<b>Blank (BFL0587-BLK1)</b>											
						Prepared: 26-Dec-2017 Analyzed: 03-Jan-2018 14:17					
Aroclor 1016	ND	8.0	20.0	ug/kg							U
Aroclor 1221	ND	8.0	20.0	ug/kg							U
Aroclor 1232	ND	8.0	20.0	ug/kg							U
Aroclor 1242	ND	8.0	20.0	ug/kg							U
Aroclor 1248	ND	8.0	20.0	ug/kg							U
Aroclor 1254	ND	8.0	20.0	ug/kg							U
Aroclor 1260	ND	9.3	20.0	ug/kg							U
Surrogate: Decachlorobiphenyl	34.8			ug/kg	40.0		86.9	40-133			
Surrogate: Tetrachlorometaxylene	29.5			ug/kg	40.0		73.8	53-120			
Surrogate: Decachlorobiphenyl [2C]	32.6			ug/kg	40.0		81.6	40-133			
Surrogate: Tetrachlorometaxylene [2C]	28.0			ug/kg	40.0		70.0	53-120			
<b>LCS (BFL0587-BS1)</b>											
						Prepared: 26-Dec-2017 Analyzed: 03-Jan-2018 14:39					
Aroclor 1016	454	8.0	20.0	ug/kg	500		90.7	52-120			
Aroclor 1260	488	9.3	20.0	ug/kg	500		97.6	57-120			
Surrogate: Decachlorobiphenyl	36.0			ug/kg	40.0		89.9	40-133			
Surrogate: Tetrachlorometaxylene	31.1			ug/kg	40.0		77.6	53-120			
Surrogate: Decachlorobiphenyl [2C]	34.7			ug/kg	40.0		86.7	40-133			
Surrogate: Tetrachlorometaxylene [2C]	30.2			ug/kg	40.0		75.6	53-120			
<b>LCS Dup (BFL0587-BSD1)</b>											
						Prepared: 26-Dec-2017 Analyzed: 03-Jan-2018 15:01					
Aroclor 1016	450	8.0	20.0	ug/kg	500		90.0	52-120	0.81	30	
Aroclor 1260	465	9.3	20.0	ug/kg	500		93.1	57-120	4.75	30	
Surrogate: Decachlorobiphenyl	33.9			ug/kg	40.0		84.7	40-133			
Surrogate: Tetrachlorometaxylene	30.9			ug/kg	40.0		77.2	53-120			
Surrogate: Decachlorobiphenyl [2C]	32.4			ug/kg	40.0		81.1	40-133			
Surrogate: Tetrachlorometaxylene [2C]	29.6			ug/kg	40.0		74.1	53-120			



The Boeing Company  
P.O. Box 3707 MS 1W-12  
Seattle WA, 98124

Project: Boeing Kent Sediments  
Project Number: Boeing Kent Sediments  
Project Manager: Lindsey Mahrt

Reported:  
10-Jan-2018 07:31

**Aroclor PCB - Quality Control**

**Batch BFL0613 - EPA 3546 (Microwave)**

Instrument: ECD7 Analyst: JR

QC Sample/Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
<b>Blank (BFL0613-BLK1)</b>											
						Prepared: 27-Dec-2017 Analyzed: 03-Jan-2018 20:59					
Aroclor 1016	ND	8.0	20.0	ug/kg							U
Aroclor 1221	ND	8.0	20.0	ug/kg							U
Aroclor 1232	ND	8.0	20.0	ug/kg							U
Aroclor 1242	ND	8.0	20.0	ug/kg							U
Aroclor 1248	ND	8.0	20.0	ug/kg							U
Aroclor 1254	ND	8.0	20.0	ug/kg							U
Aroclor 1260	ND	9.3	20.0	ug/kg							U
<i>Surrogate: Decachlorobiphenyl</i>	35.9			ug/kg	40.0		89.7	40-133			
<i>Surrogate: Tetrachlorometaxylene</i>	35.9			ug/kg	40.0		89.8	53-120			
<i>Surrogate: Decachlorobiphenyl [2C]</i>	34.5			ug/kg	40.0		86.3	40-133			
<i>Surrogate: Tetrachlorometaxylene [2C]</i>	35.0			ug/kg	40.0		87.4	53-120			
<b>LCS (BFL0613-BS1)</b>											
						Prepared: 27-Dec-2017 Analyzed: 03-Jan-2018 21:21					
Aroclor 1016	461	8.0	20.0	ug/kg	500		92.2	52-120			
Aroclor 1260	480	9.3	20.0	ug/kg	500		95.9	57-120			
<i>Surrogate: Decachlorobiphenyl</i>	36.1			ug/kg	40.0		90.2	40-133			
<i>Surrogate: Tetrachlorometaxylene</i>	35.4			ug/kg	40.0		88.6	53-120			
<i>Surrogate: Decachlorobiphenyl [2C]</i>	34.3			ug/kg	40.0		85.7	40-133			
<i>Surrogate: Tetrachlorometaxylene [2C]</i>	34.6			ug/kg	40.0		86.5	53-120			



The Boeing Company  
P.O. Box 3707 MS 1W-12  
Seattle WA, 98124

Project: Boeing Kent Sediments  
Project Number: Boeing Kent Sediments  
Project Manager: Lindsey Mahrt

Reported:  
10-Jan-2018 07:31

**Metals and Metallic Compounds - Quality Control**

**Batch BFL0628 - SWN EPA 3050B**

Instrument: ICPMS2 Analyst: TCH

QC Sample/Analyte	Isotope	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
<b>Blank (BFL0628-BLK1)</b>												
						Prepared: 29-Dec-2017 Analyzed: 30-Dec-2017 18:51						
Arsenic	75a	ND	0.03	0.20	mg/kg							U
Cadmium	111	ND	0.007	0.10	mg/kg							U
Cadmium	114	ND	0.005	0.10	mg/kg							U
Chromium	52	ND	0.07	0.50	mg/kg							U
Chromium	53	ND	0.04	0.50	mg/kg							U
Copper	63	0.06	0.04	0.50	mg/kg							J
Copper	65	0.06	0.03	0.50	mg/kg							J
Lead	208	ND	0.008	0.10	mg/kg							U
Nickel	60	ND	0.02	0.50	mg/kg							U
Nickel	62	ND	0.27	0.50	mg/kg							U
Selenium	78	ND	0.39	2.00	mg/kg							U
Silver	107	ND	0.003	0.20	mg/kg							U
Zinc	66	2.4	0.3	4.0	mg/kg							J
Zinc	67	2.4	0.2	4.0	mg/kg							J

<b>LCS (BFL0628-BS1)</b>												
						Prepared: 29-Dec-2017 Analyzed: 30-Dec-2017 19:34						
Arsenic	75a	24.1	0.03	0.20	mg/kg	25.0		96.4	80-120			
Cadmium	111	23.9	0.007	0.10	mg/kg	25.0		95.4	80-120			
Cadmium	114	24.6	0.005	0.10	mg/kg	25.0		98.3	80-120			
Chromium	52	24.6	0.07	0.50	mg/kg	25.0		98.4	80-120			
Chromium	53	24.9	0.04	0.50	mg/kg	25.0		99.4	80-120			
Copper	63	25.5	0.04	0.50	mg/kg	25.0		102	80-120			
Copper	65	26.2	0.03	0.50	mg/kg	25.0		105	80-120			
Lead	208	21.2	0.008	0.10	mg/kg	25.0		84.6	80-120			
Nickel	60	25.3	0.02	0.50	mg/kg	25.0		101	80-120			
Nickel	62	24.8	0.27	0.50	mg/kg	25.0		99.3	80-120			
Selenium	78	77.4	0.39	2.00	mg/kg	80.0		96.7	80-120			
Silver	107	25.5	0.003	0.20	mg/kg	25.0		102	80-120			
Zinc	66	80.6	0.3	4.0	mg/kg	80.0		101	80-120			
Zinc	67	76.1	0.2	4.0	mg/kg	80.0		95.2	80-120			



The Boeing Company P.O. Box 3707 MS 1W-12 Seattle WA, 98124	Project: Boeing Kent Sediments Project Number: Boeing Kent Sediments Project Manager: Lindsey Mahrt	Reported: 10-Jan-2018 07:31
---	---	--------------------------------

**Metals and Metallic Compounds - Quality Control**

**Batch BFL0629 - SMM EPA 7471B**

Instrument: CETAC Analyst: MCB

QC Sample/Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
<b>Blank (BFL0629-BLK1)</b>						Prepared: 29-Dec-2017 Analyzed: 29-Dec-2017 16:27					
Mercury	ND	0.00210	0.0250	mg/kg							U
<b>LCS (BFL0629-BS1)</b>						Prepared: 29-Dec-2017 Analyzed: 29-Dec-2017 16:29					
Mercury	0.550	0.00210	0.0250	mg/kg	0.500		110	80-120			



The Boeing Company  
P.O. Box 3707 MS 1W-12  
Seattle WA, 98124

Project: Boeing Kent Sediments  
Project Number: Boeing Kent Sediments  
Project Manager: Lindsey Mahrt

**Reported:**  
10-Jan-2018 07:31

**Wet Chemistry - Quality Control**

**Batch BFL0549 - No Prep Wet Chem**

Instrument: BAL2 Analyst: UW

QC Sample/Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
<b>Blank (BFL0549-BLK1)</b>					Prepared: 21-Dec-2017 Analyzed: 21-Dec-2017 15:47					
Total Solids	ND	0.04	%							U





The Boeing Company  
P.O. Box 3707 MS 1W-12  
Seattle WA, 98124

Project: Boeing Kent Sediments  
Project Number: Boeing Kent Sediments  
Project Manager: Lindsey Mahrt

**Reported:**  
10-Jan-2018 07:31

**Wet Chemistry - Quality Control**

**Batch BFL0601 - Plumb 1981**

Instrument: APOLLO1 Analyst: CDE

QC Sample/Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
<b>Blank (BFL0601-BLK1)</b>					Prepared: 26-Dec-2017 Analyzed: 26-Dec-2017 16:34					
Total Solids	ND	0.04	%							U



The Boeing Company  
P.O. Box 3707 MS 1W-12  
Seattle WA, 98124

Project: Boeing Kent Sediments  
Project Number: Boeing Kent Sediments  
Project Manager: Lindsey Mahrt

