PASSIVE SAMPLING & TEMPERATURE LOGGER

DATA REPORT

River Operable Unit, Bradford Island
CASCADE LOCKS, OREGON

Prepared by

U.S. ARMY CORPS OF ENGINEERS
Portland and Seattle Districts

FINAL

May 2024

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LIST OF ACRONYMS

µg/kg	microgram per kg
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CSM	conceptual site model
EPA	United States Environmental Protection Agency
OU	Operable Unit
PCB	polychlorinated biphenyl
QAPP	Quality Assurance Project Plan
RI	Remedial Investigation
USACE	United States Army Corps of Engineers

1. INTRODUCTION

The U.S. Army Corps of Engineers (USACE) conducted a Remedial Investigation (RI) for the in-water portion of Bradford Island, known as the River Operable Unit (OU) (USACE 2012), in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and Executive Order 12580. As part of the RI, USACE conducted baseline risk assessments to evaluate risks to human health and the environment from exposure to sediments, surface water, and tissues from within the River OU. Based on the unacceptable risks identified for the River OU, USACE determined remedial action is necessary in order to reduce risk to human health and the environment. USACE has begun to prepare a Supplemental RI in support of a future Feasibility Study in the River OU. As part of the Supplemental RI, USACE is updating and refining the conceptual site model (CSM) to better understand potential source areas. This includes passive sampling along the northern shoreline of Bradford Island.

Bradford Island was placed on the National Priorities List in March 2022 subsequent to completion of this effort.

2. PROJECT BACKGROUND

2.1. River OU Summary

The River OU was identified in 2000, when numerous pieces of electrical equipment and other solid waste were discovered in the Columbia River along the north shore of Bradford Island. The removal of equipment and debris took place in December 2000 and in February and March 2002. Following delineation of the extent of sediment contamination, impacted sediments along the north shore of Bradford Island were dredged in October 2007. Residual contamination in the sediment bed, as well as historically contaminated biota (e.g., fish and shellfish) may currently be sources of contamination. Transport of contaminants from the Upland OU, may also be a current and/or historical source of contamination to the River OU.

2.2. Field Effort Summary

The USACE Seattle District, with support from Portland District and Texas Tech University, conducted deployment of passive samplers from January 27th through February 1st, 2020. Retrieval of samplers was competed March 2nd through 5th, 2020. Temperature loggers were collocated with each passive sampler.

Additional details regarding field activities can be found in the Final Field Report (USACE, 2020)

3. ANALYTICAL METHODS

The methods and procedures used to prepare and analyze the passive samplers are described briefly in this section and in detail in the Quality Assurance Project Plans (QAPP) (USACE, 2020).

3.1. Passive Sampler Analytical Methods

All passive samplers retrieved from the site were analyzed for 46 PCB congeners by Texas Tech University using EPA Method 1668C. Based on the results of that analysis, Texas Tech University analyzed a subset of passive samplers for 141 PCB congeners. Samples were selected for analysis of 141 congeners based on historical data, site features, and the relative concentration results from the initial analysis of 46 PCB congeners.

Separate from analyses conducted by Texas Tech University, 35 samples were analyzed by Eurofins Test America for quantification of all 209 congeners using EPA Method 1668A. The memorandum documenting selection of those passive samplers for analysis of all 209 PCB congeners is provided in Appendix A.

Table 3-1 presents the analytical methods used by each laboratory.

Table 3-1 Analytical Methods for Passive Sampler Analyses.

Analyte	Method	Reference
Subset of PCB Congeners	GC-TQMS (Agilent 7890B) using SIM/SIM mode	EPA Method 1668C
PCB Congeners (209 congeners)	HRGC/HRMS	EPA Method 1668A

Note:
GC-TQMS – gas chromatography – triple quadrupole mass spectrometry
HRGC/HRMS – high resolution gas chromatography/high resolution mass spectrometry

3.2. Temperature Data Logger Methods

Temperature data was recorded using Hobo pendant temp/alarm 64K and associated Hoboware Pro V.3.X software. Data from each sensor was downloaded upon retrieval and analyzed on hourly intervals.

3.3. Deviations from the QAPP

There were no deviations from the QAPP that affected the quality of the data.

4. RESULTS OF ANALYSES

This section summarizes the results of the chemical analyses and data validation of the passive samplers. Results of the temperature data loggers are also presented herein.

4.1. Analytical Chemistry Results

The analytical results along with the calculated polymer concentration are presented in Appendices B and C for Texas Tech University and Eurofins Test America, respectively. Analytical results provided by the laboratories are for the PCB concentration in extract from the passive sampler. The extract concentrations are then corrected for mass of the passive sampler to obtain a PCB concentration in the polymer. Cpolymer was not corrected for Kp or fss. Table 4-1 provides a summary of the Cpolymer concentrations for each sample based on the sum of 46 PCB congeners analyzed by Texas Tech University. Congeners with "N" flag designation are summed as zero for this total concentration presented in Table 4-1.

Table 4-1. $C_{polymer}$ sum of 46 PCB congeners for all passive samplers

USACE Sample ID Num.	$C_{polymer}$, sum of 46 PCB congeners (ug/kg)	USACE Sample ID Num.	$C_{polymer}$, sum of 46 PCB congeners (ug/kg)	USACE Sample ID Num.	$C_{polymer}$, sum of 46 PCB congeners (ug/kg)	USACE Sample ID Num.	$C_{polymer}$, sum of 46 PCB congeners (ug/kg)
1	2.3	**48**	16.7	**93**	15.4	**156**	0.9
2	30.4	**49**	11.2	**94**	11.7	**164**	7.8
3	16.2	**50**	6.4	**95**	1.0	**165**	56.1
5	0.0	**51**	1.1	**96**	16.1	**168**	26.9
6	21.7	**52**	7.7	**97**	4.1	**179**	2.2
7	0.0	**53**	4.2	**98**	15.9	**180**	8.6
8	10.4	**54**	2.4	**101**	8.3	**182**	1.3
12	19.1	**55**	6.5	**102**	25.4	**184**	10.0
13	5.9	**56**	12.0	**103**	6.1	**188**	9.5
14	51.8	**57**	16.4	**105**	8.2	**190**	18.9
15	35.6	**58**	1.0	**106**	5.8	**200**	1.1
16	29.1	**59**	3.8	**107**	4.1	**204**	6.0
17	9.6	**60**	25.8	**108**	3.9	**207**	5.3
18	7.3	**61**	4.5	**109**	34.0	**224**	8.7
19	22.4	**62**	5.1	**110**	5.0	**231**	3.7
20	12.8	**63**	6.4	**112**	3.8	**242**	15.7
21	55.4	**64**	0.9	**113**	21.4	**243**	2.8
22	7.8	**65**	11.0	**114**	4.1	**259**	9.5
23	6.4	**66**	13.8	**116**	24.7	**SW40**	30.73
24	18.5	**67**	7.4	**117**	65.4	**SW156**	24.18
25	15.1	**68**	6.9	**118**	7.4	**SW5**	18.76
26	9.5	**69**	21.7	**119**	92.5	**SW80**	9.69
27	4.6	**70**	3.7	**121**	4.1	**SW110**	6.88
29	9.0	**71**	8.1	**122**	1.3		
30	17.0	**72**	4.0	**123**	2.4		
31	5.9	**73**	10.1	**126**	3.8		
32	4.6	**74**	15.5	**131**	7.1		
33	7.9	**77**	17.7	**132**	8.4		
34	25.4	**79**	39.0	**133**	1.6		
35	16.6	**80**	4.3	**135**	7.4		
37	13.6	**81**	2.9	**137**	7.2		
39	9.0	**82**	8.2	**139**	18.0		
41	7.9	**83**	2.8	**140**	1.1		
42	38.5	**84**	19.1	**146**	4.6		
43	35.0	**86**	37.7	**147**	23.1		
44	18.7	**87**	5.4	**148**	10.2		
46	5.1	**88**	23.5	**149**	8.0		
47	3.2	**90**	17.2	**155**	35.4		

Note: Sample IDs with "SW" denote surface water passive samplers

4.2. Temperature Loggers

Temperature loggers were attached to each passive sampler at the surface of the river bottom and temperature loggers were also attached five feet off the river bottom from six of the passive sampler locations, to the ropes that connected the passive samplers to the buoys (one of the six loggers measuring the water column above the samplers faulted and did not record any data). The temperature logger data was analyzed to look for evidence of groundwater upwelling coming from Bradford Island. The data did not provide evidence of groundwater upwelling.

The loggers measured in intervals of approximately 0.185 degrees Fahrenheit (°F). The baseline temperatures of the loggers was collected when they were indoors at the same temperature, prior to deployment in the river. This data showed there was an inherent difference ranging up to 0.389 °F. That data was later used to normalize the in-river data collected from each location. The largest instantaneous delta in normalized temperature data across the whole array of samplers (the largest difference between any samplers at any point in time) was 0.604 °F (0.933 °F – 0.389 °F). The array of loggers covered a wide area in a dynamic river environment, at varying depths and currents, where minor differences in temperature to this extent could be expected based on those conditions alone.

The five pairs of water column loggers that successfully collected data five feet above the passive sampler river bottom loggers they were paired with had their temperatures compared. In a scenario where groundwater upwelling may be occurring somewhat consistently across the array of loggers at the river bottom and influencing the river bottom loggers in a similar way (making comparison between them a less reliable indicator of if groundwater upwelling was occurring), comparison instead between the river bottom loggers and the water column loggers five feet above them could differentiate influence of groundwater upwelling, since temperature at the water column five feet above the river bottom would not be influenced by groundwater in a meaningful way. The results from this comparison showed the largest instantaneous delta in normalized temperature data between any given pair of river bottom and water column temperature loggers to only be 0.255 °F. A graph illustrating the comparison of one of the temperature data from one of the loggers at the river bottom versus the water column above it is presented in Appendix E.

4.3. Data Validation

As noted in the QAPP, a formal data validation was not performed on data produced by the Texas Tech University laboratory. An QA/QC review of the data was done internally.

Data produced by Eurofins/Test America underwent Stage 2A data validation by LDC, Inc. A copy of the data validation report is provided as Appendix D.

Data validation is not applicable for the temperature loggers.

5. NEXT STEPS

Data results will be used as a line of evidence to guide future characterization and refine the conceptual site model as part of the Supplemental Remedial Investigation.

A memorandum was developed 22 December 2021, to document the proposed next steps for how to assess the data. This memorandum is included as Appendix F.

There are no plans to collect additional data or complete further analysis to look for signs of groundwater upwelling from Bradford Island into the Columbia river based on the results of the temperature loggers.

6. Bibliography

USACE. (2020). *Field Report, Passive Sampling Deployment and Retrieval, River Operable Unit, Bradford Island, Cascade Locks, OR. June 2020.*

USACE. (2020). *Final Quality Assurance Project Pland for Passive Sampling at River Operable Unit, Bradford Island, Cascade Locks, Oregon. January 2020.*

APPENDIX A

Memorandum for Record, Re: Proposed Samples for full 209 PCB congener analysis, dated 08 September 2021

Memorandum for Record

Bradford Island, River Operable Unit

Prepared by USACE Seattle and Portland Districts

08 September 2021

Re: Proposed Samples for full 209 PCB congener analysis

Per the Final QAPP for Passive Sampling, January 23, 2020, all samplers were analyzed for 46 PCB congeners by Texas Technical University. This subset of 46 congeners was selected due to the large number of samples and funding constraints. The 46 congeners selected for analysis were those that historically most contributed to total concentrations in various media in the Bradford Island River OU. Additionally, Texas Technical University analyzed a subset of samples for 141 congeners. After finalization of the QAPP and at the request of the TAG, a subset of samples will also be analyzed by a commercial laboratory for all 209 PCB congeners. USACE has completed the contract award for Test America at Knoxville to analyze a total of 35 samples for all 209 PCB congeners using EPA Method 1668C. Test America at Knoxville is experienced with analyzing passive sampler extracts with C-13 labeled performance reference compounds and was a participating laboratory in the ESTCP round robin study to standardize passive samplers

The goal of this analysis is not to ensure accurate quantification of the concentration of each sample, but to *ensure no major congeners were missed that could contribute to the total concentration in such a way that changes the relative ranking of the most elevated samples*. USACE intends to use this dataset to identify the most elevated concentrations, assuming the most elevated polymer concentrations are correlated to ongoing primary sources of contamination. As such, an absolute concentration is not as imperative as a relative concentration to the rest of the dataset. This relative comparison is possible given the large number of samples and robust spatial coverage.

