LABORATORY DATA CONSULTANTS, INC.
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Windward Environmental, LLC
200 West Mercer Street, Suite 401
Seattle, WA 98119
ATTN: Amara Vandervort
amarav@windwardenv.com

September 2, 2020

SUBJECT: Revised Duwamish AOC4, Data Validation

Dear Ms. Vandervort,

Enclosed are the revised validation reports for the fractions listed below. These SDGs were received on August 3, 2020. Attachment 1 is a summary of the samples that were reviewed for each analysis.

LDC Project #48785_RV1:

SDG #	Fraction
20F0114, 20F0118, 20F0339 20F0352, 20F0359, 20F0392 20F0407, 20F0437, 20F0438	Semivolatiles, Hexachlorobenzene, Polychlorinated Biphenyls, Metals, Wet Chemistry, Polychlorinated Dioxins/Dibenzofurans

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

- Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation; May 2020
- USEPA National Functional Guidelines for Organic Superfund Methods Data Review; January 2017
- USEPA National Functional Guidelines for Inorganic Superfund Methods Data Review; January 2017
- USEPA National Functional Guidelines for High Resolution Superfund Methods Data Review; April 2016
- EPA SW 846, Third Edition, Test Methods for Evaluating Solid Waste, update 1, July 1992; update IIA, August 1993; update II, September 1994; update IIB, January 1995; update III, December 1996; update IIIA, April 1998; IIIB, November 2004; update IV, February 2007; update V, July 2014

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

Sincerely,

Pei Geng
pgeng@lab-data.com
Project Manager/Senior Chemist

Stage 2B/4 (client Select) EDD

LDC #48785 (Windward Environmental, LLC - Seattle WA / Duwamish AOC4)

LDC	SDG#	DATE REC'D	(3) DATE DUE	SVOA (8270E)		PAHs (8270E -SIM)		(1) Pest (8081B)		PCBs (8082A)		Metals (6020A)		Metals (6020A-UCT-KED)		Hg (7471B)		Dioxins (1613B)		TOC (9060A)		Total Solids (2540G)													
Matrix: Water/Sediment				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	20F0114	08/03/20	08/24/20	0	6	0	6	0	6	0	11	0	6	0	10	0	6	0	4	0	11	0	11												
B	20F0118	08/03/20	08/24/20	0	12	0	12	0	11	0	11	0	11	0	11	0	11	0	3	0	11	0	11												
C	20F0339	08/03/20	08/24/20	0	10	0	10	0	10	0	10	0	10	0	10	0	10	0	2	0	10	0	10												
D	20F0352	08/03/20	08/24/20	0	11	0	10	0	10	0	10	0	10	0	10	0	10	0	1	0	10	0	10												
E	20F0359	08/03/20	08/24/20	0	16	0	16	0	16	0	16	0	16	0	16	0	16	0	2	0	16	0	16												
F	20F0392	08/03/20	08/24/20	0	1	0	1	0	1	0	19	0	1	0	13	0	1	0	4	0	13	0	13												
G	20F0407	08/03/20	08/24/20	0	5	0	5	0	5	0	6	0	5	0	5	0	5	0	1	0	5	0	5												
H	20F0437	08/03/20	08/24/20	-	-	-	-	-	-	0	1	-	-	-	-	-	-	-	-	0	1	0	1												
I	20F0438	08/03/20	08/24/20	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	1	0	6	0	6												
Total	T/PG			0	67	0	66	0	65	0	90	0	65	0	81	0	65	0	18	0	83	0	83	0	0	0	0	0	0	0	0	0	0	0	683

Shaded cells indicate Stage 4 validation (all other cells are Stage 2B validation). These sample counts do not include MS/MSD, and DUPs

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 19, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0114

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC322	20F0114-07	Sediment	06/05/20
LDW20-SC336	20F0114-08	Sediment	06/05/20
LDW20-SC336FD	20F0114-09	Sediment	06/05/20
LDW20-IT365	20F0114-10	Sediment	06/05/20
LDW20-IT365FD	20F0114-11	Sediment	06/05/20
LDW20-IT361	20F0114-12	Sediment	06/05/20
LDW20-SC322MS	20F0114-07MS	Sediment	06/05/20
LDW20-SC322MSD	20F0114-07MSD	Sediment	06/05/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). 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:

Semivolatile Organic Compounds (SVOCs) by Environmental Protection Agency (EPA) SW 846 Method 8270E

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 9.1°C and 18.8°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples/Standard Reference Materials

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

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits with the following exceptions:

SRM ID	Compound	%R (Limits)	Associated Samples	Flag	A or P
BIF0484-SRM1	Anthracene	52.2 (57-143)	All samples in SDG 20F0114	J (all detects) UJ (all non-detects)	P

X. Field Duplicates

Samples LDW20-SC336 and LDW20-SC336FD and samples LDW20-IT365 and LDW20-IT365FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/Kg)		RPD
	LDW20-SC336	LDW20-SC336FD	
Naphthalene	31.5U	19.4	Not calculable
2-Methylnaphthalene	31.5U	12.4	Not calculable
Phenanthrene	85.9	109	24
Anthracene	15.9	12.8	22
Fluoranthene	208	177	16
Pyrene	202	182	10
Butylbenzylphthalate	2.8	14.7	136