Reported:  
10-Jan-2018 07:31

**Certified Analyses included in this Report**

Analyte	Certifications
<b>EPA 6020A in Solid</b>	
Silver-107	NELAP,DoD-ELAP,WADOE
Arsenic-75a	NELAP,ADEC,DoD-ELAP,WADOE
Arsenic-75b	ADEC,DoD-ELAP,WADOE
Cadmium-111	NELAP,DoD-ELAP,WADOE,ADEC
Cadmium-114	NELAP,DoD-ELAP,WADOE,ADEC
Chromium-52	NELAP,DoD-ELAP,WADOE,ADEC
Chromium-53	NELAP,DoD-ELAP,WADOE,ADEC
Copper-63	NELAP,DoD-ELAP,WADOE
Copper-65	NELAP,DoD-ELAP,WADOE
Nickel-60	NELAP,DoD-ELAP,WADOE,ADEC
Nickel-62	NELAP,DoD-ELAP,WADOE,ADEC
Lead-208	NELAP,DoD-ELAP,WADOE,ADEC
Selenium-82	NELAP,DoD-ELAP,WADOE
Selenium-78	NELAP,DoD-ELAP,WADOE
Zinc-66	NELAP,DoD-ELAP,WADOE
Zinc-67	NELAP,DoD-ELAP,WADOE
<b>EPA 7471B in Solid</b>	
Mercury	WADOE,NELAP,DoD-ELAP,CALAP
<b>EPA 8082A in Solid</b>	
Aroclor 1016	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Aroclor 1016 [2C]	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Aroclor 1221	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Aroclor 1221 [2C]	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Aroclor 1232	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Aroclor 1232 [2C]	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Aroclor 1242	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Aroclor 1242 [2C]	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Aroclor 1248	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Aroclor 1248 [2C]	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Aroclor 1254	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Aroclor 1254 [2C]	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Aroclor 1260	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Aroclor 1260 [2C]	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Aroclor 1262	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Aroclor 1262 [2C]	WADOE,DoD-ELAP,NELAP,CALAP,ADEC



The Boeing Company  
P.O. Box 3707 MS 1W-12  
Seattle WA, 98124

Project: Boeing Kent Sediments  
Project Number: Boeing Kent Sediments  
Project Manager: Lindsey Mahrt

Reported:  
10-Jan-2018 07:31

Aroclor 1268

WADOE,DoD-ELAP,NELAP,CALAP,ADEC

Aroclor 1268 [2C]

WADOE,DoD-ELAP,NELAP,CALAP,ADEC

**EPA 8270D-SIM in Solid**

Naphthalene

ADEC,DoD-ELAP,NELAP,WADOE

2-Methylnaphthalene

ADEC,DoD-ELAP,NELAP

1-Methylnaphthalene

ADEC,DoD-ELAP,NELAP,WADOE

Biphenyl

ADEC,DoD-ELAP,NELAP

2,6-Dimethylnaphthalene

ADEC,WADOE

Acenaphthylene

ADEC,DoD-ELAP,NELAP,WADOE

Acenaphthene

ADEC,DoD-ELAP,NELAP,WADOE

Dibenzofuran

ADEC,DoD-ELAP,NELAP

Fluorene

ADEC,DoD-ELAP,NELAP,WADOE

Phenanthrene

ADEC,DoD-ELAP,NELAP,WADOE

Anthracene

ADEC,DoD-ELAP,NELAP,WADOE

Carbazole

ADEC,DoD-ELAP,NELAP

1-Methylphenanthrene

ADEC

Fluoranthene

ADEC,DoD-ELAP,NELAP,WADOE

Pyrene

ADEC,DoD-ELAP,NELAP,WADOE

Benzo(a)anthracene

ADEC,DoD-ELAP,NELAP,WADOE

Chrysene

ADEC,DoD-ELAP,NELAP,WADOE

Benzo(b)fluoranthene

ADEC,DoD-ELAP,NELAP,WADOE

Benzo(k)fluoranthene

ADEC,DoD-ELAP,NELAP,WADOE

Benzo(j)fluoranthene

ADEC,DoD-ELAP,NELAP,WADOE

Benzo(e)pyrene

ADEC,NELAP

Benzo(a)pyrene

ADEC,DoD-ELAP,NELAP,WADOE

Perylene

ADEC,NELAP

Indeno(1,2,3-cd)pyrene

ADEC,DoD-ELAP,NELAP,WADOE

Dibenzo(a,h)anthracene

ADEC,DoD-ELAP

Benzo(g,h,i)perylene

ADEC,DoD-ELAP,NELAP,WADOE

**NWTPH-Dx in Solid**

Diesel Range Organics (C12-C24)

DoD-ELAP,NELAP,WADOE

Diesel Range Organics (C10-C25)

DoD-ELAP,NELAP,WADOE

Diesel Range Organics (Tol-C18)

DoD-ELAP,NELAP,WADOE

Diesel Range Organics (C10-24)

DoD-ELAP,NELAP,WADOE

Diesel Range Organics (C10-C28)

DoD-ELAP,NELAP,WADOE

Motor Oil Range Organics (C24-C38)

DoD-ELAP,NELAP,WADOE

Motor Oil Range Organics (C25-C36)

DoD-ELAP,NELAP,WADOE

Motor Oil Range Organics (C24-C40)

DoD-ELAP,NELAP,WADOE

Mineral Oil Range Organics (C16-C28)

DoD-ELAP,NELAP,WADOE



The Boeing Company  
P.O. Box 3707 MS 1W-12  
Seattle WA, 98124

Project: Boeing Kent Sediments  
Project Number: Boeing Kent Sediments  
Project Manager: Lindsey Mahrt

**Reported:**  
10-Jan-2018 07:31

Mineral Spirits Range Organics (Tol-C12)	DoD-ELAP,NELAP,WADOE
JP8 Range Organics (C8-C18)	DoD-ELAP,NELAP,WADOE
JP5 Range Organics (C10-C16)	DoD-ELAP,NELAP,WADOE
JP4 Range Organics (Tol-C14)	DoD-ELAP,NELAP,WADOE
Jet-A Range Organics (C10-C18)	DoD-ELAP,NELAP,WADOE
Kerosene Range Organics (Tol-C18)	DoD-ELAP,NELAP,WADOE
Stoddard Range Organics (C8-C12)	DoD-ELAP,NELAP,WADOE
Creosote Range Organics (C12-C22)	DoD-ELAP,NELAP,WADOE
Bunker C Range Organics (C10-C38)	DoD-ELAP,NELAP,WADOE
Transformer Oil Range Organics (C12-C28)	DoD-ELAP,NELAP,WADOE

Code	Description	Number	Expires
ADEC	Alaska Dept of Environmental Conservation	UST-033	05/11/2018
CALAP	California Department of Public Health CAELAP	2748	02/28/2018
DoD-ELAP	DoD-Environmental Laboratory Accreditation Program	66169	02/07/2019
NELAP	ORELAP - Oregon Laboratory Accreditation Program	WA100006	05/11/2018
WADOE	WA Dept of Ecology	C558	06/30/2018
WA-DW	Ecology - Drinking Water	C558	06/30/2018



The Boeing Company  
P.O. Box 3707 MS 1W-12  
Seattle WA, 98124

Project: Boeing Kent Sediments  
Project Number: Boeing Kent Sediments  
Project Manager: Lindsey Mahrt

**Reported:**  
10-Jan-2018 07:31

### Notes and Definitions

- Y1      Raised reporting limit due to interference
- U      This analyte is not detected above the applicable reporting or detection limit.
- P1      The reported value is greater than 40% difference between the concentrations determined on two GC columns where applicable.
- NRS     This surrogate not reported due to chromatographic interference
- J      Estimated concentration value detected below the reporting limit.
- D      The reported value is from a dilution
- DET     Analyte DETECTED
- ND     Analyte NOT DETECTED at or above the reporting limit
- NR     Not Reported
- dry     Sample results reported on a dry weight basis
- RPD     Relative Percent Difference
- [2C]    Indicates this result was quantified on the second column on a dual column analysis.



## **DATA VALIDATION REPORT**

### **BOEING KENT SPACE CENTER SEDIMENT TRAP SAMPLING**

**Prepared for:**

Dalton Olmsted & Fuglevand  
10827 NE 68<sup>th</sup> Street  
Suite B  
Kirkland, Washington 98033

**Prepared by:**

EcoChem, Inc.  
500 Union Street, Suite 1010  
Seattle, Washington 98101

EcoChem Project: C8105-1

February 1, 2018

**Approved for Release:**

A handwritten signature in black ink that reads "Christina Mott Frans".

---

Christina Mott Frans  
Senior Project Manager  
EcoChem, Inc.



## PROJECT NARRATIVE

### *Basis for the Data Validation*

This report summarizes the results of the summary validation (Stage 2A) performed on sediment trap samples and the associated laboratory and field quality control samples for the Boeing Kent Space Center. A complete list of samples is provided in the **Sample Index**.

Samples were analyzed by Analytical Resources, Incorporated, Tukwila, Washington. The analytical method and EcoChem project chemists are listed in the following table:

ANALYSIS	METHOD OF ANALYSIS	PRIMARY REVIEW	SECONDARY REVIEW
Polynuclear Aromatic Hydrocarbon Compounds (PAH)	SW8270D-SIM	E. Clayton	C. Frans
PCB Aroclors	SW8082A		
Total Petroleum Hydrocarbons – Diesel & Residual Range	NWTPH-Dx		
Total Metals and Mercury	SW6020A & SW7471A		
Total Solids	SM2540G0		

The data were reviewed using guidance and quality control criteria documented in the analytical methods; the sampling and analysis plan (SAP) for the *Remedial Investigation Work Plan Boeing Kent Space Center Facility, Ecology Review Draft* (Landau Associates, July 29, 2016); *USEPA National Functional Guidelines for Organic Data Review* (EPA, 1999 & 2008); and *USEPA National Functional Guidelines for Inorganic Data Review* (EPA, 2010 & 2014).

EcoChem's goal in assigning data assessment qualifiers is to assist in proper data interpretation. If values are estimated (J or UJ), data may be used for site evaluation and risk assessment purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. If values are assigned an R, the data are to be rejected and should not be used for any site evaluation purposes. If values have no data qualifier assigned, then the data meet the data quality objectives as stated in the documents and methods referenced above.

Data qualifier definitions, reason codes, and validation criteria are included as **Appendix A**. A Qualified Data Summary Table is included in **Appendix B**. Data Validation Worksheets will be kept on file at EcoChem, Inc. A qualified laboratory electronic data deliverable (EDD) is also submitted with this report.

**Sample Index**  
**Boeing Kent Space Center**

<b>SDG</b>	<b>Sample ID</b>	<b>Lab Sample ID</b>	<b>NWTPH-Dx</b>	<b>PAHs</b>	<b>PCB</b>	<b>Total Metals</b>	<b>Total Solids</b>
17L0370	KSC-MH-20.235M-1217	17L0370-01			✓		✓
	KSC-MH-20.237M-1217	17L0370-02	✓	✓	✓	✓	✓
	KSC-MH-15.10M-1217	17L0370-03	✓	✓	✓	✓	✓

**DATA VALIDATION REPORT**  
**DOF – Boeing Kent Space Center**  
**Polynuclear Aromatic Hydrocarbons - Method SW8270D-SIM**

This report documents the review of analytical data from the analyses of suspended solids samples and the associated laboratory quality control (QC) samples. Samples were analyzed by Analytical Resources, Incorporated, Tukwila, Washington. Refer to the Sample Index for a complete list of samples.