USACE proposes analyzing the samples with the most elevated concentrations of PCBs based on the sum of 46 congeners originally analyzed. USACE plans to use the passive sampling results to highlight those areas along the northern shoreline of Bradford Island that most likely serve as an ongoing source of elevated PCB contamination. For this reason, USACE believes running the full 209 congener analysis on the most elevated samples will ensure that those samples are accurately representing the most elevated concentrations at the site. The goal of this additional analysis of 209 congeners is to ensure USACE has accurately identified the most elevated samples at the site.

A secondary objective of analyzing samples for full 209 analysis was identified by USACE after the initial results were provided. Texas Technical University reports estimated quantifications of various congeners with an N flag (indicating a tentatively identified compound). This data flag has resulted in confusion with how to treat those results, as it is not clear if commercial laboratories would typically report N-flagged data as U-flagged data (indicating the compound was not detected). As such, performing the full 209 congener analysis on the proposed subset of samples will help to elucidate how to manage N-flagged data.

Oregon DEQ also provided objectives and a list of specific samples for analysis of all 209 congeners. Oregon DEQ identified the following objectives for selection of samples:

1) Validate the assumption that a subset of congeners is an appropriate surrogate for total PCBs by 209 congeners given the different source areas and environments at the island; and

2) Determine if the analytical methods used are technically representative of total PCB congeners present (by analysis of either 46, 141 or 209 congeners).

To accomplish these objectives, Oregon DEQ identified samples that represented different source areas and bathymetry, as well as those that had the most significant difference in results considering rejected or N-qualified data.

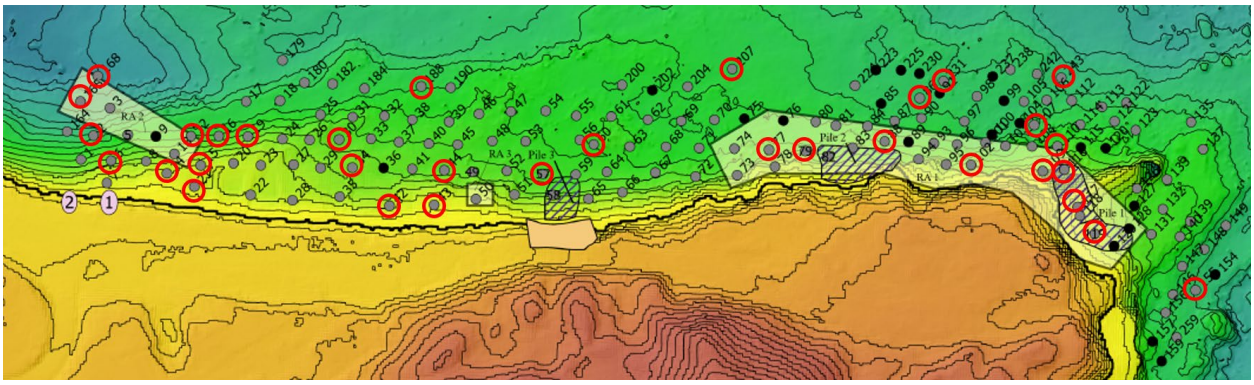
The 35 samples USACE proposes for full 209 analysis is presented in Table 1. This list of 35 samples also includes 20 samples proposed by Oregon DEQ.

Table 1. Samples proposed by USACE and/or Oregon DEQ for full 209 analysis along with associated concentrations

Number	Sample ID	Cpolymer (ug/kg) with N=estimated value	Identified by:
1.	155	41.91	ODEQ/USACE
2.	119	111.17	ODEQ/USACE
3.	117	78.94	ODEQ/USACE
4.	116	41.28	ODEQ
5.	110	7.46	ODEQ
6.	107	5.99	ODEQ
7.	243	4.81	ODEQ
8.	231	7.64	ODEQ
9.	88	26.43	ODEQ
10.	79	55.89	ODEQ/USACE
11.	207	6.92	ODEQ
12.	60	28.48	ODEQ
13.	57	34.55	ODEQ
14.	44	23.09	ODEQ
15.	188	12.54	ODEQ
16.	42	46.30	ODEQ/USACE
17.	30	27.70	ODEQ
18.	21	57.66	ODEQ/USACE
19.	12	25.34	ODEQ
20.	165	59.49	ODEQ/USACE
21.	SW40	38.30	ODEQ
22.	14	53.89	USACE
23.	43	43.22	USACE
24.	15	41.35	USACE
25.	86	40.91	USACE
26.	109	39.69	USACE
27.	2	38.18	USACE
28.	34	36.78	USACE
29.	168	34.13	USACE
30.	19	31.66	USACE
31.	6	31.26	USACE
32.	102	31.07	USACE

33.	16	29.96	USACE
34.	77	28.94	USACE
35.	SW156	30.56	USACE

These 35 samples proposed for full 209 analysis also provide good spatial representation across the sampling area. Map 1 depicts the spatial distribution of the 35 samples proposed for full 209 analysis. USACE considers that spatial representation is important to capture potentially different signatures from different sources of PCB contamination that could vary spatially across the sampling area. For example, samples 14, 15, and 21 are on the western end of the sampling area and could have potentially different signatures of PCBs compared to samples 117 and 119 on the eastern tip of the sampling area, since they may have different sources due to their spatial separation. Capturing this potential variability in PCB sources and associated signatures will help to ensure all congeners are accounted for.



Map 1. Location of 35 samples proposed by USACE for full 209 congener analysis (red circles)

USACE is requesting confirmation from the TAG on this proposal of 35 samples for full 209 analysis. Confirmation is requested from the TAG via email no later than **29 September 2021**.

APPENDIX B

Analytical Results and Calculated Polymer Concentrations, Texas Tech

(Provided as a separate Microsoft Excel file)

APPENDIX C

Analytical Results and Calculated Polymer Concentrations, Eurofins

(Provided as a separate Microsoft Excel file)

APPENDIX D

Data Validation Report for Eurofins Results

LABORATORY DATA CONSULTANTS, INC.
2701 Loker Ave. West, Suite 220, Carlsbad, CA 92010 Bus: 760-827-1100 Fax: 760-827-1099

USACE Seattle District
4735 East Marginal Way South
Seattle, WA 98134
ATTN: Ms. Kristen Kerns
Kristen.Kerns@usace.army.mil

March 17, 2022

SUBJECT: Bradford Island - Data Validation

Dear Ms. Kerns,

Enclosed are the final validation reports for the fractions listed below. This SDG was received on February 4, 2022. Attachment 1 is a summary of the samples that were reviewed for each analysis.

LDC Project #53362:

SDG #	Fraction
140-25554-1 140-25555-1	Polychlorinated Biphenyls as Congeners

The data validation was performed under Stage 2A guidelines. The analysis were validated using the following documents, as applicable to each method:

- U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.3 (2019)

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

Sincerely,

Christina Rink

Christina Rink
crink@lab-data.com
Project Manager/Senior Chemist

Attachment 1

	Stage 2A EDD	LDC# 53362 (USACE Seattle District - Seattle, WA / Bradford Island)																																					
LDC	SDG#	DATE REC'D	(3) DATE DUE	PCB Cong. (1668A)																																			
Matrix:	Water/Soil			W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S
A	140-25554-1	02/04/22	02/28/22	15	0																																		
B	140-25555-1	02/04/22	02/28/22	20	0																																		
Total	T/KK			35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	35

Shaded cells indicate Stage 4 validation (all other cells are Stage 2A validation). These sample counts do not include MS/MSD, DUPs, and field QC \TLC\ENFUSACE Seattle\Bradford Island\53362ST.wpd

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Bradford Island

LDC Report Date: March 16, 2022

Parameters: Polychlorinated Biphenyls as Congeners

Validation Level: Stage 2A

Laboratory: Eurofins, Knoxville, TN

Sample Delivery Group (SDG): 140-25554-1

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
19-7	140-25554-1	Water	11/22/21
18-7	140-25554-2	Water	11/22/21
18-5	140-25554-3	Water	11/22/21
6-3	140-25554-4	Water	11/22/21
10-7	140-25554-5	Water	11/22/21
14-7	140-25554-6	Water	11/22/21
18-4	140-25554-7	Water	11/22/21
17-7	140-25554-8	Water	11/22/21
9-8	140-25554-9	Water	11/22/21
5-3	140-25554-10	Water	11/22/21
21-4	140-25554-11	Water	11/22/21
9-3	140-25554-12	Water	11/22/21
4-2	140-25554-13	Water	11/22/21
3-6	140-25554-14	Water	11/22/21
22-7	140-25554-15	Water	11/22/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.3 (2019). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Biphenyls (PCBs) as Congeners by Environmental Protection Agency (EPA) Method 1668A

All sample results were subjected to Stage 2A data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

X (Exclusion of data recommended): The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Exclusion of the data is recommended.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance check data were not reviewed for Stage 2A validation.

III. Initial Calibration and Initial Calibration Verification

Initial calibration data were not reviewed for Stage 2A validation.

IV. Continuing Calibration

Continuing calibration data were not reviewed for Stage 2A validation.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Extraction Date	Analyte	Concentration	Associated Samples
MB 140-57145/17-A	09/21/21	PCB-183 PCB-185	0.00629 ng/Sample 0.00629 ng/Sample	All samples in SDG 140-25554-1

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater (>5X blank contaminants) than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Analyte	Reported Concentration	Modified Final Concentration
19-7	PCB-183 PCB-185	0.018 ng/Sample 0.018 ng/Sample	0.018U ng/Sample 0.018U ng/Sample
18-5	PCB-183 PCB-185	0.019 ng/Sample 0.019 ng/Sample	0.019U ng/Sample 0.019U ng/Sample
6-3	PCB-183 PCB-185	0.004 ng/Sample 0.004 ng/Sample	0.004U ng/Sample 0.004U ng/Sample
10-7	PCB-183 PCB-185	0.015 ng/Sample 0.015 ng/Sample	0.015U ng/Sample 0.015U ng/Sample

Sample	Analyte	Reported Concentration	Modified Final Concentration
14-7	PCB-183 PCB-185	0.017 ng/Sample 0.017 ng/Sample	0.017U ng/Sample 0.017U ng/Sample
18-4	PCB-183 PCB-185	0.0082 ng/Sample 0.0082 ng/Sample	0.0082U ng/Sample 0.0082U ng/Sample
17-7	PCB-183 PCB-185	0.0027 ng/Sample 0.0027 ng/Sample	0.0027U ng/Sample 0.0027U ng/Sample
9-8	PCB-183 PCB-185	0.0051 ng/Sample 0.0051 ng/Sample	0.0051U ng/Sample 0.0051U ng/Sample
3-6	PCB-183 PCB-185	0.0067 ng/Sample 0.0067 ng/Sample	0.0067U ng/Sample 0.0067U ng/Sample
22-7	PCB-183 PCB-185	0.0096 ng/Sample 0.0096 ng/Sample	0.0096U ng/Sample 0.0096U ng/Sample

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VIII. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Labeled Compounds

Labeled compounds data were not reviewed for Stage 2A validation.