SDG	NUMBER OF SAMPLES	VALIDATION LEVEL
17L0370	3 Sediment Trap Samples	Stage 2A

**DATA PACKAGE COMPLETENESS**

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

**EDD TO HARDCOPY VERIFICATION**

All sample IDs and results reported in the electronic data deliverable (EDD) were verified (10% verification) by comparing the EDD to the laboratory data package.

**TECHNICAL DATA VALIDATION**

The QC requirements that were reviewed are listed below.

1	Sample Receipt, Preservation, and Holding Times	1	Matrix Spikes/Matrix Spike Duplicates (MS/MSD)
✓	Laboratory Blanks	1	Field Duplicates
1	Field Blanks	✓	Target Analyte List
✓	Surrogate Compounds	✓	Reporting Limits
✓	Laboratory Control Samples (LCS)	✓	Reported Results

✓ *Stated method quality objectives (MQO) and QC criteria have been met. No outliers are noted or discussed.*  
 1 *Quality control outliers are discussed below, but no data were qualified.*  
 2 *Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.*

**Sample Receipt, Preservation, and Holding Times**

As stated in validation guidance documents, sample shipping coolers should arrive at the laboratory within the advisory temperature range of 0°C-6°C and be extracted within 14 days for solid samples and extracts must be analyzed within 40 days of extraction. The samples were subcontracted to Materials Testing & Consulting, Inc. for separation of solids by means of centrifuging according to modified Corps of Engineers draft interim guidelines. The resulting solids were analyzed by Analytical Resources incorporated. The samples arrived at both laboratories within the advisory temperature range.

Samples KSC-MH-20.235M-1217 and KSC-MH-16.12M-1217 were submitted, but had insufficient volume for analysis.

### **Field Blanks**

Field blanks were not submitted with this data set.

### **Matrix Spike/Matrix Spike Duplicate**

No matrix spikes were analyzed with this analytical batch. The laboratory did not perform a laboratory control sample duplicate; no measure of precision was available for evaluation.

### **Field Duplicates**

Field duplicates were not submitted with this data set.

### **Target Analyte List**

All target analytes as specified in the QAPP/SAP were reported.

### **Reporting Limits**

The target analyte reporting limits specified in the QAPP/SAP were met.

### **Reported Results**

No anomalies were noted during validation for evaluated results.

### **OVERALL ASSESSMENT**

As determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable as demonstrated by the surrogate and laboratory control sample (LCS) recovery values. No measure of precision was available for evaluation.

No data were qualified for any reason.

All data, as reported, are acceptable for use.

**DATA VALIDATION REPORT**  
**DOF – Boeing Kent Space Center**  
**Polychlorinated Biphenyl Compounds - Method SW8082A**

This report documents the review of analytical data from the analyses of suspended solids samples and the associated laboratory quality control (QC) samples. Samples were analyzed by Analytical Resources, Incorporated, Tukwila, Washington. Refer to the **Sample Index** for a complete list of samples.

SDG	NUMBER OF SAMPLES	VALIDATION LEVEL
17L0370	3 Sediment Trap Samples	Stage 2A

**DATA PACKAGE COMPLETENESS**

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

**EDD TO HARDCOPY VERIFICATION**

All sample IDs and results reported in the electronic data deliverable (EDD) were verified (10% verification) by comparing the EDD to the laboratory data package.

**TECHNICAL DATA VALIDATION**

The QC requirements that were reviewed are listed below.

1	Sample Preservation and Holding Times	1	Field Duplicates
✓	Laboratory Blanks	✓	Target Analyte List
1	Field Blanks	2	Reporting Limits
✓	Surrogate Compounds	2	Compound Identification
✓	Laboratory Control Samples (LCS)	1	Reported Results
1	Matrix Spikes/Matrix Spike Duplicates		

*✓ Stated method quality objectives (MQO) and QC criteria have been met. No outliers are noted or discussed*

*1 Quality control outliers are discussed below, but no data were qualified.*

*2 Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.*

**Sample Receipt, Preservation, and Holding Times**

As stated in validation guidance documents, sample shipping coolers should arrive at the laboratory within the advisory temperature range of 0°C-6°C and be extracted within 14 days for solid samples and extracts must be analyzed within 40 days of extraction. The samples were subcontracted to

Materials Testing & Consulting, Inc. for separation of solids by means of centrifuging according to modified Corps of Engineers draft interim guidelines. The resulting solids were analyzed by Analytical Resources incorporated. The samples arrived at both laboratories within the advisory temperature range.

Samples KSC-MH-16.12M-1217 were submitted, but had insufficient volume for analysis.

### **Field Blanks**

No field blanks were submitted with this sampling event.

### **Matrix Spikes/Matrix Spike Duplicates**

No matrix spikes were analyzed with this analytical batch. The laboratory did not perform a laboratory control sample duplicate; therefore, no measure of precision was available for evaluation.

### **Field Duplicates**

No field duplicates were submitted with this sampling event.

### **Target Analyte List**

All target analytes as specified in the QAPP/SAP were reported.

### **Reporting Limits**

The target analyte reporting limits specified in the QAPP/SAP were not met due to required dilutions.

The chromatograms for Samples KSC-MH-20.235M-1217 and KSC-MH-15.10M-1217 indicated non-target background interference for Aroclor 1248. The RL for these analytes were flagged "Y" by the laboratory. These "Y" flagged results have been qualified (U-22) to indicate that the results were not detected at an elevated RL.

### **Compound Identification**

As required by the method, the laboratory analyzed any samples with positive detections on a confirmatory column. The results from the two analytical columns were compared for agreement. An elevated RPD value may indicate the presence of an interference resulting in a high bias. When the RPD value was greater than 40% but less than 60% the reported value was estimated (J-3). If the RPD value was greater than 60%, the result was qualified as a tentative identification (NJ-3). Confirmation outliers resulting in data qualification are discussed below.

The case narrative indicated that the second column confirmation percent difference (%D) value was greater than 40% for Aroclor 1260 in Sample KSC-MH-15.10M-1217. The data package only reported a concentration value from one column and the %D value was not indicated in the case narrative or data sheet. A determination of the magnitude of difference could not be determined. This result was qualified as estimated (J-3).

### **Reported Results**

Reporting limits for Sample KSC-MH-20.235M-1217 were elevated due to matrix interference.

### **OVERALL ASSESSMENT**

As determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable, as demonstrated by the surrogate and laboratory control sample/laboratory control sample duplicate (LCS/LCSD) percent recovery values. Precision was also acceptable as demonstrated by the LCS/LCSD RPD values.

One result was estimated because confirmation criteria were not met. Reporting limits were elevated due to non-target background interference.

All data, as qualified, are acceptable for use.

**DATA VALIDATION REPORT**  
**DOF – Boeing Kent Space Center**  
**Diesel Range Organics (DRO) - Method NWTPH-Dx**

This report documents the review of analytical data from the analyses of suspended solids samples and the associated field and laboratory quality control (QC) samples. Samples were analyzed by Analytical Resources, Incorporated, Tukwila, Washington. Refer to the **Sample Index** for a complete list of samples.

SDG	NUMBER OF SAMPLES	VALIDATION LEVEL
17L0370	2 sediment trap samples	Stage 2A

**DATA PACKAGE COMPLETENESS**

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

**EDD TO HARDCOPY VERIFICATION**

All sample IDs and results reported in the electronic data deliverable (EDD) were verified (10% verification) by comparing the EDD to the laboratory data package.

**TECHNICAL DATA VALIDATION**

The QC requirements that were reviewed are listed below.

1	Sample Preservation and Holding Times	1	Matrix Spikes/Matrix Spike Duplicates
✓	Laboratory Blanks	2	Field Duplicates
1	Field Blanks	✓	Target Analyte List
✓	Surrogate Compounds	✓	Reporting Limits
✓	Laboratory Control Samples (LCS)	1	Reported Results

✓ *Stated method quality objectives (MQO) and QC criteria have been met. No outliers are noted or discussed*

1 *Quality control outliers are discussed below, but no data were qualified.*

2 *Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.*

**Sample Receipt, Preservation, and Holding Times**

As stated in validation guidance documents, sample shipping coolers should arrive at the laboratory within the advisory temperature range of 0°C-6°C and be extracted within 14 days for solid samples and extracts must be analyzed within 40 days of extraction. The samples were subcontracted to Materials Testing & Consulting, Inc. for separation of solids by means of centrifuging according to



modified Corps of Engineers draft interim guidelines. The resulting solids were analyzed by Analytical Resources incorporated. The samples arrived at both laboratories within the advisory temperature range.

Samples KSC-MH-20.235M-1217 and KSC-MH-16.12M-1217 were submitted, but had insufficient volume for analysis.

### **Field Blanks**

No field blanks were submitted with this sampling event.

### **Matrix Spike/Matrix Spike Duplicate**

Matrix spikes were not performed for this SDG. The laboratory did not perform a laboratory control sample duplicate; no measure of precision was available for evaluation.

### **Field Duplicates**

Field duplicates were not submitted with this data set.

### **Target Analyte List**

All target analytes as specified in the QAPP/SAP were reported.

### **Reporting Limits**

The target analyte reporting limits specified in the QAPP/SAP were met.

### **Reported Results**

No anomalies were noted during validation for evaluated results.

### **OVERALL ASSESSMENT**

As determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable, as demonstrated by the surrogate and laboratory control sample (LCS) percent recovery values. No measure of precision was available for evaluation.

No data were qualified for any reason.

All data, as reported, are acceptable for use.

**DATA VALIDATION REPORT**  
**DOF – Boeing Kent Space Center**  
**Total Mercury – EPA Method 7471B**  
**Total Metals – EPA Method 6020A**

This report documents the review of analytical data from the analyses of suspended solids samples and the associated field and laboratory quality control (QC) samples. Samples were analyzed by Analytical Resources, Incorporated, Tukwila, Washington. Refer to the **Sample Index** for a complete list of samples.

SDG	NUMBER OF SAMPLES AND MATRIX	VALIDATION LEVEL
17L0370	2 Sediment Trap Samples	Stage 2A

**DATA PACKAGE COMPLETENESS**

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

**EDD TO HARDCOPY VERIFICATION**

All sample IDs and results reported in the electronic data deliverable (EDD) were verified (10% verification) by comparing the EDD to the laboratory data package.

**TECHNICAL DATA VALIDATION**

The QC requirements that were reviewed are listed below.