XI. Target Analyte Quantitation

All target analyte quantitations were within validation criteria with the following exceptions:

Sample	Analyte	Flag	A or P
All samples in SDG 140-25554-1	Results flagged "q" by the laboratory as estimated maximum possible concentration (EMPC).	J (all detects)	A

Raw data were not reviewed for Stage 2A validation.

XII. Target Analyte Identification

Raw data were not reviewed for Stage 2A validation.

XIII. System Performance

Raw data were not reviewed for Stage 2A validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to results reported by the laboratory as EMPCs, data were qualified as estimated in fifteen samples.

Due to laboratory blank contamination, data were qualified as not detected in ten samples.

Bradford Island
Polychlorinated Biphenyls as Congeners - Data Qualification Summary - SDG 140-25554-1

Sample	Analyte	Flag	A or P	Reason
19-7 18-7 18-5 6-3 10-7 14-7 18-4 17-7 9-8 5-3 21-4 9-3 4-2 3-6 22-7	Results flagged "q" by the laboratory as estimated maximum possible concentration (EMPC).	J (all detects)	A	Target analyte quantitation (EMPC)

Bradford Island
Polychlorinated Biphenyls as Congeners - Laboratory Blank Data Qualification Summary - SDG 140-25554-1

Sample	Analyte	Modified Final Concentration	A or P
19-7	PCB-183 PCB-185	0.018U ng/Sample 0.018U ng/Sample	A
18-5	PCB-183 PCB-185	0.019U ng/Sample 0.019U ng/Sample	A
6-3	PCB-183 PCB-185	0.004U ng/Sample 0.004U ng/Sample	A
10-7	PCB-183 PCB-185	0.015U ng/Sample 0.015U ng/Sample	A
14-7	PCB-183 PCB-185	0.017U ng/Sample 0.017U ng/Sample	A
18-4	PCB-183 PCB-185	0.0082U ng/Sample 0.0082U ng/Sample	A
17-7	PCB-183 PCB-185	0.0027U ng/Sample 0.0027U ng/Sample	A
9-8	PCB-183 PCB-185	0.0051U ng/Sample 0.0051U ng/Sample	A

Sample	Analyte	Modified Final Concentration	A or P
3-6	PCB-183 PCB-185	0.0067U ng/Sample 0.0067U ng/Sample	A
22-7	PCB-183 PCB-185	0.0096U ng/Sample 0.0096U ng/Sample	A

Bradford Island
Polychlorinated Biphenyls as Congeners - Field Blank Data Qualification Summary - SDG 140-25554-1

No Sample Data Qualified in this SDG

LDC #: 53362A31 **VALIDATION COMPLETENESS WORKSHEET** Date: 3/1/22
SDG #: 140-25554-1 Stage 2A Page: 1 of 1
Laboratory: Eurofins, Knoxville, TN Reviewer: A
2nd Reviewer:

METHOD: HRGC/HRMS Polychlorinated Biphenyl Congeners (EPA Method 1668A)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	HRGC/HRMS Instrument performance check	N	
III.	Initial calibration/ICV	N/N	
IV.	Continuing calibration	N	
V.	Laboratory Blanks	SW	
VI.	Field blanks	N	
VII.	Matrix spike/Matrix spike duplicates	N	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	N	
X.	Labeled Compounds	N SW	
XI.	Target analyte quantitation	SW	Results flagged "q" as EMPC - Jlek/A
XII.	Target analyte identification	N	
XIII.	System performance	N	
XIV.	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

*LDPE Solvent Extract per COC

	Client ID	Lab ID	Matrix *	Date
1	19-7	140-25554-1	Water	11/22/21
2	18-7	140-25554-2	Water	11/22/21
3	18-5	140-25554-3	Water	11/22/21
4	6-3	140-25554-4	Water	11/22/21
5	10-7	140-25554-5	Water	11/22/21
6	14-7	140-25554-6	Water	11/22/21
7	18-4	140-25554-7	Water	11/22/21
8	17-7	140-25554-8	Water	11/22/21
9	9-8	140-25554-9	Water	11/22/21
10	5-3	140-25554-10	Water	11/22/21
11	21-4	140-25554-11	Water	11/22/21
12	9-3	140-25554-12	Water	11/22/21
13	4-2	140-25554-13	Water	11/22/21
14	3-6	140-25554-14	Water	11/22/21
15	22-7	140-25554-15	Water	11/22/21

5/14/5

LDC#: 53362A31

VALIDATION FINDINGS WORKSHEET
Blanks

Reviewer: SC

METHOD: HRGC/HRMS PCB (EPA Method 1668A)

Extraction Date: 9/21/21 **Associated samples:** All Qualify U

Analyte	Blank ID (ng/Sample)	Sample Identification									
	MB 140-57145/17-A	Lab qual	5X	1	3	4	5	6	7	8	9
PCB-183	0.00629	JC	0.03145	0.018	0.019	0.004	0.015	0.017	0.0082	0.0027	0.0051
PCB-185	0.00629	JC	0.03145	0.018	0.019	0.004	0.015	0.017	0.0082	0.0027	0.0051

Analyte	Blank ID (ng/Sample)	Sample Identification									
	MB 140-57145/17-A	Lab qual	5X	14	15						
PCB-183	0.00629	JC	0.03145	0.0067	0.0096						
PCB-185	0.00629	JC	0.03145	0.0067	0.0096						

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Bradford Island

LDC Report Date: March 16, 2022

Parameters: Polychlorinated Biphenyls as Congeners

Validation Level: Stage 2A

Laboratory: Eurofins, Knoxville, TN

Sample Delivery Group (SDG): 140-25555-1

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
3-2	140-25555-1	Water	11/22/21
7-4	140-25555-2	Water	11/22/21
1-3	140-25555-3	Water	11/22/21
6-7	140-25555-4	Water	11/22/21
17-1	140-25555-5	Water	11/22/21
SW8-1	140-25555-6	Water	11/22/21
1-2	140-25555-7	Water	11/22/21
3-4	140-25555-8	Water	11/22/21
1-8	140-25555-9	Water	11/22/21
14-3	140-25555-10	Water	11/22/21
6-2	140-25555-11	Water	11/22/21
11-5	140-25555-12	Water	11/22/21
2-8	140-25555-13	Water	11/22/21
17-2	140-25555-14	Water	11/22/21
7-5	140-25555-15	Water	11/22/21
1-7	140-25555-16	Water	11/22/21
6-1	140-25555-17	Water	11/22/21
6-8	140-25555-18	Water	11/22/21
9-7	140-25555-19	Water	11/22/21
SW19-6	140-25555-20	Water	11/22/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.3 (2019). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Biphenyls (PCBs) as Congeners by Environmental Protection Agency (EPA) Method 1668A

All sample results were subjected to Stage 2A data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

X (Exclusion of data recommended): The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Exclusion of the data is recommended.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance check data were not reviewed for Stage 2A validation.

III. Initial Calibration and Initial Calibration Verification

Initial calibration data were not reviewed for Stage 2A validation.

IV. Continuing Calibration

Continuing calibration data were not reviewed for Stage 2A validation.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Extraction Date	Analyte	Concentration	Associated Samples
MB 140-57148/22-A	12/16/21	PCB-20	0.00214 ng/Sample	All samples in SDG 140-25555-1
		PCB-28	0.00214 ng/Sample	
		PCB-32	0.00148 ng/Sample	
		PCB-40	0.00168 ng/Sample	
		PCB-41	0.00168 ng/Sample	
		PCB-44	0.00399 ng/Sample	
		PCB-47	0.00399 ng/Sample	
		PCB-61	0.00204 ng/Sample	
		PCB-65	0.00399 ng/Sample	
		PCB-66	0.000583 ng/Sample	
		PCB-70	0.00204 ng/Sample	
		PCB-71	0.00168 ng/Sample	
		PCB-74	0.00204 ng/Sample	
		PCB-76	0.00204 ng/Sample	
		PCB-183	0.00501 ng/Sample	
		PCB-185	0.00501 ng/Sample	
		PCB-200	0.00212 ng/Sample	

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater (>5X blank contaminants) than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Analyte	Reported Concentration	Modified Final Concentration
3-2	PCB-32	0.0042 ng/Sample	0.0042U ng/Sample
	PCB-40	0.007 ng/Sample	0.007U ng/Sample
	PCB-41	0.007 ng/Sample	0.007U ng/Sample
	PCB-71	0.007 ng/Sample	0.007U ng/Sample
	PCB-74	0.055 ng/Sample	0.055U ng/Sample
	PCB-183	0.052 ng/Sample	0.052U ng/Sample
	PCB-200	0.0068 ng/Sample	0.0068U ng/Sample
7-4	PCB-32	0.0058 ng/Sample	0.0058U ng/Sample
	PCB-40	0.0077 ng/Sample	0.0077U ng/Sample
	PCB-41	0.0077 ng/Sample	0.0077U ng/Sample
	PCB-71	0.0077 ng/Sample	0.0077U ng/Sample
	PCB-74	0.026 ng/Sample	0.026U ng/Sample
	PCB-183	0.0097 ng/Sample	0.0097U ng/Sample
	PCB-185	0.0097 ng/Sample	0.0097U ng/Sample
1-3	PCB-74	0.092 ng/Sample	0.092U ng/Sample
	PCB-183	0.016 ng/Sample	0.016U ng/Sample
	PCB-185	0.016 ng/Sample	0.016U ng/Sample
	PCB-200	0.0029 ng/Sample	0.0029U ng/Sample
6-7	PCB-32	0.0044 ng/Sample	0.0044U ng/Sample
	PCB-74	0.12 ng/Sample	0.12U ng/Sample
	PCB-183	0.021 ng/Sample	0.021U ng/Sample
	PCB-185	0.021 ng/Sample	0.021U ng/Sample
17-1	PCB-20	0.0054 ng/Sample	0.0054U ng/Sample
	PCB-28	0.0054 ng/Sample	0.0054U ng/Sample
	PCB-32	0.0028 ng/Sample	0.0028U ng/Sample
	PCB-40	0.0042 ng/Sample	0.0042U ng/Sample
	PCB-41	0.0042 ng/Sample	0.0042U ng/Sample
	PCB-44	0.019 ng/Sample	0.019U ng/Sample
	PCB-47	0.019 ng/Sample	0.019U ng/Sample
	PCB-65	0.019 ng/Sample	0.019U ng/Sample
	PCB-71	0.0042 ng/Sample	0.0042U ng/Sample
	PCB-74	0.024 ng/Sample	0.024U ng/Sample
	PCB-183	0.035 ng/Sample	0.035U ng/Sample
	PCB-200	0.0059 ng/Sample	0.0059U ng/Sample
SW8-1	PCB-20	0.009 ng/Sample	0.009U ng/Sample
	PCB-28	0.009 ng/Sample	0.009U ng/Sample
	PCB-32	0.0048 ng/Sample	0.0048U ng/Sample
	PCB-44	0.018 ng/Sample	0.018U ng/Sample
	PCB-47	0.018 ng/Sample	0.018U ng/Sample
	PCB-65	0.018 ng/Sample	0.018U ng/Sample
	PCB-74	0.029 ng/Sample	0.029U ng/Sample
	PCB-183	0.0096 ng/Sample	0.0096U ng/Sample
	PCB-185	0.0096 ng/Sample	0.0096U ng/Sample
1-2	PCB-32	0.0027 ng/Sample	0.0027U ng/Sample
	PCB-74	0.065 ng/Sample	0.065U ng/Sample
	PCB-183	0.028 ng/Sample	0.028U ng/Sample
1-8	PCB-74	0.025 ng/Sample	0.025U ng/Sample
	PCB-183	0.023 ng/Sample	0.023U ng/Sample
	PCB-185	0.023 ng/Sample	0.023U ng/Sample