1	Sample Receipt, Preservation, and Holding Times	1	Laboratory Duplicates
1	Laboratory Blanks	1	Field Duplicates
✓	Laboratory Control Samples (LCS)	✓	Target Analyte List
1	Matrix Spikes (MS)	1	Reporting Limits
1	Field Blanks	✓	Reported Results

✓ *Stated method quality objectives (MQO) and QC criteria have been met. No outliers are noted or discussed.*  
 1 *Quality control outliers are discussed below, but no data were qualified.*  
 2 *Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.*

**Sample Receipt, Preservation, and Holding Times**

As stated in validation guidance documents, sample shipping coolers should arrive at the laboratory within the advisory temperature range of 0°C-6°C and be analyzed within 180 days for solid ICP-MS metals samples and within 28 days for mercury samples. The samples were subcontracted to Materials Testing & Consulting, Inc. for separation of solids by means of centrifuging according to modified Corps of Engineers draft interim guidelines. The resulting solids were analyzed by Analytical Resources incorporated. The samples arrived at both laboratories within the advisory temperature range.

Samples KSC-MH-20.235M-1217 and KSC-MH-16.12M-1217 were submitted, but had insufficient volume for analysis.

### **Method Blanks**

To assess the impact of any blank contaminant on the reported sample results, an action level is established at five times (5x) the concentration reported in the blank. If a contaminant is reported in an associated field sample and the concentration is less than the action level, the result is qualified as not detected (U-7). No action is taken if the sample result is greater than the action level, or for non-detected results. For laboratory blanks that are less than the negative MDL, positive results less than the action level of five times the absolute value of the blank concentration are estimated (J-7L) and non-detects are estimated (UJ-7L) to indicate a potential low bias.

Laboratory blanks were analyzed at the appropriate frequency. Contaminant levels, associated samples, and action levels are documented in the data validation worksheets.

Copper and zinc were detected in the method blank. All associated samples results were greater than the 5x action level; no data were qualified.

### **Matrix Spikes**

No matrix spike/matrix spike duplicate (MS/MSD) samples were analyzed. Precision could not be assessed.

### **Field Blanks**

Field blanks were not submitted with this data set.

### **Laboratory Duplicates**

No laboratory duplicate samples were analyzed. Precision could not be assessed.

### **Field Duplicates**

No field duplicates were submitted.

### **Target Analyte List**

All target analytes as specified in the QAPP/SAP were reported.

### **Reporting Limits**

Reporting limits were elevated for both samples due to required dilutions.

### **Reported Results**

No anomalies were noted during validation for evaluated results.

## **OVERALL ASSESSMENT**

As determined by this evaluation, the laboratory followed the specified analytical methods. Accuracy was acceptable, as demonstrated by the laboratory control sample (LCS) recovery values. Precision could not be assessed.

No data were qualified for any reason.

All data, as reported, are acceptable for use.

**DATA VALIDATION REPORT**  
**DOF – Boeing Kent Space Center**  
**Total Solids by SM 2540G**

This report documents the review of analytical data from the analyses of suspended solids samples and the associated field and laboratory quality control (QC) samples. Samples were analyzed by Analytical Resources, Incorporated, Tukwila, Washington. Refer to the **Sample Index** for a complete list of samples.

SDG	NUMBER OF SAMPLES AND MATRIX	VALIDATION LEVEL
17L0370	3 Sediment Trap Samples	Stage 2A

**DATA PACKAGE COMPLETENESS**

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

**EDD TO HARDCOPY VERIFICATION**

All sample IDs and results reported in the electronic data deliverable (EDD) were verified (10% verification) by comparing the EDD to the laboratory data package.

**TECHNICAL DATA VALIDATION**

The QC requirements that were reviewed are listed below.

1	Sample Receipt, Preservation, and Holding Times	1	Field Duplicates
✓	Laboratory Blanks	✓	Target Analyte List
1	Field Blanks	✓	Reporting Limits
1	Laboratory Duplicates	✓	Reported Results

*✓ Stated method quality objectives (MQO) and QC criteria have been met. No outliers are noted or discussed.*

*1 Quality control outliers are discussed below, but no data were qualified.*

*2 Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.*

**Sample Receipt, Preservation, and Holding Times**

As stated in validation guidance documents, sample shipping coolers should arrive at the laboratory within the advisory temperature range of 0°C-6°C. Sediment samples must be analyzed within 7 days for total solids. The samples were subcontracted to Materials Testing & Consulting, Inc. for separation of solids by means of centrifuging according to modified Corps of Engineers draft interim guidelines. The resulting solids were analyzed by Analytical Resources incorporated. The samples arrived at both laboratories within the advisory temperature range.

Sample KSC-MH-16.12M-1217 was submitted, but had insufficient volume for analysis.

**Field Blanks**

Field blanks were not submitted with this data set.

**Laboratory Duplicates**

Laboratory duplicates were not performed. Precision could not be assessed.

**Field Duplicates**

Field blanks were not submitted with this data set.

**Target Analyte List**

All target analytes as specified in the QAPP/SAP were reported.

**Reporting Limits**

The target analyte reporting limits specified in the QAPP/SAP were met.

**Reported Results**

No anomalies were noted during validation for evaluated results.

**OVERALL ASSESSMENT**

As determined by this evaluation, the laboratory followed the specified analytical method. Precision was not assessed.

No data were qualified for any reason.

All data, as reported, are acceptable for use.



**ECO-CHEM**  
Data Quality

**APPENDIX A**

**DATA QUALIFIER DEFINITIONS**

**REASON CODES**

**AND CRITERIA TABLES**

## **DATA VALIDATION QUALIFIER CODES**

### **Based on National Functional Guidelines**

The following definitions provide brief explanations of the qualifiers assigned to results in the data review process.

---

U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
J	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
NJ	The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents the approximate concentration.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
R	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

The following is an EcoChem qualifier that may also be assigned during the data review process:

DNR	Do not report; a more appropriate result is reported from another analysis or dilution.
-----	---

---



## DATA QUALIFIER REASON CODES

Group	Code	Reason for Qualification
Sample Handling	1	Improper Sample Handling or Sample Preservation (i.e., headspace, cooler temperature, pH, summa canister pressure); Exceeded Holding Times
Instrument Performance	24	Instrument Performance (i.e., tune, resolution, retention time window, endrin breakdown, lock-mass)
	5A	Initial Calibration (RF, %RSD, $r^2$ )
	5B	Calibration Verification (CCV, CCAL; RF, %D, %R) Use bias flags (H,L) <sup>1</sup> where appropriate
	5C	Initial Calibration Verification (ICV %D, %R) Use bias flags (H,L) <sup>1</sup> where appropriate
Blank Contamination	6	Field Blank Contamination (Equipment Rinsate, Trip Blank, etc.)
	7	Lab Blank Contamination (i.e., method blank, instrument blank, etc.) Use low bias flag (L) <sup>1</sup> for negative instrument blanks
Precision and Accuracy	8	Matrix Spike (MS and/or MSD) Recoveries Use bias flags (H,L) <sup>1</sup> where appropriate
	9	Precision (all replicates: LCS/LCSD, MS/MSD, Lab Replicate, Field Replicate)
	10	Laboratory Control Sample Recoveries (a.k.a. Blank Spikes) Use bias flags (H,L) <sup>1</sup> where appropriate
	12	Reference Material Use bias flags (H,L) <sup>1</sup> where appropriate
	13	Surrogate Spike Recoveries (a.k.a. labeled compounds, recovery standards) Use bias flags (H,L) <sup>1</sup> where appropriate
Interferences	16	ICP/ICP-MS Serial Dilution Percent Difference
	17	ICP/ICP-MS Interference Check Standard Recovery Use bias flags (H,L) <sup>1</sup> where appropriate
	19	Internal Standard Performance (i.e., area, retention time, recovery)
	22	Elevated Detection Limit due to Interference (i.e., chemical and/or matrix)
	23	Bias from Matrix Interference (i.e. diphenyl ether, PCB/pesticides)
Identification and Quantitation	2	Chromatographic pattern in sample does not match pattern of calibration standard
	3	2 <sup>nd</sup> column confirmation (RPD or %D)
	4	Tentatively Identified Compound (TIC) (associated with NJ only)
	20	Calibration Range or Linear Range Exceeded
	25	Compound Identification (i.e., ion ratio, retention time, relative abundance, etc.)
Miscellaneous	11	A more appropriate result is reported (multiple reported analyses i.e., dilutions, re-extractions, etc. Associated with "R" and "DNR" only)
	14	Other (See DV report for details)
	26	Method QC information not provided

<sup>1</sup>H = high bias indicated

L = low bias indicated

DATA VALIDATION CRITERIA

**Semivolatile Organic Compounds by Gas Chromatography-Mass Spectroscopy (GC-MS)**  
 (Based on NFG 1999 & 2008 and SW-846 Method 8270D)

QC Element	Acceptance Criteria	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
<b>Sample Handling</b>					
Cooler/Storage Temperature Preservation	4°C±2°C sediment/tissues may require storage at -20°C	NFG <sup>(1)</sup> Method <sup>(3)</sup>	<b>If required by project:</b> J (pos)/UJ (ND) if greater than 6° C	1	Use <b>PJ</b> for temp outliers; see <b>TM20</b> Current SW846 criterion is ≤ 6° C <sup>(3)</sup>
Holding Time	<b>Extraction Aqueous:</b> 7 days from collection <b>Extraction Solid:</b> 14 days from collection <b>Analysis (all matrices):</b> 40 days from extraction Holding time may be extended to 1 year for frozen sediments/tissues	NFG <sup>(1)</sup> Method <sup>(3)</sup>	J (pos)/UJ (ND) if HT exceeded J (pos)/R (ND) if gross exceedance (> 2x HT)	1	Gross exceedance = > 2x HT, as per 1999 NFG
<b>Instrument Performance</b>					
Tuning	DFTPP Beginning of each 12 hour period Use method or project acceptance criteria	NFG <sup>(1)</sup> Method <sup>(3)</sup>	R (pos/ND) all analytes in all samples associated with the tune	24	
Initial Calibration <b>Sensitivity</b>	RRF ≥ 0.05 except: RRF ≥ 0.01 poor responders *	NFG <sup>(1)</sup> Method <sup>(3)</sup>	Use <b>PJ</b> to qualify J (pos)/UJ (ND)	5A	<b>TM-06</b> EcoChem Policy for the Evaluation and Qualification of GCMS Instrument Performance <b>PJ</b> - no action if response is stable (ICAL RSD and CCAL %D acceptable)
Initial Calibration <b>Stability</b>	Minimum 5 standards %RSD ≤ 20.0% except: %RSD ≤ 40.0% poor responders * <b>or</b> co-efficient of determination (r <sup>2</sup> ) > 0.99	NFG <sup>(1)</sup> Method <sup>(3)</sup>	J (pos) if %RSD > limit <b>or</b> r <sup>2</sup> value <0.99	5A	
Initial Calibration Verification Check	Prepared from second source; analyze after each ICAL Percent recovery limits = 70-130%	Method <sup>(3)</sup>	J (pos) %R > UCL J (pos)/UJ (ND) %R < LCL	5A (H,L) <sup>4</sup>	QAPP may have overriding accuracy limits.

DATA VALIDATION CRITERIA

Table: NFG-SVOC-GCMS  
 Revision No.: 8  
 Last Rev. Date: 01/29/2015  
 Page: 2 of 4

**Semivolatile Organic Compounds by Gas Chromatography-Mass Spectroscopy (GC-MS)**  
 (Based on NFG 1999 & 2008 and SW-846 Method 8270D)

QC Element	Acceptance Criteria	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
<b>Instrument Performance (continued)</b>					
Continuing Calibration <b>Sensitivity</b>	RRF $\geq$ 0.05 except: RRF $\geq$ 0.01 poor responders *	NFG <sup>(1)</sup> Method <sup>(3)</sup>	Use <b>PJ</b> to qualify J (pos)/UJ (ND)	5B	see ICAL RRF guidance
Continuing Calibration <b>Stability</b>	Prior to sample analysis and every 12 hours %D $\leq$ 25% except: %D $\leq$ 40.0% poor responders *	NFG <sup>(1)</sup> Method <sup>(3)</sup>	J (pos) - %D > control limit (high bias) J (pos)/UJ (ND) - %D < -control limit (low bias)	5B (H,L) <sup>4</sup>	
<b>Blank Contamination</b>					
Method Blank (MB)	MB: One per matrix per batch of (of $\leq$ 20 samples) No detected compounds > MDL	NFG <sup>(2)</sup> Method <sup>(3)</sup>	U(pos) if result is < 5X or 10X action level	7	10X action level applies to phthalates only. 5X for all other target analytes  <b>Hierarchy of blank review:</b> <b>#1 - Review MB, qualify as needed</b> <b>#2 - Review FB , qualify as needed</b>  <b>Note: Actions as per 1999 NFG</b>
	No TICs present		R (pos) TICs using 10X rule	7	
Field Blank (FB)	No detected compounds > MDL	NFG <sup>(2)</sup> Method <sup>(3)</sup>	U (pos) if result is < 5X or 10X action level	6	
<b>Precision and Accuracy</b>					
LCS/LCSD (recovery)	One per matrix per batch (of $\leq$ 20 samples) LCSD not required by NFG or method Use method acceptance criteria/laboratory limits	Method <sup>(3)</sup>	J (pos) if %R > UCL J (pos)/UJ (ND) if %R < LCL J (pos)/R (ND)%R < 10%	10 (H,L) <sup>4</sup>	No action if only one spike %R is outside criteria when LCSD is analyzed, unless one recovery is <10%.  QAPP may have overriding accuracy limits. Qualify all associated samples.
LCS/LCSD (RPD)	If LCSD analyzed RPD < lab limits	Method <sup>(3)</sup>	J (pos)	9	Qualify all associated samples. QAPP may have overriding precision limits.

DATA VALIDATION CRITERIA

**Semivolatile Organic Compounds by Gas Chromatography-Mass Spectroscopy (GC-MS)**  
 (Based on NFG 1999 & 2008 and SW-846 Method 8270D)

QC Element	Acceptance Criteria	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
<b>Precision and Accuracy (continued)</b>					
Reference Material (RM, SRM, or CRM)	Result $\pm$ 20% of the 95% confidence interval of the true value for analytes	EcoChem standard policy	J (pos)/UJ (ND) if < LCL J (pos) if > UCL	12 (H,L) <sup>4</sup>	QAPP may have overriding accuracy limits. Some manufacturers have different RM control limits
MS/MSD (recovery)	One per matrix per batch (of $\leq$ 20 samples) Use method acceptance criteria/laboratory limits	NFG <sup>(1)</sup> Method <sup>(3)</sup>	J (pos) %R > UCL J (pos)/UJ (ND) if both %R < LCL J (pos)/R (ND) if both %R < 10% J (pos)/UJ (ND) if one > UCL & one < LCL, with no bias	8 (H,L) <sup>4</sup>	No action if only one spike %R is outside criteria. No action if parent concentration is >4x the amount spiked. Qualify parent sample only.
MS/MSD (RPD)	One per matrix per batch (of $\leq$ 20 samples) Use method acceptance criteria/laboratory limits	NFG <sup>(1)</sup> Method <sup>(2)</sup>	J (pos) in parent sample if RPD > CL	9	Qualify parent sample only
Surrogates	Minimum of 3 acid & 3 base/neutral (B/N) compounds added to all samples Within method control limits	NFG <sup>(1)</sup> Method <sup>(3)</sup>	J (pos) if %R > UCL J (pos)/UJ (ND) if %R < LCL J (pos)/R (ND) if %R < 10%	13 (H,L) <sup>4</sup>	Qualify all compounds in associated fraction. Do not qualify if only 1 acid and/or 1 B/N surrogate is out, unless <10%. If 1 surrogate outlier < 10% then J (pos)/R (ND)
Internal Standards	Added to all samples Acceptable Range: IS area 50% to 200% of CCAL area RT within 30 seconds of CC RT	NFG <sup>(1)</sup> Method <sup>(3)</sup>	J (pos) if > 200% J (pos)/UJ (ND) if < 50% J (pos)/R (ND) if < 25% if RT >30 seconds use <b>PJ</b>	19	Qualify compounds quantified using particular internal standard
Field Duplicates	<b>Solids:</b> RPD < 50% OR difference < 2X RL (for results < 5X RL) <b>Aqueous:</b> RPD < 35% OR difference < 1X RL (for results < 5X RL)	EcoChem standard policy	J (pos)/UJ (ND) Qualify only parent and field duplicate samples	9	Use project limits if specified

DATA VALIDATION CRITERIA

**Semivolatile Organic Compounds by Gas Chromatography-Mass Spectroscopy (GC-MS)**  
 (Based on NFG 1999 & 2008 and SW-846 Method 8270D)

QC Element	Acceptance Criteria	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
<b>Compound Identification and Quantitation and Calculation</b>					
Retention times and relative ion intensities	RRT within 0.06 of standard RRT Ion relative intensity within 20% of standard All ions in std. at > 10% intensity must be present in sample	NFG <sup>(1)</sup> Method <sup>(3)</sup>	U (pos) if identification criteria not met	25	
TICs	Major ions (>10%) in reference must be present in sample; intensities agree within 20%; check identification	NFG <sup>(1)</sup> Method <sup>(3)</sup>	NJ the TIC unless: R (pos) common laboratory contaminants	4	
Calibration Range	Results greater than highest calibration standard	EcoChem standard policy	Qualify J (pos)	20	If result from dilution analysis is not reported.
Dilutions, Re-extractions and/or Reanalyses	Report only one result per analyte	EcoChem standard policy	Use "DNR" to flag results that will not be reported.	11	<b>TM-04</b> EcoChem Policy for Rejection/Selection Process for Multiple Results

<sup>1</sup> National Functional Guidelines for Organic Data Review, June, 2008

(pos): Positive Result(s)

<sup>2</sup> National Functional Guidelines for Organic Data Review, October, 1999

(ND): Non-detects

<sup>3</sup> Method SW846 8270D Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS), Revision 4, February 2007.

<sup>4</sup> NFG 2013 suggests using "+ / -" to indicate bias; EcoChem has chosen "H" = high bias indicated; "L" = low bias indicated.

\* "Poor responder" compounds: acetophenone, atrazine, benzaldehyde, 1,1'-biphenyl, bis(2-ethylhexyl)phthalate, butylbenzylphthalate, caprolactam, carbazole, 4-chloroaniline, diethylphthalate, di-n-butylphthalate, 3-3'-dichlorobenzidine, dimethylphthalate, 2,4-dinitrophenol, 4,6-dinitro-2-methylphenol, di-n-octylphthalate, hexachlorobutadiene, hexachlorocyclopentadiene, 2-nitroaniline, 3-nitroaniline, 4-nitroaniline, 4-nitrophenol, N-nitrosodiphenylamine, 2,2'-oxybis-(1-chloropropane), 1,2,4,5-tetrachlorobenzene use a 0.010 RRF criterion.

**PCB Aroclors by GC**  
**(Based on Organic NFG 2008 and SW-846 Method 8082A)**

QC Element	Acceptance Criteria (NFG)	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
<b>Sample</b>					
Cooler/Storage Temperature Preservation	4°C ± 2°C Tissue/sediments (may be frozen -20°C)	NFG <sup>(1)</sup> Method <sup>(2)</sup>	<b>If required by project:</b> J (pos)/UJ (ND) if greater than 6° C	1	Use Professional Judgment (PJ) to qualify for temperature outlier. Current SW846 criterion is ≤ 6° C <sup>(3)</sup>
Holding Time	<b>Extraction Aqueous:</b> 7 days from collection <b>Extraction Solid:</b> 14 days from collection <b>Extraction Tissue/Sediment (frozen):</b> 1 year <b>Analysis (all matrices):</b> 40 days from extraction	NFG <sup>(1)</sup> Method <sup>(2)</sup>	<b>If required by project:</b> J (pos)/UJ (ND) if ext/analyzed > HT J (pos)/R (ND) if gross exceedance (> 2x HT)	1	Use PJ to qualify for holding time outlier. <b>Current SW846 does not have an extraction holding time limit.</b> <sup>(3)</sup> Gross exceedance > 2x HT, as per NFG 1999
<b>Instrument Performance</b>					
Retention Times	Surrogates: TCMX (± 0.05); DCB (± 0.10) Aroclors (± 0.07)	NFG <sup>(1)</sup>	NJ (pos)/R (ND) results for analytes with RT shifts	24	
Initial Calibration	Minimum 5 point with RSD ≤ 20% OR correlation coefficient (r-value) ≥ 0.995 OR Minimum 6-point with co-efficient of determination (r <sup>2</sup> -value) ≥ 0.99	NFG <sup>(1)</sup> Method <sup>(4)</sup>	J (pos) if %RSD greater than 20% OR r-value < 0.995 OR r <sup>2</sup> -value < 0.99	5A	Refer to TM-01 for additional information. Use bias flags (H,L) <sup>(5)</sup> where appropriate
Initial Calibration Verification (ICV)	No NFG criteria. Project specific.	Project	J (pos) if > UCL J (pos)/UJ (ND) if < LCL	5B	Use bias flags (H,L) where appropriate
Continuing Calibration (Prior to each 12 hr. shift)	%D ± 20%	Method <sup>(2)</sup>	If > 20% (high bias): J (pos) If < 20% (low bias): J (pos)/UJ (ND)	5B	Refer to TM-01 for additional information. Use bias flags (H,L) where appropriate
<b>Blank Contamination</b>					
Method Blank (MB)	MB: One per matrix per batch of (of ≤ 20 samples) No detected compounds > RL	NFG <sup>(1)</sup> Method <sup>(2)</sup>	U (pos) if result is less than appropriate 5X action level.	7	<b>Hierarchy of blank review:</b> <b>#1 - Review MB and IB, qualify as needed</b> <b>#2 - Review FB , qualify as needed</b>  Note: Actions as per NFG 1999  Note: IB not required by method
Field Blank (FB)	FB: frequency as per QAPP No detected compounds > RL	NFG <sup>(1)</sup> Method <sup>(2)</sup>	U (pos) if result is less than appropriate 5X action level.	6	
Instrument Blanks (IB)	Analyzed at the beginning and end of every 12 hour sequence No analyte > CRQL	NFG <sup>(1)</sup>	U (pos) if result is less than appropriate 5X action level.	7	