Sample	Analyte	Reported Concentration	Modified Final Concentration
14-3	PCB-74 PCB-183 PCB-185	0.072 ng/Sample 0.011 ng/Sample 0.011 ng/Sample	0.072U ng/Sample 0.011U ng/Sample 0.011U ng/Sample
6-2	PCB-74 PCB-183 PCB-185	0.28 ng/Sample 0.017 ng/Sample 0.017 ng/Sample	0.28U ng/Sample 0.017U ng/Sample 0.017U ng/Sample
11-5	PCB-32 PCB-74 PCB-183	0.0024 ng/Sample 0.14 ng/Sample 0.042 ng/Sample	0.0024U ng/Sample 0.14U ng/Sample 0.042U ng/Sample
2-8	PCB-20 PCB-28 PCB-32 PCB-74 PCB-183 PCB-185	0.010 ng/Sample 0.010 ng/Sample 0.0052 ng/Sample 0.081 ng/Sample 0.013 ng/Sample 0.013 ng/Sample	0.010U ng/Sample 0.010U ng/Sample 0.0052U ng/Sample 0.081U ng/Sample 0.013U ng/Sample 0.013U ng/Sample
17-2	PCB-20 PCB-28 PCB-32 PCB-74 PCB-183	0.0087 ng/Sample 0.0087 ng/Sample 0.0047 ng/Sample 0.037 ng/Sample 0.034 ng/Sample	0.0087U ng/Sample 0.0087U ng/Sample 0.0047U ng/Sample 0.037U ng/Sample 0.034U ng/Sample
7-5	PCB-20 PCB-28 PCB-32 PCB-40 PCB-41 PCB-71 PCB-74 PCB-183 PCB-185 PCB-200	0.0073 ng/Sample 0.0073 ng/Sample 0.0042 ng/Sample 0.0044 ng/Sample 0.0044 ng/Sample 0.0044 ng/Sample 0.031 ng/Sample 0.022 ng/Sample 0.022 ng/Sample 0.0041 ng/Sample	0.0073U ng/Sample 0.0073U ng/Sample 0.0042U ng/Sample 0.0044U ng/Sample 0.0044U ng/Sample 0.0044U ng/Sample 0.031U ng/Sample 0.022U ng/Sample 0.022U ng/Sample 0.0041U ng/Sample
1-7	PCB-20 PCB-28 PCB-32 PCB-40 PCB-41 PCB-71 PCB-74 PCB-183 PCB-185	0.0082 ng/Sample 0.0082 ng/Sample 0.002 ng/Sample 0.0059 ng/Sample 0.0059 ng/Sample 0.0059 ng/Sample 0.041 ng/Sample 0.009 ng/Sample 0.009 ng/Sample	0.0082U ng/Sample 0.0082U ng/Sample 0.002U ng/Sample 0.0059U ng/Sample 0.0059U ng/Sample 0.0059U ng/Sample 0.041U ng/Sample 0.009U ng/Sample 0.009U ng/Sample
6-1	PCB-74 PCB-183 PCB-185 PCB-200	0.082 ng/Sample 0.0089 ng/Sample 0.0089 ng/Sample 0.0040 ng/Sample	0.082U ng/Sample 0.0089U ng/Sample 0.0089U ng/Sample 0.0040U ng/Sample
9-7	PCB-74	0.11 ng/Sample	0.11U ng/Sample

Sample	Analyte	Reported Concentration	Modified Final Concentration
SW19-6	PCB-20	0.0099 ng/Sample	0.0099U ng/Sample
	PCB-28	0.0099 ng/Sample	0.0099U ng/Sample
	PCB-32	0.0049 ng/Sample	0.0049U ng/Sample
	PCB-74	0.043 ng/Sample	0.043U ng/Sample
	PCB-183	0.011 ng/Sample	0.011U ng/Sample
	PCB-185	0.011 ng/Sample	0.011U ng/Sample

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VIII. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Labeled Compounds

Labeled compounds data were not reviewed for Stage 2A validation.

XI. Target Analyte Quantitation

All target analyte quantitations were within validation criteria with the following exceptions:

Sample	Analyte	Flag	A or P
All samples in SDG 140-25555-1	Results flagged "q" by the laboratory as estimated maximum possible concentration (EMPC).	J (all detects)	A

Raw data were not reviewed for Stage 2A validation.

XII. Target Analyte Identification

Raw data were not reviewed for Stage 2A validation.

XIII. System Performance

Raw data were not reviewed for Stage 2A validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to results reported by the laboratory as EMPCs, data were qualified as estimated in twenty samples.

Due to laboratory blank contamination, data were qualified as not detected in eighteen samples.

Bradford Island
Polychlorinated Biphenyls as Congeners - Data Qualification Summary - SDG 140-25555-1

Sample	Analyte	Flag	A or P	Reason
3-2 7-4 1-3 6-7 17-1 SW8-1 1-2 3-4 1-8 14-3 6-2 11-5 2-8 17-2 7-5 1-7 6-1 6-8 9-7 SW19-6	Results flagged "q" by the laboratory as estimated maximum possible concentration (EMPC).	J (all detects)	A	Target analyte quantitation (EMPC)

Bradford Island
Polychlorinated Biphenyls as Congeners - Laboratory Blank Data Qualification Summary - SDG 140-25555-1

Sample	Analyte	Modified Final Concentration	A or P
3-2	PCB-32 PCB-40 PCB-41 PCB-71 PCB-74 PCB-183 PCB-200	0.0042U ng/Sample 0.007U ng/Sample 0.007U ng/Sample 0.007U ng/Sample 0.055U ng/Sample 0.052U ng/Sample 0.0068U ng/Sample	A
7-4	PCB-32 PCB-40 PCB-41 PCB-71 PCB-74 PCB-183 PCB-185	0.0058U ng/Sample 0.0077U ng/Sample 0.0077U ng/Sample 0.0077U ng/Sample 0.026U ng/Sample 0.0097U ng/Sample 0.0097U ng/Sample	A
1-3	PCB-74 PCB-183 PCB-185 PCB-200	0.092U ng/Sample 0.016U ng/Sample 0.016U ng/Sample 0.0029U ng/Sample	A
6-7	PCB-32 PCB-74 PCB-183 PCB-185	0.0044U ng/Sample 0.12U ng/Sample 0.021U ng/Sample 0.021U ng/Sample	A

Sample	Analyte	Modified Final Concentration	A or P
17-1	PCB-20 PCB-28 PCB-32 PCB-40 PCB-41 PCB-44 PCB-47 PCB-65 PCB-71 PCB-74 PCB-183 PCB-200	0.0054U ng/Sample 0.0054U ng/Sample 0.0028U ng/Sample 0.0042U ng/Sample 0.0042U ng/Sample 0.019U ng/Sample 0.019U ng/Sample 0.019U ng/Sample 0.0042U ng/Sample 0.024U ng/Sample 0.035U ng/Sample 0.0059U ng/Sample	A
SW8-1	PCB-20 PCB-28 PCB-32 PCB-44 PCB-47 PCB-65 PCB-74 PCB-183 PCB-185	0.009U ng/Sample 0.009U ng/Sample 0.0048U ng/Sample 0.018U ng/Sample 0.018U ng/Sample 0.018U ng/Sample 0.029U ng/Sample 0.0096U ng/Sample 0.0096U ng/Sample	A
1-2	PCB-32 PCB-74 PCB-183	0.0027U ng/Sample 0.065U ng/Sample 0.028U ng/Sample	A
1-8	PCB-74 PCB-183 PCB-185	0.025U ng/Sample 0.023U ng/Sample 0.023U ng/Sample	A
14-3	PCB-74 PCB-183 PCB-185	0.072U ng/Sample 0.011U ng/Sample 0.011U ng/Sample	A
6-2	PCB-74 PCB-183 PCB-185	0.28U ng/Sample 0.017U ng/Sample 0.017U ng/Sample	A
11-5	PCB-32 PCB-74 PCB-183	0.0024U ng/Sample 0.14U ng/Sample 0.042U ng/Sample	A
2-8	PCB-20 PCB-28 PCB-32 PCB-74 PCB-183 PCB-185	0.010U ng/Sample 0.010U ng/Sample 0.0052U ng/Sample 0.081U ng/Sample 0.013U ng/Sample 0.013U ng/Sample	A
17-2	PCB-20 PCB-28 PCB-32 PCB-74 PCB-183	0.0087U ng/Sample 0.0087U ng/Sample 0.0047U ng/Sample 0.037U ng/Sample 0.034U ng/Sample	A

Sample	Analyte	Modified Final Concentration	A or P
7-5	PCB-20 PCB-28 PCB-32 PCB-40 PCB-41 PCB-71 PCB-74 PCB-183 PCB-185 PCB-200	0.0073U ng/Sample 0.0073U ng/Sample 0.0042U ng/Sample 0.0044U ng/Sample 0.0044U ng/Sample 0.0044U ng/Sample 0.031U ng/Sample 0.022U ng/Sample 0.022U ng/Sample 0.0041U ng/Sample	A
1-7	PCB-20 PCB-28 PCB-32 PCB-40 PCB-41 PCB-71 PCB-74 PCB-183 PCB-185	0.0082U ng/Sample 0.0082U ng/Sample 0.002U ng/Sample 0.0059U ng/Sample 0.0059U ng/Sample 0.0059U ng/Sample 0.041U ng/Sample 0.009U ng/Sample 0.009U ng/Sample	A
6-1	PCB-74 PCB-183 PCB-185 PCB-200	0.082U ng/Sample 0.0089U ng/Sample 0.0089U ng/Sample 0.0040U ng/Sample	A
9-7	PCB-74	0.11U ng/Sample	A
SW19-6	PCB-20 PCB-28 PCB-32 PCB-74 PCB-183 PCB-185	0.0099U ng/Sample 0.0099U ng/Sample 0.0049U ng/Sample 0.043U ng/Sample 0.011U ng/Sample 0.011U ng/Sample	A

Bradford Island
Polychlorinated Biphenyls as Congeners - Field Blank Data Qualification Summary - SDG 140-25555-1

No Sample Data Qualified in this SDG

LDC #: 53362B31 **VALIDATION COMPLETENESS WORKSHEET** Date: 3/1/22
SDG #: 140-25555-1 Stage 2A Page: 1 of 2
Laboratory: Eurofins, Knoxville, TN Reviewer: A
2nd Reviewer: C

METHOD: HRGC/HRMS Polychlorinated Biphenyl Congeners (EPA Method 1668A)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	HRGC/HRMS Instrument performance check	N	
III.	Initial calibration/ICV	N/N	
IV.	Continuing calibration	N	
V.	Laboratory Blanks	SW	
VI.	Field blanks	N	
VII.	Matrix spike/Matrix spike duplicates	N	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	N	
X.	Labeled Compounds	N SW	
XI.	Target analyte quantitation	SW N	Results flagged "J" as EMPC - Jake/A
XII.	Target analyte identification	N	
XIII.	System performance	N	
XIV.	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