**PCB Aroclors by GC**  
**(Based on Organic NFG 2008 and SW-846 Method 8082A)**

QC Element	Acceptance Criteria (NFG)	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
<b>Precision and Accuracy</b>					
MS/MSD (recovery)	One set per matrix per batch (of ≤ 20 samples) AR1016 and AR1260: %R = 29% - 135%, or project limits	NFG <sup>(1)</sup> Method <sup>(2)</sup>	Qualify parent only unless other QC indicates systematic problems. J (pos) if both %R > upper control limit (UCL) J (pos)/UJ (ND) if both %R < lower control limit (LCL) J (pos)/R (ND) if both %R < 10%	8	No action if only one spike %R is outside criteria. No action if native analyte conc. > 5x the amount spiked. Use bias flags (H,L) where appropriate. Actions apply to all Aroclors in parent sample.
MS/MSD (RPD)	One set per matrix per batch (of ≤ 20 samples) AR1016: RPD < 15%, AR1260: RPD < 20% or project limits	NFG <sup>(1)</sup> Method <sup>(2)</sup>	Qualify parent only unless other QC indicates systematic problems. J (pos) if RPD > control limit	9	No action if parent is ND.
LCS	One per lab batch (of ≤ 20 samples) AR1016 and AR1260: %R = 50% - 150%, or project limits	NFG <sup>(1)</sup>	J (pos) if %R > UCL J (pos)/UJ (ND) if %R < LCL J (pos)/R (ND) if %R < 10%	10	Use bias flags (H,L) where appropriate. Actions apply to all Aroclors in associated samples.
LCS/LCSD (RPD)	if analyzed use MS/MSD RPD criteria	NFG <sup>(1)</sup>	J (pos) assoc. compound in all samples	9	LCSD not required by method or NFG
<b>Precision and Accuracy</b>					
Surrogates	TCMX and DCBP added to every sample %R = 30% - 150% or project limits	NFG <sup>(1)</sup> Method <sup>(2)</sup>	J (pos) if either %R > UCL J (pos)/UJ (ND) if either %R < LCL J (pos)/R (ND) if either %R < 10%	13	If %R < 10% (sample dilution is a factor), use PJ Use bias flags (H,L) where appropriate
Internal Standards (if used)	Acceptable Range: IS area = 50% to 200% of CCAL area RT within 30 seconds of CC RT	Method <sup>(2)</sup>	J (pos) if area > 200% J (pos)/UJ (ND) if area < 50% J (pos)/R (ND) if area < 25% RT > 30 seconds, narrate	19	
Field Duplicates	<b>Solids:</b> RPD < 50% OR difference < 2X RL (for results < 5X RL) <b>Aqueous:</b> RPD < 35% OR difference < 1X RL (for results < 5X RL)	EcoChem	J (pos)/UJ (ND) Qualify only parent and field duplicate samples	9	use project limits if specified

**PCB Aroclors by GC**  
**(Based on Organic NFG 2008 and SW-846 Method 8082A)**

QC Element	Acceptance Criteria (NFG)	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
<b>Compound Identification/Quantification</b>					
Quantitation/ Identification	Between two columns: RPD < 40% or %D < 25% Within Retention Time Windows on both columns.	NFG <sup>(1)</sup> Method <sup>(2)</sup>	J (pos) if RPD = 40% - 60% (25% - 60% for %D) NJ (pos) if > 60% R (pos) if RTW criterion not met	3	See TM-08 for additional info.
Calibration Range	on column concentration < high calibration standard	NFG <sup>(1)</sup> Method <sup>(2)</sup>	J (pos) if conc > high standard and sample was not diluted	20	
Dilutions, Re-extractions and/or Reanalyses	Report only one result per analyte	Standard reporting policy	Use "DNR" to flag results that will not be reported.	11	TM-04 Rev. 1 for additional info.
<b>Sample Clean-up</b>					
GPC/Sulfur/ Florisil/Acid	No criteria - cleanups are optional	NFG <sup>(1)</sup> Method <sup>(2)</sup>	Use Professional Judgment	14	special cleanups may be required for project cleanup standards may be associated with GPC/florisil cleanups

<sup>1</sup> National Functional Guidelines for Organic Data Review, June, 2008

<sup>2</sup> Polychlorinated Biphenyls (PCBs) by Gas Chromatography USEPA Method SW846 8082A, Feb 2007, Rev. 1

<sup>3</sup> SW846, Chapter 4, Organic Analytes

<sup>4</sup> Determinative Chromatographic Separations, Method 8000C, March 2003, Rev.3

<sup>5</sup> "H" = high bias indicated; "L" = low bias indicated



**EcoChem Validation Guidelines for Total Petroleum Hydrocarbons-Diesel & Residual Range**  
(Based on EPA National Functional Guidelines as applied to criteria in NWTPH-Dx,  
June 1997, Wa DOE & Oregon DEQ)

QC Element	Acceptance Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
<b>Sample Handling</b>				
Cooler Temperature & Preservation	4°C±2°C Water: HCl to pH < 2	J(+)/UJ(-) if greater than 6 deg. C	1	
Holding Time	Ext. Waters: 14 days preserved 7 days unpreserved Ext. Solids: 14 Days Analysis: 40 days from extraction	J(+)/UJ(-) if hold times exceeded J(+)/R(-) if exceeded > 3X	1	Professional Judgement
<b>Instrument Performance</b>				
Initial Calibration	5 calibration points (All within 15% of true value)  Linear Regression: $r^2 \geq 0.990$ If used, RSD of response factors $\leq 20\%$	Narrate if fewer than 5 calibration levels or if %R > 15%  J(+)/UJ(-) if $r^2 < 0.990$ J(+)/UJ(-) if %RSD > 20%	5A	
Mid-range Calibration Check Std.	Analyzed before and after each analysis shift & every 20 samples.  Recovery range 85% to 115%	Narrate if frequency not met.  J(+)/UJ(-) if %R < 85% J(+) if %R > 115%	5B	
<b>Blank Contamination</b>				
Method Blank	At least one per batch ( $\leq 20$ samples) No results > RL	U (at the RL) if sample result is < RL & < 5X blank result.	7	
		U (at reported sample value) if sample result is $\geq$ RL and < 5X blank result	7	
Field Blanks (if required by project)	No results > RL	Action is same as method blank for positive results remaining in the field blank after method blank qualifiers are assigned.	6	

**EcoChem Validation Guidelines for Total Petroleum Hydrocarbons-Diesel & Residual Range**  
 (Based on EPA National Functional Guidelines as applied to criteria in NWTPH-Dx,  
 June 1997, Wa DOE & Oregon DEQ)

QC Element	Acceptance Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
<b>Precision and Accuracy</b>				
MS samples (accuracy) (if required by project)	%R within lab control limits	Qualify parent only, unless other QC indicates systematic problems. J(+) if both %R > upper control limit (UCL) J(+)/UJ(-) if both %R < lower control limit (LCL) No action if parent conc. >5X the amount spiked.	8	Use Professional Judgement if only one %R outlier
Precision: MS/MSD or LCS/LCSD or sample/dup	At least one set per batch (≤10 samples) RPD ≤ lab control limit	J(+) if RPD > lab control limits	9	
LCS (not required by method)	%R within lab control limits	J(+)/UJ(-) if %R < LCL J(+) if %R > UCL J(+)/R(-) if any %R < 10%	10	Professional Judgement
Surrogates	2-fluorobiphenyl, p-terphenyl, o-terphenyl, and/or pentacosane added to all samples (inc. QC samples).  %R = 50-150%	J(+)/UJ(-) if %R < LCL J(+) if %R > UCL J(+)/R(-) if any %R < 10% No action if 2 or more surrogates are used, and only one is outside control limits.	13	Professional Judgement
Pattern Identification	Compare sample chromatogram to standard chromatogram to ensure range and pattern are reasonable match. Laboratory may flag results which have poor match.	J(+)	2	
Field Duplicates	Use project control limits, if stated in QAPP  <b>EcoChem default:</b> water: RPD < 35% solids: RPD < 50%	Narrate (Use Professional Judgement to qualify)	9	

**EcoChem Validation Guidelines for Total Petroleum Hydrocarbons-Diesel & Residual Range**  
 (Based on EPA National Functional Guidelines as applied to criteria in NWTPH-Dx,  
 June 1997, Wa DOE & Oregon DEQ)

QC Element	Acceptance Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
<b>Compound ID and Calculation</b>				
Two analyses for one sample (dilution)	Report only one result per analyte	"DNR" (or client requested qualifier) all results that should not be reported.	11	See EcoChem TM-04

**Metals by ICP-MS**  
**(Based on Inorganic NFG 2010 and SW-846 6020A)**

QC Element	EcoChem Acceptance Criteria	Source of Criteria	EcoChem Action for Non-Conformance	Reason Code	Discussion and Comments
<b>Sample Handling</b>					
Cooler / Storage Temperature Preservation	<b>Solid:</b> Cooler temperature 4°C±2°C <b>Aqueous:</b> Nitric Acid to pH < 2 <b>Dissolved Metals:</b> 0.45 µm filter, preserve to pH < 2 after filtration	NFG <sup>(1)</sup> Method <sup>(2)</sup>	Cooler Temps: <b>If required by project</b> J (pos)/UJ (ND) if greater than 6° C Aqueous: J (pos)/UJ (ND) if pH > 2	1	Use <b>PJ</b> to qualify for temperature outlier. Current SW846 criterion is ≤ 6° C <sup>(4)</sup> No quals for pH if samples preserved by lab immediately upon receipt and within 1 day of collection.
Holding Time	All matrices: 180 days from date sampled Frozen soils, sediments, tissues (-20°C) - HT extended to 1 year	NFG <sup>(1)</sup> Method <sup>(2)</sup> EcoChem standard policy	J (pos)/UJ (ND) if holding time exceeded	1	
<b>Instrument Performance</b>					
Tune	Analyzed prior to ICAL tuningsolution analyzed 5 times with Std. Dev. ≤ 5% Mass calibration < 0.1 amu difference from target mass Resolution < 0.9 amu @ 10% peak height	NFG <sup>(1)</sup> Method <sup>(2)</sup>	J(pos)/UJ(ND) if tune criteria not met	5A	Use <b>PJ</b> to evaluate tune. Alternate Resolution criteria may apply based on instrument specs (i.e <0.75 amu at 5% peak height)
Initial Calibration (ICAL)	Based on instrument requirements, blank + 1 standard minimum requirement for calibration If more than 1 standard used, r ≥ 0.995	NFG <sup>(1)</sup> Method <sup>(2)</sup>	J (pos)/UJ (ND) if r < 0.995	5A	
Initial Calibration Verification (ICV)	Independent source analyzed immediately after calibration %R within ± 10% of true value	NFG <sup>(1)</sup> Method <sup>(2)</sup>	R (pos/ND) if %R < 75% J (pos)/UJ (ND) if %R 75% - 89% J (pos) if %R >111%	5A (H,L) <sup>3</sup>	Qualify all samples in run
Reporting Limit (RL) Standard Low Level ICV/CCV	concentration at RL %R = 70%-130%	Method <sup>(2)</sup>	J (pos) < 2x RL / R (ND) if %R <50% J (pos) < 2x RL / UJ (ND) if %R 50 - 69% J (pos) < 2x RL if %R > 130%	5A (H,L) <sup>3</sup>	Qualify all samples in run