* LDPE Solvent Extract per COC

	Client ID	Lab ID	Matrix *	Date
1	3-2	140-25555-1	Water	11/22/21
2	7-4	140-25555-2	Water	11/22/21
3	1-3	140-25555-3	Water	11/22/21
4	6-7	140-25555-4	Water	11/22/21
5	17-1	140-25555-5	Water	11/22/21
6	SW8-1	140-25555-6	Water	11/22/21
7	1-2	140-25555-7	Water	11/22/21
8	3-4	140-25555-8	Water	11/22/21
9	1-8	140-25555-9	Water	11/22/21
10	14-3	140-25555-10	Water	11/22/21
11	6-2	140-25555-11	Water	11/22/21
12	11-5	140-25555-12	Water	11/22/21
13	2-8	140-25555-13	Water	11/22/21
14	17-2	140-25555-14	Water	11/22/21
15	7-5	140-25555-15	Water	11/22/21

LDC #: 53362B31 **VALIDATION COMPLETENESS WORKSHEET** Date: 3/1/22

SDG #: 140-25555-1 Stage 2A Page: 2 of 2

Laboratory: Eurofins, Knoxville, TN Reviewer: M

2nd Reviewer:

METHOD: HRGC/HRMS Polychlorinated Biphenyl Congeners (EPA Method 1668A)

	Client ID	Lab ID	Matrix	Date
16	1-7	140-25555-16	Water	11/22/21
17	6-1	140-25555-17	Water	11/22/21
18	6-8	140-25555-18	Water	11/22/21
19	9-7	140-25555-19	Water	11/22/21
20	SW19-6	140-25555-20	Water	11/22/21
21				
22				
23				

Notes:

	57148						

LDC#: 53362B31

VALIDATION FINDINGS WORKSHEET
Blanks

Reviewer: SC

METHOD: HRGC/HRMS PCB (EPA Method 1668A)

Extraction Date: 12/16/21 **Associated samples:** ALL Qualify U

Analyte	Blank ID (ng/Sample)	Sample Identification									
	MB 140-57148/22-A	Lab qual	5X	1	2	3	4	5	6	7	8
PCB-20	0.00214	JC	0.0107					0.0054	0.009		
PCB-28	0.00214	JC	0.0107					0.0054	0.009		
PCB-32	0.00148	JQ	0.0074	0.0042	0.0058		0.0044	0.0028	0.0048	0.0027	
PCB-40	0.00168	JQC	0.0084	0.007	0.0077			0.0042			
PCB-41	0.00168	JQC	0.0084	0.007	0.0077			0.0042			
PCB-44	0.00399	JQC	0.01995					0.019	0.018		
PCB-47	0.00399	JQC	0.01995					0.019	0.018		
PCB-61	0.00204	JQC	0.0102								
PCB-65	0.00399	JQC	0.01995					0.019	0.018		
PCB-66	0.000583	JQ	0.002915								
PCB-70	0.00204	JQC	0.0102								
PCB-71	0.00168	JQC	0.0084	0.007	0.0077			0.0042			
PCB-74	0.00204	JQC	0.0102	0.055	0.026	0.092	0.12	0.024	0.029	0.065	
PCB-76	0.00204	JQC	0.0102								
PCB-183	0.00501	JC	0.02505	0.052	0.0097	0.016	0.021	0.035	0.0096	0.028	
PCB-185	0.00501	JC	0.02505		0.0097	0.016	0.021		0.0096		
PCB-200	0.00212	J	0.0106	0.0068		0.0029		0.0059			

Analyte	Blank ID (ng/Sample)	Sample Identification									
	MB 140-57148/22-A	Lab qual	5X	9	10	11	12	13	14	15	16
PCB-20	0.00214	JC	0.0107					0.010	0.0087	0.0073	0.0082
PCB-28	0.00214	JC	0.0107					0.010	0.0087	0.0073	0.0082
PCB-32	0.00148	JQ	0.0074				0.0024	0.0052	0.0047	0.0042	0.002
PCB-40	0.00168	JQC	0.0084							0.0044	0.0059
PCB-41	0.00168	JQC	0.0084							0.0044	0.0059
PCB-44	0.00399	JQC	0.01995								
PCB-47	0.00399	JQC	0.01995								
PCB-61	0.00204	JQC	0.0102								
PCB-65	0.00399	JQC	0.01995								
PCB-66	0.000583	JQ	0.002915								
PCB-70	0.00204	JQC	0.0102								
PCB-71	0.00168	JQC	0.0084							0.0044	0.0059
PCB-74	0.00204	JQC	0.0102	0.025	0.072	0.28	0.14	0.081	0.037	0.031	0.041
PCB-76	0.00204	JQC	0.0102								
PCB-183	0.00501	JC	0.02505	0.023	0.011	0.017	0.042	0.013	0.034	0.022	0.009
PCB-185	0.00501	JC	0.02505	0.023	0.011	0.017		0.013		0.022	0.009
PCB-200	0.00212	J	0.0106							0.0041	

LDC#: 53362B31

VALIDATION FINDINGS WORKSHEET
Blanks

Reviewer: SC

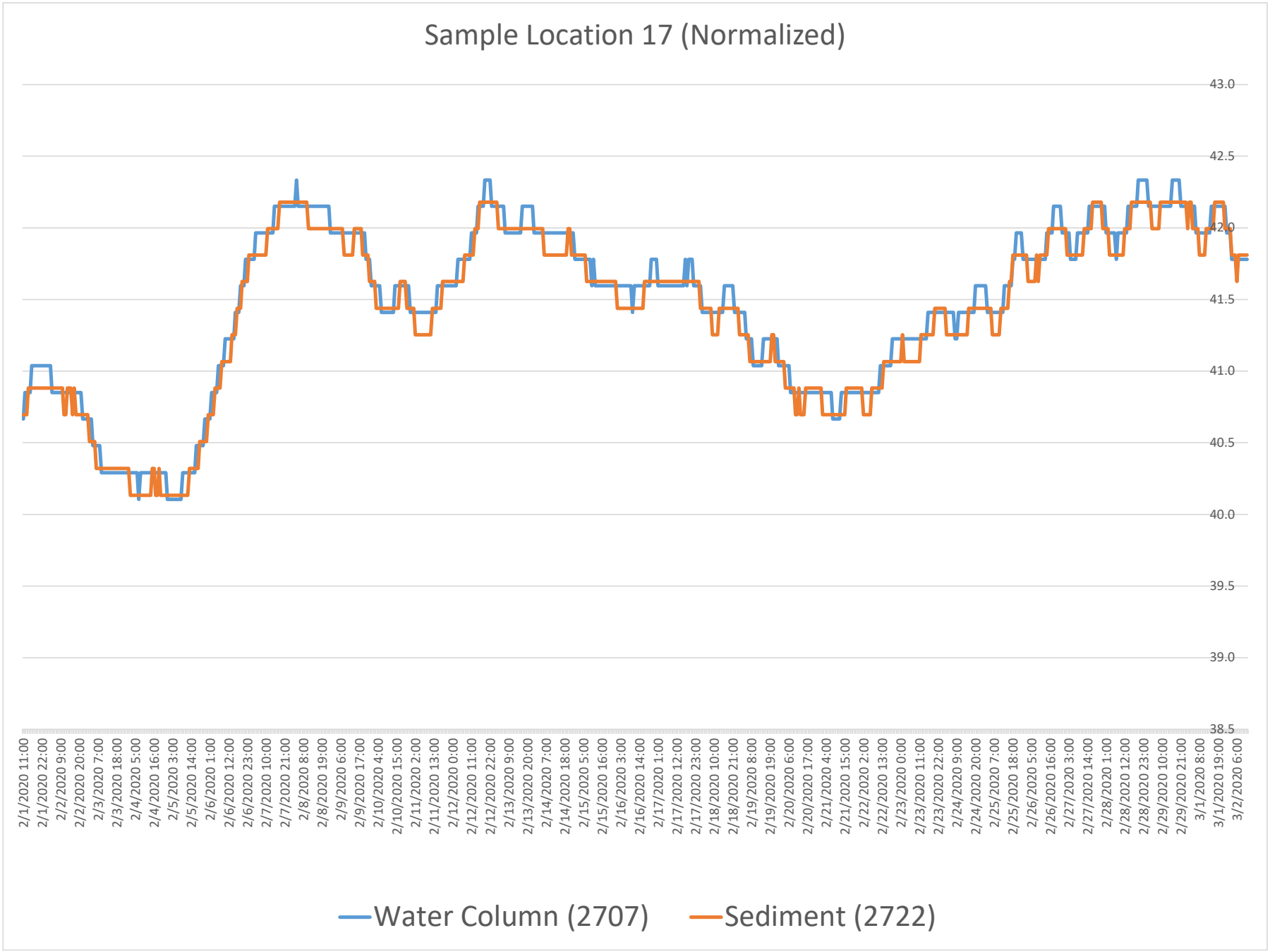
METHOD: HRGC/HRMS PCB (EPA Method 1668A)

Extraction Date: 12/16/21 **Associated samples:** ALL Qualify U

Analyte	Blank ID (ng/Sample)	Sample Identification									
	MB 140-57148/22-A	Lab qual	5X	1	2	3	4	5	6	7	8
Analyte	Blank ID (ng/Sample)	Sample Identification									
	MB 140-57148/22-A	Lab qual	5X	17	18	19	20				
PCB-20	0.00214	JC	0.0107				0.0099				
PCB-28	0.00214	JC	0.0107				0.0099				
PCB-32	0.00148	JQ	0.0074				0.0049				
PCB-40	0.00168	JQC	0.0084								
PCB-41	0.00168	JQC	0.0084								
PCB-44	0.00399	JQC	0.01995								
PCB-47	0.00399	JQC	0.01995								
PCB-61	0.00204	JQC	0.0102								
PCB-65	0.00399	JQC	0.01995								
PCB-66	0.000583	JQ	0.002915								
PCB-70	0.00204	JQC	0.0102								
PCB-71	0.00168	JQC	0.0084								
PCB-74	0.00204	JQC	0.0102	0.082		0.11	0.043				
PCB-76	0.00204	JQC	0.0102								
PCB-183	0.00501	JC	0.02505	0.0089			0.011				
PCB-185	0.00501	JC	0.02505	0.0089			0.011				
PCB-200	0.00212	J	0.0106	0.0040							

APPENDIX E

Graphical Illustration of Temperature Data Logger River Bottom Versus Water Column


Sample Location 17 (Normalized)
43.0
42.5
42.0
41.5
41.0
40.5
40.0
39.5
39.0
38.5
2/1/2020 11:00
2/1/2020 22:00
2/2/2020 9:00
2/2/2020 20:00
2/3/2020 7:00
2/3/2020 18:00
2/4/2020 5:00
2/4/2020 16:00
2/5/2020 3:00
2/5/2020 14:00
2/6/2020 1:00
2/6/2020 12:00
2/6/2020 23:00
2/7/2020 10:00
2/7/2020 21:00
2/8/2020 8:00
2/8/2020 19:00
2/9/2020 6:00
2/9/2020 17:00
2/10/2020 4:00
2/10/2020 15:00
2/11/2020 2:00
2/11/2020 13:00
2/12/2020 0:00
2/12/2020 11:00
2/12/2020 22:00
2/13/2020 9:00
2/13/2020 20:00
2/14/2020 7:00
2/14/2020 18:00
2/15/2020 5:00
2/15/2020 16:00
2/16/2020 3:00
2/16/2020 14:00
2/17/2020 1:00
2/17/2020 12:00
2/17/2020 23:00
2/18/2020 10:00
2/18/2020 21:00
2/19/2020 8:00
2/19/2020 19:00
2/20/2020 6:00
2/20/2020 17:00
2/21/2020 4:00
2/21/2020 15:00
2/22/2020 2:00
2/22/2020 13:00
2/23/2020 0:00
2/23/2020 11:00
2/23/2020 22:00
2/24/2020 9:00
2/24/2020 20:00
2/25/2020 7:00
2/25/2020 18:00
2/26/2020 5:00
2/26/2020 16:00
2/27/2020 3:00
2/27/2020 14:00
2/28/2020 1:00
2/28/2020 12:00
2/28/2020 23:00
2/29/2020 10:00
2/29/2020 21:00
3/1/2020 8:00
3/1/2020 19:00
3/2/2020 6:00
Water Column (2707)
Sediment (2722)