**Metals by ICP-MS  
 (Based on Inorganic NFG 2010 and SW-846 6020A)**

QC Element	EcoChem Acceptance Criteria	Source of Criteria	EcoChem Action for Non-Conformance	Reason Code	Discussion and Comments
<b>Instrument Performance cont'd</b>					
Continuing Calibration Verification (CCV)	Immediately following ICV/ICB, then every two hours or ten samples, and at end of run. %R within ± 10% of true value	NFG <sup>(1)</sup> Method <sup>(2)</sup>	R (pos/ND) if %R < 75% J (pos)/UJ (ND) if %R = 75% - 89% J (pos) if %R > 111%	5B (H,L) <sup>3</sup>	Qualify samples bracketed by CCV outliers
Interference Check Samples (ICSA / ICSAB)	ICSAB %R 80% - 120% for all spiked elements   ICSA   < MDL for all unspiked elements	NFG <sup>(1)</sup> Method <sup>(2)</sup>	For samples with Al, Ca, Fe, Mg > ICS levels: <b>ICSAB:</b> J( pos)/R (ND) if %R < 50% J (pos)/UJ (ND) if %R = 50% - 79% J (pos) if %R > 120% <b>ICSA:</b> J (pos) < 2x ICSA/UJ (ND) for ICSA < Neg MDL J (pos) < 2x ICSA for ICSA > MDL	17 (H,L) <sup>3</sup>	Use <b>PJ</b> and molecular interferences to evaluate ICSA to determine if bias is present. Refer to <b>TM-14</b> for additional information.
<b>Blank Contamination</b>					
Method Blank (MB)	One per matrix per batch of (of ≤ 20 samples) Blank conc < MDL	NFG <sup>(1)</sup> Method <sup>(2)</sup>	U (pos) if result is < 5X method blank concentration	7	Refer to <b>TM-02</b> for additional information. Blank Evaluation based on NFG 1994
Instrument Blanks (ICB/CCB)	After each ICV & CCV   blank concentration   < MDL	NFG <sup>(1)</sup> Method <sup>(2)</sup>	Action level is 5x absolute value of blank conc. For positive blanks: U (pos) results < action level For negative blanks: J (pos)/UJ (ND) results < action level	Pos Blks: 7 Neg Blks: 7L <sup>3</sup>	Use blanks bracketing samples for Qualification Refer to <b>TM-02</b> for additional information. <b>Hierarchy of blank review:</b> <b>#1 - Review MB, qualify as needed</b> <b>#2 - Review IB , qualify as needed</b> <b>#3 - Review FB , qualify as needed</b>
Field Blank (FB)	Blank conc < MDL	EcoChem standard policy	U (pos) if result is < 5x action level, as per analyte.	6	Qualify in associated field samples only. Refer to <b>TM-02</b> for additional information.

**Metals by ICP-MS**  
**(Based on Inorganic NFG 2010 and SW-846 6020A)**

QC Element	EcoChem Acceptance Criteria	Source of Criteria	EcoChem Action for Non-Conformance	Reason Code	Discussion and Comments
<b>Precision and Accuracy</b>					
Internal Standards (IS)	Added to all samples. All analytes must be associated with an internal standard 60-125% of cal blank IS	NFG <sup>(1)</sup> Method <sup>(2)</sup>	J(pos)/UJ(ND) all analytes associated with IS outlier	19	6020A criteria - IS >70% of ICAL std
LCS (recovery)	One per matrix per batch (of ≤ 20 samples); LCSD not required %R between 80-120%	Method <sup>(2)</sup>	J (pos)/R (ND) if %R <50% J (pos)/UJ (ND) if %R 50% - 79% J (pos) if %R > 120%	10 (H,L) <sup>3</sup>	Qualify all samples in batch QAPP may have overriding accuracy limits. NFG Limits 70% -130%
LCS/LCSD (RPD)	LCSD not required, if analyzed: RPD ≤ 20%	Method <sup>(2)</sup>	J (pos)/UJ (ND) if RPD > 20%	9	Qualify all samples in batch QAPP may have overriding precision limits.
MS/MSD (recovery)	One per matrix per batch (of ≤ 20 samples); MSD not required %R between 75-125%	NFG <sup>(1)</sup> Method <sup>(2)</sup>	J (pos) if %R > 125% J (pos)/UJ (ND) if %R <75% J (pos)/R (ND) if %R < 30%, unless post digestion spike analyzed, J (pos)/UJ (ND) if post digestion spike %R OK	8 (H,L) <sup>3</sup>	No action if only one spike %R is outside criteria. NA if parent concentration >4x the amount spiked. Qualify all samples in batch. QAPP may have overriding accuracy limits.
Post Digestion Spikes	If MS is outside 75-125%, post-spike should be analyzed %R 80%-120% (method); 75%-125% (NFG)	NFG <sup>(1)</sup> Method <sup>(2)</sup>	Only used to support MS qualification decisions	NA	No qualifiers assigned based solely on this element.
MS/MSD (RPD)	MSD not required, if analyzed: RPD ≤ 20%	NFG <sup>(1)</sup> Method <sup>(2)</sup>	J (pos)/UJ (ND) if RPD > 20%	9	QAPP may have overriding precision limits.
Laboratory Duplicate	One per matrix per batch (of ≤ 20 samples) RPD ≤ 20% for results ≥ 5x RL  Solids: difference < 2X RL for results < 5X RL Aqueous: difference < 1X RL for results < 5X RL	NFG <sup>(1)</sup> Method <sup>(2)</sup>	J (pos)/UJ (ND) if RPD > 20% or if difference > control limit	9	Qualify all samples in batch. QAPP may have overriding precision limits.

**Metals by ICP-MS  
 (Based on Inorganic NFG 2010 and SW-846 6020A)**

QC Element	EcoChem Acceptance Criteria	Source of Criteria	EcoChem Action for Non-Conformance	Reason Code	Discussion and Comments
<b>Precision and Accuracy cont'd</b>					
Reference Material (RM, SRM, or CRM)	Result $\pm$ 20% of the 95% confidence interval of the true value for analytes	EcoChem standard policy	J (pos)/UJ (ND) if < LCL J (pos) if > UCL	12 (H,L) <sup>3</sup>	QAPP may have overriding accuracy limits. Some manufacturers may have different RM control limits
Serial Dilution	Analyze one sample per matrix at a 5x dilution %D <10% for original sample conc. > 50x MDL	NFG <sup>(1)</sup>	J(pos)/UJ(ND) if %D > 10% and native sample concentration > 50x MDL	16	Note serial dilutions for soil are reported in ug/L, but the MDL is in mg/kg. The units need to be adjusted. Qualify all samples in batch.
Field Duplicate	Solids: RPD <50% OR difference < 2X RL (for results < 5X RL)  Aqueous: RPD <35% OR difference < 1X RL (for results < 5X RL)	EcoChem standard policy	Narrate and qualify if required by project <b>(EcoChem PJ)</b> Qualify only field duplicate samples J(pos)/UJ(ND)	9	QAPP may have overriding precision limits.
<b>Compound Quantitation</b>					
Total and Dissolved Comparison	Total > Dissolved	EcoChem standard policy	J (pos)/UJ (ND) if Dissolved > Total and results fall outside of standard duplicate precision criteria	14	
Calibration Range	Results < instrument linear range	NFG <sup>(1)</sup> Method <sup>(2)</sup>	if result exceeds linear range and sample was not diluted J (pos)	20	
Dilutions, Re-extractions and/or Reanalyses	Report only one result per analyte	EcoChem standard policy	Use "DNR" to flag results that will not be reported.	11	<b>TM-04</b> EcoChem Policy for Rejection/Selection Process for Multiple Results

<sup>1</sup> National Functional Guidelines for Inorganic Superfund Data Review, January 2010.

<sup>2</sup> Method SW846 6020A Inductively Coupled Plasma-Mass Spectrometry (ICP-MS), Revision 1, February 2007.

<sup>3</sup> "H" = high bias indicated; "L" = low bias indicated

<sup>4</sup> SW846, Chapter 3, Inorganic Analytes

(pos): Positive Result

(ND): Not detected

**Mercury by CVAA**  
(Based on Inorganic NFG 2010 and SW846 7470A & 7471B)

QC Element	Acceptance Criteria	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
<b>Sample Handling</b>					
Cooler / Storage Temperature Preservation	<b>Solid:</b> Cooler temperature 4°C±2°C <b>Aqueous:</b> Nitric Acid to pH < 2 <b>Dissolved Metals:</b> 0.45 µm filter, preserve to pH < 2 after filtration	NFG <sup>(1)</sup> Method <sup>(2)</sup>	Cooler Temps: <b>If required by project</b> J (pos)/UJ (ND) if greater than 6° C Aqueous: J (pos)/UJ (ND) if pH > 2	1	Use <b>PJ</b> to qualify for temperature outlier. Current SW846 criterion is ≤ 6° C (4) No quals for pH if samples preserved by lab immediately upon receipt and within 1 day of collection.
Holding Time	28 days from date sampled Frozen solids and tissues HT extended to 6 months	NFG <sup>(1)</sup> Method <sup>(2)</sup> EcoChem standard policy	J (pos)/UJ (ND) if HT exceeded	1	
<b>Instrument Performance</b>					
Initial Calibration (ICAL)	Daily Calibration Blank + 5 standards, one ≤ RL Correlation coefficient (r) ≥ 0.995	NFG <sup>(1)</sup> Method <sup>(2)</sup>	J (pos)/UJ (ND) if r < 0.995	5A (H,L) <sup>3</sup>	
Initial Calibration Verification (ICV)	Independent source analyzed immediately after ICAL %R within ± 15% of true value	NFG <sup>(1)</sup> Method <sup>(2)</sup>	R(pos/ND) if %R <70% J(pos)/UJ(ND) if %R = 70-84% J(pos) if %R = > 116%	5A (H,L) <sup>3</sup>	Qualify all samples in run
Reporting Limit (RL) Standard	Conc = RL %R = 70-130%	Method <sup>(2)</sup>	J (pos) < 2x RL / R (ND) if %R <50% J (pos) < 2x RL / UJ (ND) if %R 50 - 69% J (pos) < 2x RL if %R > 130%	5A (H,L) <sup>3</sup>	Qualify all samples in run
Continuing Calibration Verification (CCV)	At beginning of run, every ten samples, and again after last sample. %R within ± 15% of true value	NFG <sup>(1)</sup> Method <sup>(2)</sup>	R(pos/ND) if %R <70% J(pos)/UJ(ND) if %R = 70-84% J(pos) if %R = > 116%	5B (H,L) <sup>3</sup>	Qualify samples bracketed by CCV outliers
<b>Blank Contamination</b>					
Method Blank (MB)	One per matrix per batch of (of ≤ 20 samples) Blank conc < MDL	NFG <sup>(1)</sup> Method <sup>(2)</sup>	U (pos) if result is < 5X method blank concentration	7	Refer to <b>TM-02</b> for additional information. Blank Evaluation based on NFG 1994



**Mercury by CVAA**  
 (Based on Inorganic NFG 2010 and SW846 7470A & 7471B)

QC Element	Acceptance Criteria	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
Instrument Blanks (ICB/CCB)	After each ICV & CCV   blank concentration   < MDL	NFG <sup>(1)</sup> Method <sup>(2)</sup>	Action level is 5x absolute value of blank conc. For positive blanks: U (pos) results < action level For negative blanks: J (pos)/UJ (ND) results < action level	Pos Blanks: 7 Neg Blanks: 7L <sup>3</sup>	Use blanks bracketing samples for Qualification Refer to <b>TM-02</b> for additional information.  <b>Hierarchy of blank review:</b> <b>#1 - Review MB, qualify as needed</b> <b>#2 - Review IB, qualify as needed</b> <b>#3 - Review FB, qualify as needed</b>
Field Blank (FB)	Blank conc < MDL	EcoChem standard policy	U (pos) if result is < 5x action level, as per analyte.	6	Qualify in associated field samples only. Refer to <b>TM-02</b> for additional information.
<b>Precision and Accuracy</b>					
Laboratory Control Sample (recovery)	One per matrix per batch (of ≤ 20 samples); LCSD not required %R between 80-120%	Method <sup>(2)</sup>	J (pos)/R (ND) if %R < 50% J (pos)/UJ (ND) if %R 50% - 79% J (pos) if %R > 120%	10 (H,L) <sup>3</sup>	Qualify all samples in batch QAPP may have overriding accuracy limits. NFG does not address LCS
LCS/LCSD (RPD)	LCSD not required, if analyzed: RPD ≤ 20%	Method <sup>(2)</sup>	J (pos)/UJ (ND) if RPD > 20%	9	Qualify all samples in batch QAPP may have overriding precision limits.
Matrix Spike/Matrix Spike Duplicate MS/MSD (recovery)	One per matrix per batch (of ≤ 20 samples); MSD not required %R between 75-125%	NFG <sup>(1)</sup> Method <sup>(2)</sup>	J (pos) if %R > 125% J (pos)/UJ (ND) if %R < 75% J (pos)/R (ND) if %R < 30%	8 (H,L) <sup>3</sup>	No action if only one spike %R is outside criteria. NA if parent concentration > 4x the amount spiked. Qualify all samples in batch. QAPP may have overriding accuracy limits.
MS/MSD (RPD)	MSD not required, if analyzed: RPD ≤ 20%	NFG <sup>(1)</sup> Method <sup>(2)</sup>	J (pos)/UJ (ND) if RPD > 20%	9	QAPP may have overriding precision limits.
Laboratory Duplicate	One per matrix per batch (of ≤ 20 samples) RPD ≤ 20% for results ≥ 5x RL  Solids: difference < 2X RL for results < 5X RL Aqueous: difference < 1X RL for results < 5X RL	NFG <sup>(1)</sup> Method <sup>(2)</sup>	J (pos)/UJ (ND) if RPD > 20% or if difference > control limit	9	Qualify all samples in batch. QAPP may have overriding precision limits.

**Mercury by CVAA**  
**(Based on Inorganic NFG 2010 and SW846 7470A & 7471B)**

QC Element	Acceptance Criteria	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
Reference Material (RM, SRM, or CRM)	Result $\pm$ 20% of the 95% confidence interval of the true value for analytes	EcoChem standard policy	J (pos)/UJ (ND) if < LCL J (pos) if > UCL	12 (H,L) <sup>3</sup>	QAPP may have overriding accuracy limits. Some manufacturers may have different RM control limits
Field Duplicate	Solids: RPD <50% (for results $\geq$ 5x RL) OR difference < 2X RL (for results < 5X RL)  Aqueous: RPD <35% (for results $\geq$ 5x RL) OR difference < 1X RL (for results < 5X RL)	EcoChem standard policy	Qualify only parent and field duplicate samples J (pos)/UJ (ND)	9	QAPP may have overriding precision limits. Client/QAPP may not require qualification based on field precision.
<b>Compound Quantitation</b>					
Total and Dissolved Comparison	Total > Dissolved	EcoChem standard policy	J (pos)/UJ (ND) if Dissolved > Total and results fall outside of standard duplicate precision criteria	14	
Calibration Range	Results < instrument linear range	NFG <sup>(1)</sup> Method <sup>(2)</sup>	if result exceeds linear range and sample was not diluted J (pos)	20	
Dilutions, Re-extractions and/or Reanalyses	Report only one result per analyte	EcoChem standard policy	Use "DNR" to flag results that will not be reported.	11	<b>TM-04</b> EcoChem Policy for Rejection/Selection Process for Multiple Results

<sup>1</sup> National Functional Guidelines for Inorganic Superfund Data Review, January 2010.

<sup>2</sup> Method SW846 7470A Mercury in Liquid Waste (Manual Cold-Vapor Technique), Revision 1, September 1994.  
 Method SW846 7471B Mercury in Solid or Semisolid Waste (Manual Cold-Vapor Technique), Revision 2, February 2007.

<sup>3</sup> "H" = high bias indicated; "L" = low bias indicated

<sup>4</sup> SW846, Chapter 3, Inorganic Analytes

(pos): Positive Result  
 (ND): Not Detected

**Conventional Methods by Gravimetric Analysis  
 (i.e., Total Solids, Total Dissolved Solids, Total Suspended Solids, Grain Size)  
 (Based on Inorganic NFG 2010 and EPA methods)**

QC Element	EcoChem Acceptance Criteria	Source of Criteria	EcoChem Action for Non-Conformance	Reason Code	Discussion and Comments
<b>Sample Handling</b>					
Cooler/Storage Temperature Preservation	Cooler temperature: 4°C±2°C Preservation: Analyte/Method Specific	Method <sup>(1)</sup> NFG <sup>(2)</sup>	J (pos)/UJ (ND) if preservation requirements not met	1	Use <b>PJ</b> to qualify for cooler temp outliers.
Holding Time	Analyte/Method Specific	Method NFG <sup>(2)</sup>	J (pos)/UJ (ND) if holding time exceeded	1	
<b>Blank Contamination</b>					
Method Blank (MB)	If required by method,one per matrix per batch of (of ≤ 20 samples) Blank conc < MDL	NFG <sup>(1)</sup> Method <sup>(2)</sup>	U (pos) if result is < 5X method blank concentration	7	Refer to <b>TM-02</b> for additional information. Blank Evaluation based on NFG 1994
<b>Precision and Accuracy</b>					
LCS (If appropriate to method)	One per matrix per batch (of ≤ 20 samples) %R between 80-120%	Method <sup>(2)</sup>	J (pos)/R (ND) if %R <50% J (pos)/UJ (ND) if %R 50% - 79% J (pos) if %R > 120%	10 (H,L) <sup>3</sup>	Qualify all samples in batch QAPP may have overriding accuracy limits.
Reference Material (RM, SRM, or CRM)	Result ±20% of the 95% confidence interval of the true value for analytes	EcoChem standard policy	J (pos)/UJ (ND) if < LCL J (pos) if > UCL	12 (H,L) <sup>3</sup>	QAPP may have overriding accuracy limits. Some manufacturers may have different RM control limits

**Conventional Methods by Gravimetric Analysis  
 (i.e., Total Solids, Total Dissolved Solids, Total Suspended Solids, Grain Size)  
 (Based on Inorganic NFG 2010 and EPA methods)**

QC Element	EcoChem Acceptance Criteria	Source of Criteria	EcoChem Action for Non-Conformance	Reason Code	Discussion and Comments
Laboratory Duplicate	One per matrix per batch (of ≤ 20 samples) RPD ≤ 20% for results ≥ 5x RL  Solids: difference < 2X RL for results < 5X RL Aqueous: difference < 1X RL for results < 5X RL	NFG <sup>(1)</sup> Method <sup>(2)</sup>	J (pos)/UJ (ND) if RPD > 20% For Grain Size, no action if results for fraction are less than 5%	9	Qualify all samples in batch, except Grain Size - qualify parent only. QAPP may have overriding precision limits.
Field Duplicate	Solids: RPD < 50% (for results ≥ 5x RL) OR difference < 2X RL (for results < 5X RL)  Aqueous: RPD < 35% (for results ≥ 5x RL) OR difference < 1X RL (for results < 5X RL)	EcoChem standard policy	Qualify only parent and field duplicate samples J (pos)/UJ (ND)	9	QAPP may have overriding precision limits. Client/QAPP may not require qualification based on field precision.
<b>Compound Quantitation</b>					
Dilutions, Re-extractions and/or Reanalyses	Report only one result per analyte per sample	EcoChem standard policy	Use "DNR" to flag results that will not be reported.	11	

<sup>1</sup> National Functional Guidelines for Inorganic Superfund Data Review, January 2010.

<sup>2</sup> SW846 or EPA Standard Methods

<sup>3</sup> "H" = high bias indicated; "L" = low bias indicated

(pos): Positive Result  
 (ND): Not Detected



**ECO-CHEM**  
Data Quality

## **APPENDIX B**

# **QUALIFIED DATA SUMMARY TABLE**

**Qualified Data Summary Table  
Boeing Kent Space Center**

<b>SDG</b>	<b>Sample ID</b>	<b>Laboratory ID</b>	<b>Method</b>	<b>Analyte</b>	<b>Result</b>	<b>Units</b>	<b>Lab Flag</b>	<b>Validation Qualifier</b>	<b>Validation Reason</b>
17L0370	KSC-MH-15.10M-1217	SW8082A	17L0370-03	Aroclor 1248		ug/kg	Y1 U	U	22
17L0370	KSC-MH-15.10M-1217	SW8082A	17L0370-03	Aroclor 1260	80.8	ug/kg	P1	J	3
17L0370	KSC-MH-20.235M-1217	SW8082A	17L0370-01	Aroclor 1248		ug/kg	Y1 D U	U	22