APPENDIX F

Memorandum for Record, Re: Criteria for Evaluating PCB Congeners

FINAL
Memorandum for Record
Bradford Island, River Operable Unit
Prepared by USACE Seattle and Portland Districts
22 December 2021

Re: Criteria for Evaluating PCB Congeners

Per the Final QAPP for Passive Sampling, January 23, 2020, all samplers were analyzed for 46 PCB congeners by Texas Technical University. This subset of 46 congeners was selected based on the congeners that historically most contributed to total concentrations in various media in the Bradford Island River OU and to prioritize the ability to analyze many samples given the high-cost of PCB congener analysis. To provide additional data detail, USACE directed Texas Technical University to analyze a subset of samples for 141 congeners, and that subset of 141 congeners is Texas Technical University's standard full PCB congener analysis suite, based on calibrations standards created to capture congeners relevant to Aroclors. Texas Technical University does not analyze a full PCB congener analysis suite of 209 congeners. After finalization of the QAPP and at the request of external technical experts, a subset of samples will also be analyzed by a commercial laboratory with the capability to analyze 209 PCB congeners. A total of 35 samples were identified by USACE and Oregon DEQ for analysis of all 209 PCB congeners using EPA Method 1668C (see the 22 September 2021 memo for identification of these 35 samples).

The objective of analyzing all 209 PCB congeners in 35 samples is to confirm that the subset of 46congeners analyzed for in all samples (and/or 141 for a subset of samples) sufficiently represents the relative PCB concentration in those samples. In order to achieve this objective, USACE proposes evaluating the results using multiple statistical and qualitative methods. The results of these evaluations will be considered collectively to help inform how the data is used and interpreted as a line of evidence for identification of ongoing PCB sources of contamination near Bradford Island.

For purposes of this memo, all references to passive sampler PCB concentrations are in units of µg/kg polymer, also referred to as $C_{polymer}$. The total sums used in this memo vary between the use of N flagged data equal to zero and N flagged data equal to the estimated value. The differing use of N flagged data are noted in the examples provided in the memo.

Relative Order/Ranking of Samples
First, USACE will assess whether the relative ranking of the most elevated samples changes as a result of ranking samples by the sum total 209 congener concentrations compared to the current rankings based on the sum total of 46 and 141 congeners.

Some reordering of the relative ranking between samples is expected from the total sum of all 209 congeners relative to the ranking of samples using 46 or 141 congeners. The intent of evaluating the relative ranking is to assess which samples potentially 'fall out' of the top 10 and top 20 highest elevated samples. The results of the full 209 congener analysis will only be used to confirm those samples that show the highest relative concentrations within the dataset. This effort will not have a quantitative threshold for determining acceptability of the data, but will inform overall interpretation of the results.

Sample IDs		Cpolymer (ug/kg) with N=0			Cpolymer (ug/kg) with N=estimated value		
USACE ID	TTU ID	Total sum (ug/kg)	Aroclor 1254	Ecological	Total sum (ug/kg)	Aroclor 1254	Ecological
119	18-7	92.490	90.776	35.251	111.172	104.401	37.097
117	18-5	65.358	61.858	16.791	78.941	69.916	18.442
165	17-1	56.13	7.40	0.00	59.49	9.45	1.31
21	1-3	55.37	48.60	12.42	57.66	50.43	13.50
79	5-3	39.034	37.139	15.127	55.895	49.670	17.734
14	1-2	51.76	40.05	3.79	53.89	41.64	4.71
42	3-2	38.50	17.22	1.19	46.30	25.03	4.10
43	3-4	35.01	30.29	12.19	43.22	38.51	13.49
155	19-7	35.44	30.53	0.00	41.91	37.00	3.71
15	1-8	35.62	31.75	8.01	41.35	37.27	10.17
116	6-3	24.666	21.486	3.950	41.281	31.141	8.984
86	14-3	37.66	6.00	0.87	40.91	8.78	2.51
109	6-2	34.01	32.91	8.60	39.69	37.57	11.45
2	11-5	30.38	13.69	5.69	38.18	20.54	6.72
34	2-8	25.36	20.27	5.57	36.78	31.96	9.89
57	4-2	16.378	14.654	5.901	34.557	31.660	14.619
168	17-2	26.93	5.82	0.00	34.13	12.65	2.01
19	7-5	22.39	20.74	8.49	31.66	28.24	9.95

Figure 1. Ranking of the twenty most elevated samples, based on $C_{polymer}$ with N flagged data at the estimated value.

Correlation Analysis

Second, USACE will conduct correlation analyses of the subset of 46 and 141 congeners versus 209 congeners, as well as subsets of those for Aroclor 1254, Aroclor 1260, and those congeners identified as contributing to ecological risk (see the Final QAPP, 2020).

Based on a review of the literature, an R^2 value can be considered significant at a value of 0.6 or greater, depending on the application (Minitab, 2019; Mukaka M. M., 2012). For this exercise, USACE considers R^2 values greater than or equal to 0.7 indicative of a representative relationship between the subset of 46 and 141 congeners and the 209 congeners. An outlier analysis will accompany each correlation. If correlation analyses result in R^2 values less than 0.7, the subset of 46 or 141 congeners will not be rejected, but will be evaluated with the other criteria and used to inform overall interpretation of the results.

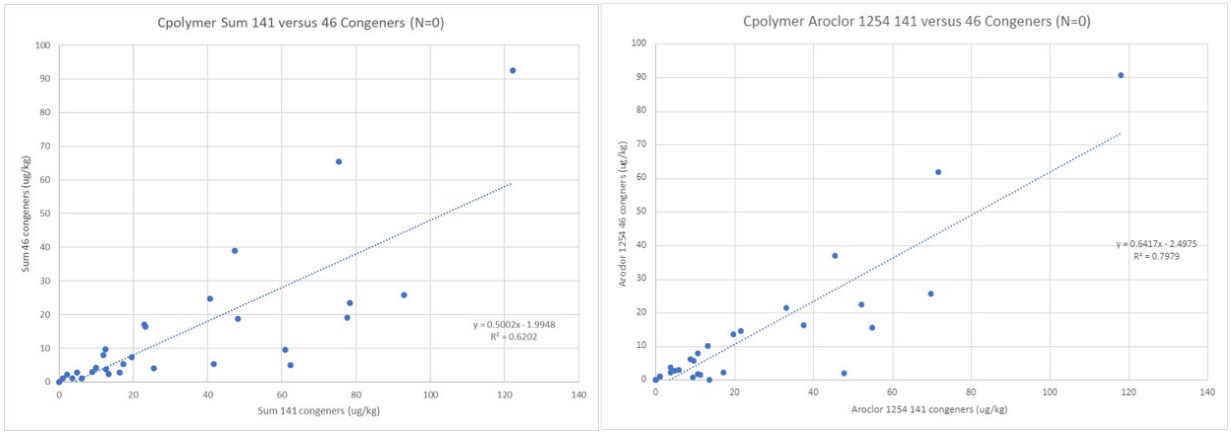


Figure 2. Example correlation analyses between 46 congeners and a subset of samples run for 141 congeners. The graphs shows the correlation for all congeners in the 46 and 141 subsets (left, R^2 = 0.6202) as well those congeners that contribute to Aroclor 1254 (right, R^2 = 0.7979).

Residuals Analysis
Third, USACE will perform a residuals analysis with each correlation. A linear correlation is not always suited for every dataset, and the residuals analysis will serve to assess the appropriateness of the model by defining residuals and examining residual plots. The residuals analysis will confirm whether a linear correlation analysis is appropriate for each of the correlation analyses conducted. Accompanying the residuals analysis, the standard error of the residuals will be evaluated along with histograms of the residuals to further assess skewness and potential outliers.

No acceptance criteria are established for evaluating the results of the residual analysis. The results of the residual analysis will only be used to inform whether a linear correlation is acceptable for the data.

Relative Proportions
Fourth, USACE will analyze any changes to relative proportions of congeners in sample. Based on the existing results of the 46 and 141 congener analyses, the proportional contribution of each congener within a sample will be evaluated to determine the relative contribution from each congener within a single sample. These contributions within a sample will be compared to the results of the 209 congener analysis and the resulting relative proportional contributions.

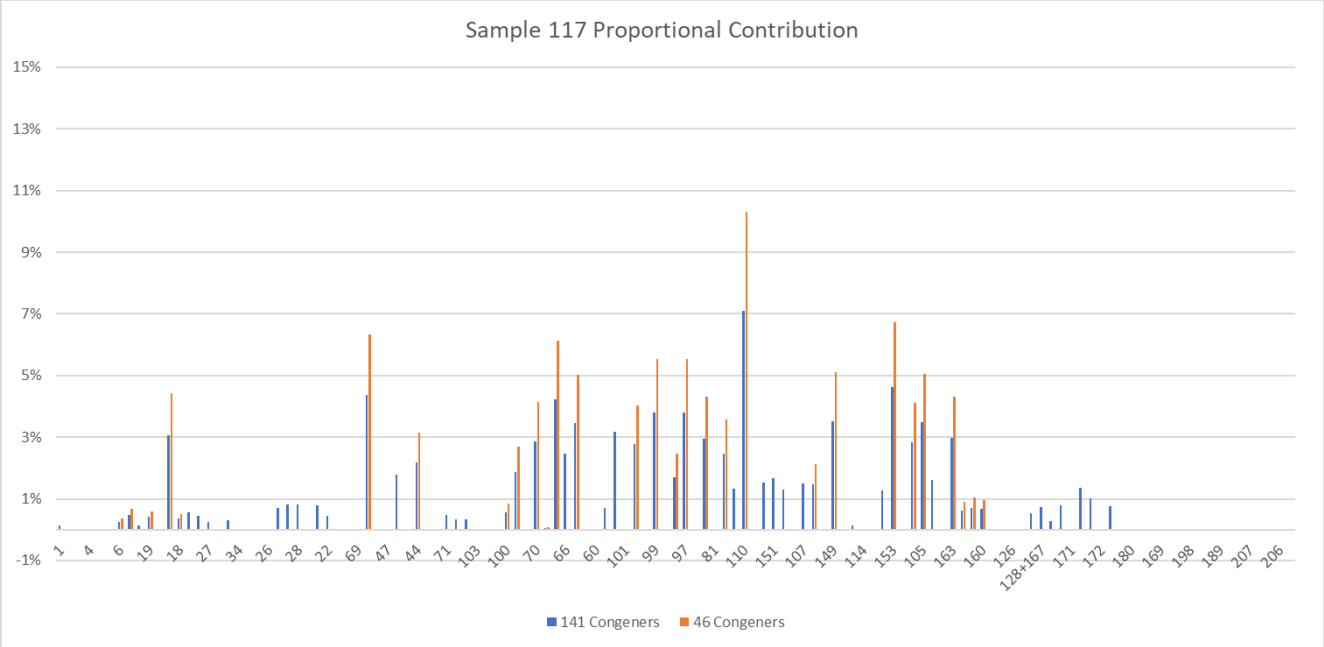


Figure 3. Example of a relative proportion of the 46 and 141 congeners for Sample 117.

USACE plans to evaluate how proportional contributions vary both within a single sample, and across samples, based on the comparison between the 46, 141, and 209 congeners. While results of the 209 congener analysis may elucidate a previously unanalyzed congener(s) as contributing significantly to the overall proportion within a single sample, it will be important to consider whether this congener(s) is repeatedly seen in multiple samples. In addition to looking at proportional contributions, absolute concentrations will also be assessed for individual congeners within a sample. Congeners that serve as major components to aroclors, particularly 1254 and 1260, will also be highlighted in the proportional analysis. Given the multiple factors and criteria that will be assessed within this proportional analysis, no quantitative thresholds are proposed for assessing the representativeness of the 46 or 141 congener analysis. Rather, this proportional analysis will be evaluated with the other criteria and used to inform overall interpretation of the results.

Spatial Display
A spatial presentation of sample results will be presented as 'heat maps' as part of the data evaluation. These 'heat maps' will not include any geostatistical or interpolation of the data, but rather depict relative concentrations for the samples based on the 46, 141, and 209 congener results. This spatial presentation of results will not be used to assess the 46 and 141 congener analysis relative to the 209 congener results, but rather is provided as a component of the overall analysis to inform potential spatial differences resulting from the varying subsets of congeners.

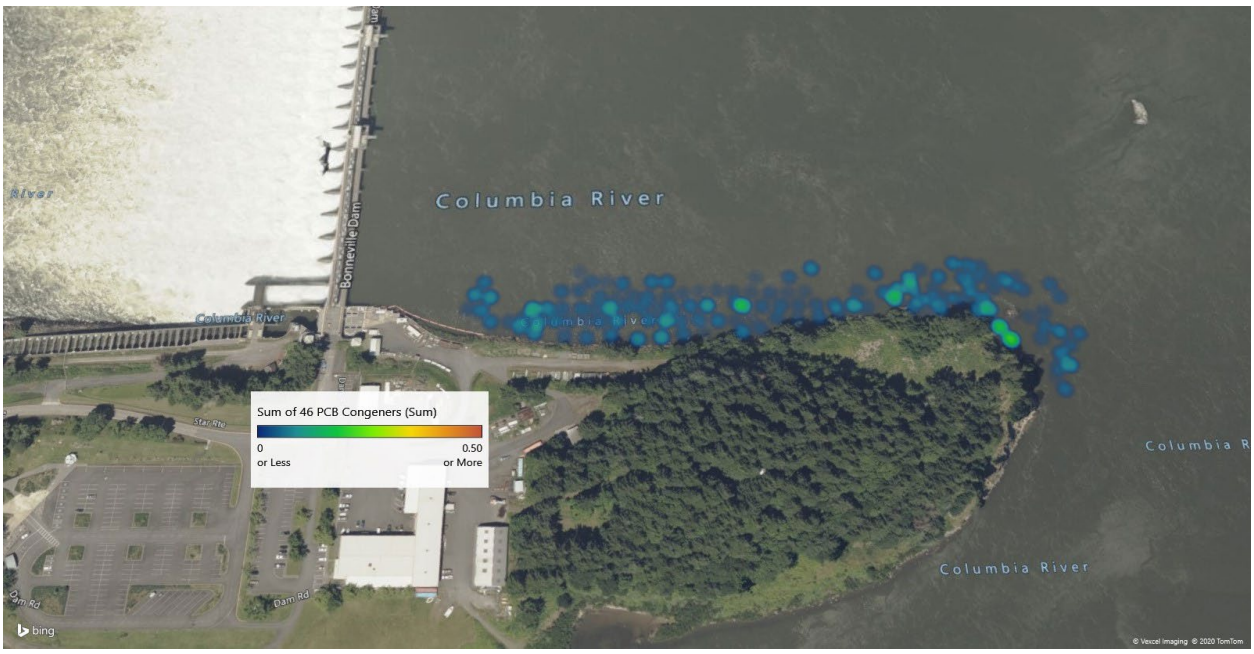


Figure 4. Example of a spatial presentation of samples as a 'heat map' based on the sum total of 46 congeners.

References
Minitab, 2019. Interpreting Key Results for Correlation. https://support.minitab.com/en-us/minitab-express/1/help-and-how-to/modeling-statistics/regression/how-to/correlation/interpret-the-results/. 2019.

Mukaka M. M., 2012. Statistics corner: A guide to appropriate use of correlation coefficient in medical research. Malawi medical journal : the journal of Medical Association of Malawi, 24(3), 69–71.

USACE, 2020. Final Quality Assurance Project Plan for Passive Sampling at River Operable Unit, Bradford Island, Cascade Locks, Oregon. January 23, 2020.

USACE, 2021. Memorandum for Record, Re: Proposed Samples for full 209 PCB congener analysis. September 22, 2021.

Attachment
Response to Comments, 22 December 2021

Response to Comments, 22 December 2021
Draft Memorandum for Record
Bradford Island, River Operable Unit
6 December 2021
Re: Criteria for Evaluating PCB Congeners

Num.	Comment	Response
Comments from EPA Received via Email, 17 December 2021		
1.	While it will be interesting to see what the results from the commercial lab say as to the concentration of all 209 PCB congeners and how you can relate that back to the TTU data, we do have concerns regarding the QC aspects of this approach. First, the Method for analysis of equipment rinsate blanks needs to be the same Method used for the groundwater samples. There are comparability issues if different Methods with different detection limits are used.	No equipment rinsate blanks are required for analysis of the LDPE extracts. Method 1668C was used by TTU for quantification of PCB congeners and Test America will also use Method 1668C for quantification of all 209 congeners.
2.	Second, the failure to measure loading of the performance reference compound on the individual polymer strips is a significant concern to EPA. This type of oversight can call contaminant concentration of the samples at equilibrium into question. We are still at a very early stage in the process, so there is some time to discuss the level of data needed for investigations versus design and if commercial labs would be more appropriate or not. I would caution, though, that if EPA agrees that this approach is something that can be applied to future work, then an effort will be needed to ensure that the data quality objectives meet CERCLA guidance.	C13 labeled PRCs for PCBs were loaded and analyzed by TTU as part of the analysis of all LPDE samplers deployed for the study. Based on the results of the PRC analysis, a fraction to steady state (fss) coefficient was calculated for the suite of PCB congeners analyzed by TTU (46 and 141). However, through extensive coordination and collaboration with external technical reviewers in a series of meetings, the request was made to utilize results of $C_{polymer}$ for data interpretation purposes, which is a 'raw' concentration of $C_{extract}$, corrected for mass of the LDPE and volume of extract. USACE is apprehensive to change the approach at this time given the amount of coordination needed to get to this point with external reviewers and the firm position external reviewers took regarding use of $C_{polymer}$. USACE does not intend to employ this method of analyzing a subset of 46 congeners followed by an expanded analysis of additional congeners for a subset of samples on other media or in future project sampling. This method was employed specifically given the need to analyze 200 LDPE samplers by a university

		laboratory in a research capacity. While it is common for some commercial laboratories to only analyze 140 to 150 PCB congeners (out of the 209) as part of their accredited procedures, USACE does not plan to use this same methodology of selecting 46 congeners for analysis. This was a onetime sampling specific method that would not be employed in the future.
Comments from USFWS Received via Email, December 17, 2021		
3.	The memo states "The objective of analyzing all 209 PCB congeners in 35 samples is to confirm that the subset of 46 congeners analyzed for in all samples sufficiently represents the relative PCB concentration in those samples. In order to achieve this objective, USACE proposes evaluating the results using multiple statistical and qualitative methods." Part of this evaluation could include various graphical evaluations or data visualization to help better understand contributions of congeners to the total for 1) the 46 congener analysis, 2) the 141 congener analysis, and 3) the 209 congener analysis (or the 3 analyses) for each of the 35 samples (depending on how many samples overlap all three analyses). For just a summed total PCB value, we want to know if analysis 1 (46 congeners) is as representative of the total as analysis 2 or 3 (within some margin of error) and if not, are there specific congeners consistently missing from the 46 that would account for the error (and show up in the other analyses) or are they just random differences in congeners that account for the total. I see this approach a little different from your top 10 and or 20 relative order/ranking approach (which is also important) as it can help to identify if other congeners have important contributions to the summed PCB values (at least for PE analysis), help to determine if we may be missing key congeners specific to a source, and see if there are noticeable differences between samples within proximity to each other (it could also be useful in comparing to tissue data to see if certain congeners are preferentially taken up by one matrix or the other – which we would expect and be able to predict to a degree – and this could also be useful for identifying sources, depending on data quality). I think you are getting at the same thing with the correlation graph in Figure 2 (after plotting the	USACE agrees that graphical presentations of the results will be valuable in the presentation and interpretation of the 46/141/209 congener analyses. USACE also agrees that it will be important to look at whether certain congeners were missed in the initial 46 or 141 analysis that are consistently (or randomly) contributing to total PCB concentrations. This evaluation can be included as part of the proportional analysis to look at individual congener contributions both within a single sample and across samples. USACE can include an evaluation of the absolute concentration contribution by congener in addition to the proportional analysis. Proportional analyses for 46, 141, and 209 can also be presented as part of the data evaluation.

	residuals to assure a linear approach will work) but the correlation won't really identify individual congeners. It may be helpful to just plot concentrations of each congener for each sample, such as in figure 3 but using actual concentrations on the y axis rather than proportions. So, all 3 analyses would be plotted on the same graph for each sample where there is sample overlap (so about 35 graphs each with 209 congeners minus the congeners below detection or below some flagged value). This will help identify standout groupings and standalone discrepancies (if present). The same then could be done looking at the proportional contribution to the total as in figure 3 for all 3 analyses in the same graph for each sample (minus the congeners with little to no contributions).	
4.	With the total summed values for each of the 3 analyses, it would be helpful to evaluate the results spatially, such as producing a "heat map" of the relative concentrations of the total summed congeners (I would not include any type of interpolation in this analysis at first, but that could be up for discussion if sufficient data are available to support it).	A 'heat map' can be provided in the evaluation to show spatial differences for the 46, 141, and 209 PCB total congener results. This heat map will include no geostatistical analysis or interpolation. Currently, a 'heat map' has already been provided for the 46 congener results. This will be provided in the analysis of the 209 congeners for the 141 and 209 results.
5.	Also, we should be handling detection limit values and flagged data (censored data) using the Kaplan Meier process, not reporting as 0 or using ½ detection limit methods. For this, we need to decide how to handle flagged data including N-flagged data, and Estimated Maximum Potential Concentrations (EMPCs). We should be consistent with what was done previously in the Remedial Investigation for this process (both for the PE analysis and especially the tissue data moving forward). In the June 2012 Upland and River Operable Units Remedial Investigation Report for Bradford Island, page 5-2 discusses how censored data were handled: "Summing PCB Congeners – Total PCBs as Congeners were summed for each River OU media in which it was analyzed. Data qualified as "U" are undetected results at the laboratory-provided reported detection limit (RDL). Neither MDLs nor MRLs were provided by the laboratory. Data qualified as "EMPC" represent the estimated maximum potential concentration of analytes that were not definitively identified. Total PCBs as Congeners were summed using the Kaplan-Meier (K-M) method with Efron's bias correction, capped at the simple sum (see Appendix H, Tables H-7 through H-12).	USACE agrees that total PCB sums should be calculated using Kaplan Meier bootstrapping methods for summations with non-detects. Assuming non-detects are equal to zero has only been done as part of these preliminary analyses. Test America will provide EMPC flags as part of the data package. The intent is to follow the same data management rules presented in the RI for the analyses of these results.

	Undetected results were censored at the RDL; EMPC-qualified data were censored at the full reported value."	
6.	We would also want to look at data quality of a few key congeners, such as PCB 118, that had interferences in the original 46 congener analysis to see if we can better discern a concentration of PCB 118 that would present (if the congener was better resolved under the 209 analysis).	Agree. Individual congeners that may pose specific concerns can be addressed through analysis of the full 209 congener analysis, including PCB 118. USACE will plan to investigate this specific congener given this comment and the previous related questions raised.
Comments from Yakama Nation Received via Email, December 17, 2021		
7.	Introduction, first paragraph. Selection of the 46 congeners (and the 141 congeners) was based on percent composition in Aroclor mixtures and not on human or environmental toxicity. Therefore, even if the original 46 congeners prove to be correlated with total Aroclor or total congener concentrations, they would only indicate the relative presence of total PCBs. Identifying possible reservoirs of PCBs that may remain in the offshore areas was and is the primary goal of this effort, but this can be evaluated in more than one way. Lipid samplers are a surrogate for fish tissue, and toxicological information is at least as important as the total amount of PCBs in identifying source areas that we may want to focus on for protection of aquatic receptors. Both can be evaluated with full congener results, while it is possible that toxicological information cannot be as easily provided with partial congener data that mainly represent the most abundant congeners. A comparison of the three data sets both from a total abundance and ecological significance standpoint (as shown in Figure 1) will help evaluate the usability of the data to identify priority source areas.	Identification of the original 46 congeners for analysis were based on prevalence in previously sampled media from the River OU during the RI. Selection of the 46 congeners was not limited to components of Aroclor. Rather, Aroclor composition was given secondary consideration if there were congeners of interest not initially selected for analysis. Assessing correlation among congeners associated with specific Aroclors is only one way of assessing the data, and correlation of total congeners will also be evaluated. While information related to ecological significance can be provided as part of the data analysis, the primary goals of this study are not related to elucidating toxicity, but rather to find areas of elevated PCB concentrations that may be indicative to the presence of primary sources of PCBs.
8.	Introduction, second paragraph. The stated objective is worded in a biased manner, in that it is intended to "confirm" that the subset of 46 congeners is acceptable to use, as opposed to wording such as "determine whether." It may be appropriate to develop formal null and alternate hypotheses for each data evaluation method, along with clear criteria for accepting or rejecting the null hypothesis.	The initial subset of 46 congeners were collaboratively selected for analysis because of their dominance in previously sampled media from the River OU during the RI. This analysis of all 209 congeners serves as a confirmation that those pre-selected congeners remain the predominant contributors within the River OU.

Response to Comments, 22 December 2021
Draft Memorandum for Record
Bradford Island, River Operable Unit
6 December 2021
Re: Criteria for Evaluating PCB Congeners

	It would be helpful to explain why the 141-congener data set is not also being compared to the 209-congener data set. Would there be value in doing that? If the 46-congener data set proves dissimilar to the 209-congener data set, this comparison would allow an evaluation of whether the 141-congener data set could be used in its place. Some background on the previous comparisons between the 46-congener data set and the 141-congener data set could be added for those not extensively involved in that process.	USACE can also evaluate the 141 congener dataset relative to the 209 congener dataset. This will be done in addition to the 46 congener dataset given that 141 congeners were analyzed by TTU for only a subset of the total samples.
9.	Relative Order/Ranking of Samples. The second paragraph is unclear. The approach appears to be assuming that the relative order of the top 10 and top 20 samples of the 46-congener data set are accurate, and is proposing to use the 209-congener data to confirm that (or possibly reduce that group by a few). Yakama Nation would be more interested in whether the 209-congener data set identifies additional, higher-concentration samples that were not identified in the top group by the 46-congener data set, either with respect to total PCB concentration or toxicological significance. The 141-congener data set should also be included in this comparison.	USACE can take into account any high concentration samples that are identified through analysis of 141 and 209 congeners.
10	Figure 1. This figure should add to the legend that this is the ranking based on the 46-congener data set. The relative order analysis that will be completed should include all samples analyzed for the full 209 congeners and the 141 congeners, and the standard of comparison should be to the full 209-congener data set. Looking at the ecological rankings in this table, it's clear that general abundance is not correlated with ecological significance in the 46-congener data set. The evaluation of all three data sets should be done both ways – ranking by total concentrations and by ecological significance, as well as the degree of similarity or dissimilarity between them for each data set.	Relative order/ranking will also be assessed for 141 and 209. While information can be provided related to ecological toxicity and the dominant congeners contributing to ecological toxicity, the primary goals of this study are not related to elucidating toxicity, but rather to find areas of elevated PCB concentrations that may be indicative to the presence of primary sources of PCBs.
11	Correlation Analysis. The second paragraph identifies an r2 of 0.7 as a "representative" relationship and shows examples of graphs with less than and greater than 0.7. First it is unclear why "statistically significant" is not used, rather than "representative." This is not an unreasonable threshold to use when evaluating noisy environmental data, but the two graphs above and below this cutoff are not that different.	While correlation analyses with an R2 value of 0.7 will not result in rejecting data, this criterion is proposed to provide a common understanding/interpretation among USACE and external reviewers for what is considered a representative relationship between the 46 (or 141) congeners and the 209 congeners

	This section states that values below 0.7 will not cause rejection of the 46-congener data set. Therefore, it is unclear exactly how this threshold will be used, and why it was chosen. The literature that was reviewed to select this value for this purpose should be cited.	
12	Residuals Analysis. The purpose and uses of this analysis make sense. Ideally, this should be completed before the correlation analysis, to evaluate whether a linear correlation is expected and should be assumed.	USACE will conduct a residuals analysis as a first step but will present the results of the correlation analysis with supporting information from the residuals analysis to aid in interpretation.
13	Relative Proportions. This is an important analysis. Part of our concern with the 46-congener and 141-congener analytical results was the occurrence of "anomalous" relative congener concentrations in the sample results, e.g., the reported presence of congeners that do not occur in substantial concentrations in any possible Aroclor source or from "weathering;" and the low relative concentrations of congeners that are major component of Aroclors, particularly Aroclor 1254. This analysis should include apples-to-apples comparisons base on the congeners reported in the results from all three data sets to demonstrate that the reported congener mix is reasonable. The results should also be compared to the relative concentrations in Aroclors, again at least Aroclor 1254. None of the evaluations suggested above seem appropriate if the underlying congener data are flawed.	The proportional analysis can include a comparison to dominant Aroclors for the site, likely to include 1254 and 1260.
Comments from Oregon DEQ Received via Email, December 21, 2021		
14	Objectives and Data Analysis: DEQ's objective is to make the best use of all the passive sampler data. Objectives should not be exclusively limited to confirmation that the subset of 46 congeners analyzed in all samples sufficiently represents a relative magnitude of total PCB concentrations. Relative ranking should not be the only line of evidence appropriate for identifying locations for follow-up sampling. The passive sampling locations represent a range of water depths and distances from shore, and different distances from potential sources. Congener composition, along with other lines of evidence, should be used to help identify source areas. The methods used for identification of likely sources may include a variety of techniques including those presented in the memorandum.	a. A 'heat map' can be provided in the evaluation to show spatial differences for the 46, 141, and 209 PCB total congener results. This heat map will include no geostatistical analysis or interpolation. Currently, a 'heat map' has already been provided for the 46 congener results. This will be provided in the analysis of the 209 congeners for the 141 and 209 results. b. USACE will include an analysis for outliers.

	a. Concentration or "heat" maps should be presented for extract total PCB concentrations for each sampling location (and by 46, 141 and 209 congeners). Previous presentations were of dissolved phase porewater. b. Regression relationships using best fit lines are useful, and should be supplemented with outlier analysis. Methods to identify outliers may include identification of locations more than two standard deviations above or below the best-fit line or residuals analysis. c. Data visualization methods: As an example, these could include three dimensional graphs illustrating location, PCB congener composition, and magnitude. (see example graph below).	c. Noted. USACE will consider incorporating this form of data presentation.
15	Data Quality: The ability to use the subset data is contingent on the data quality review using the analysis of all 209 congeners. Samples analyzed for the full 209 congeners help eliminate uncertainty in the use of a subset of congeners to estimate total PCBs. In addition, the full analysis should reduce uncertainty around identification of congeners with suspected interferences. Due to these and other data quality concerns, it may not be possible to use only the total of 46 congeners to rank samples.	Noted.
16	Data Reporting: a. Data should be reported according to 2012 Remedial Investigation (RI), Appendix D of Washington Department of Ecology Sediment Cleanup Users' Manual (1209057.pdf (wa.gov)), and Oregon DEQ Quality Assurance Policy for the Environmental Cleanup Programs, 2015 (ECD QA Policy (Formerly Policy 760.00) (oregon.gov)). Both the MDL and the PQL should be reported, along with reported concentrations between these values, flagged appropriately. i. MDL: Defined by USEPA in Appendix B of 40 CFR 136 as "the minimum concentration of a substance that can be measured with 99% confidence that the analyte concentration is greater than zero". ii. PQL: Defined in Washington SMS as: "the lowest concentration that can be reliably measured within specified limits of precision, accuracy, representativeness,	a. Data will be reported using previously established data management rules presented in the RI. An electronic version of data will be provided to external reviewers. b. Correct. $C_{polymer}$ is extract concentration from the LDPE correct for mass of the LDPE and sample volume. c. Noted. USACE will consider this in the later stages of data evaluation.

	completeness, and comparability during routine laboratory operating conditions, using department approved methods (WAC 173-204-200(35)). As Washington Sediment Cleanup User's Manual (SCUM) 2019 notes, there are several alternative methods and definitions for determining MDLs and PQLs. Ecology recognizes that the PQL, method reporting limit (MRL), and lower level of quantitation (LLOQ) are generally the same concept. iii. Analytical reporting should not be limited to those detected above the reporting limit (or PQL). The MDL should be reported, as well as all results should be reported above the MDL with appropriate data qualifiers, including EMPCs, consistent with the Remedial Investigation. iv. Please report data in electronic form (Excel) to aid in review and analysis. b. Please confirm that Cpolymer incorporates extract concentrations corrected for sample volume and LDPE mass in the sample. c. The fractional approach to steady state should be considered in some form, as the polymer at equilibrium. As indicated by the February, 2021 memorandum from Texas Tech, the extract concentrations can be corrected for volume of extract (Vextract), the mass of the polymer dissolved in that extract (MLDPE), and the fraction approach to steady state (fss). DEQ recommends presenting the results of Cpolymer (corrected for volume and mass) as both, 1) the polymer concentration, and 2) the polymer concentrations at equilibrium	
17	Summing PCB Congeners – Total PCBs as congeners should be summed following data rules in the remedial investigation, described as follows in the June 2012 Remedial Investigation report: Data qualified as "U" are undetected results at the laboratory-provided reported detection limit (RDL). Data qualified as "EMPC" represent the estimated maximum potential concentration of analytes that were not definitively identified. Total PCBs as congeners were summed using the Kaplan-Meir (K-M) method with Efron's bias correction, capped at the simple sum (see Appendix H, Tables H-7 through H-12). Undetected results were censored at the RDL; EMPC-qualified data were censored at the full reported value. The use of data summation rules should be consistent between PCB totals by 46, 141 and 209 congeners.	USACE agrees that total PCB sums should be calculated using Kaplan Meier bootstrapping methods for summations with non-detects. Assuming non-detects are equal to zero has only been done as part of these preliminary analyses. Test America will provide EMPC flags as part of the data package.

		The intent is to follow the same data management rules presented in the RI for the analyses of these results.