Compound	Concentration (ug/Kg)		RPD
	LDW20-SC336	LDW20-SC336FD	
Benzo(a)anthracene	70.9	59.5	17
Chrysene	107	99.6	7
Bis(2-ethylhexyl)phthalate	113	104	8
Benzofluoranthenes, total	219	191	14
Benzo(a)pyrene	85.6	75.4	13
Indeno(1,2,3-cd)pyrene	64.5	55.4	15
Dibenzo(a,h)anthracene	18.0	14.0	25
Benzo(g,h,i)perylene	78.4	61.6	24

Compound	Concentration (ug/Kg)		RPD
	LDW20-IT365	LDW20-IT365FD	
Phenanthrene	13.0	15.7	19
Fluoranthene	33.8	32.8	3
Pyrene	34.9	33.7	3
Benzo(a)anthracene	12.5	13.2	5
Chrysene	18.3	17.8	3
Bis(2-ethylhexyl)phthalate	49.8U	32.8	Not calculable
Benzofluoranthenes, total	36.6	35.1	4
Benzo(a)pyrene	15.5	14.6	6
Indeno(1,2,3-cd)pyrene	11.2	10.7	5
Benzo(g,h,i)perylene	13.3	12.4	7

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

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

Due to SRM %R, data were qualified as estimated in six samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4
Semivolatiles - Data Qualification Summary - SDG 20F0114

Sample	Compound	Flag	A or P	Reason
LDW20-SC322 LDW20-SC336 LDW20-SC336FD LDW20-IT365 LDW20-IT365FD LDW20-IT361	Anthracene	J (all detects) UJ (all non-detects)	P	Standard reference materials (%R)

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0114

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0114

No Sample Data Qualified in this SDG

LDC #: 48785A2a

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 08/14/20

SDG #: 20F0114

Page: 1 of 1

Laboratory: Analytical Resources, Inc.

Reviewer: [illegible]

2nd Reviewer: [illegible]

METHOD: GC/MS Semivolatiles (EPA SW 846 Method 8270E)

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 (Insufficient time to cool)
I.	Sample receipt/Technical holding times	SW, A	Cooler temps = 18.8°C, 16.2°C, 12.6°C, 15.5°C, 9.1°C, 14.3°C, 9.7°C, 10.2°C, 11.8°C
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A, A	ICAL ≤ 20% ICV ≤ 30%
IV.	Continuing calibration	A	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	SW	SRM (no LCS)
X.	Field duplicates	SW	D = 2/3, 4/5
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SC322	20F0114-07	Sediment	06/05/20
2	LDW20-SC336 D1	20F0114-08	Sediment	06/05/20
3	LDW20-SC336FD D1	20F0114-09	Sediment	06/05/20
4	LDW20-IT365 D2	20F0114-10	Sediment	06/05/20
5	LDW20-IT365FD D2	20F0114-11	Sediment	06/05/20
6	LDW20-IT361	20F0114-12	Sediment	06/05/20
7	LDW20-SC322MS	20F0114-07MS	Sediment	06/05/20
8	LDW20-SC322MSD	20F0114-07MSD	Sediment	06/05/20
9				
10				

Notes:

	BIF0484-Blk1						

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

A. Phenol	AA. 2-Chloronaphthalene	AAA. Butylbenzylphthalate	AAAA. Dibenzothiophene	A1. N-Nitrosodiethylamine
B. Bis (2-chloroethyl) ether	BB. 2-Nitroaniline	BBB. 3,3'-Dichlorobenzidine	BBBB. Benzo(a)fluoranthene	B1. N-Nitrosodi-n-butylamine
C. 2-Chlorophenol	CC. Dimethylphthalate	CCC. Benzo(a)anthracene	CCCC. Benzo(b)fluorene	C1. N-Nitrosomethylethylamine
D. 1,3-Dichlorobenzene	DD. Acenaphthylene	DDD. Chrysene	DDDD. cis/trans-Decalin	D1. N-Nitrosomorpholine
E. 1,4-Dichlorobenzene	EE. 2,6-Dinitrotoluene	EEE. Bis(2-ethylhexyl)phthalate	EEEE. Biphenyl	E1. N-Nitrosopyrrolidine
F. 1,2-Dichlorobenzene	FF. 3-Nitroaniline	FFF. Di-n-octylphthalate	FFFF. Retene	F1. Phenacetin
G. 2-Methylphenol	GG. Acenaphthene	GGG. Benzo(b)fluoranthene	GGGG. C30-Hopane	G1. 2-Acetylaminofluorene
H. 2,2'-Oxybis(1-chloropropane)	HH. 2,4-Dinitrophenol	HHH. Benzo(k)fluoranthene	HHHH. 1-Methylphenanthrene	H1. Pronamide
I. 4-Methylphenol	II. 4-Nitrophenol	III. Benzo(a)pyrene	IIII. 1,4-Dioxane	I1. Methyl methanesulfonate
J. N-Nitroso-di-n-propylamine	JJ. Dibenzofuran	JJJ. Indeno(1,2,3-cd)pyrene	JJJJ. Acetophenone	J1. Ethyl methanesulfonate
K. Hexachloroethane	KK. 2,4-Dinitrotoluene	KKK. Dibenz(a,h)anthracene	KKKK. Atrazine	K1. o,o',o''-Triethylphosphorothioate
L. Nitrobenzene	LL. Diethylphthalate	LLL. Benzo(g,h,i)perylene	LLLL. Benzaldehyde	L1. n-Phenylene diamine
M. Isophorone	MM. 4-Chlorophenyl-phenyl ether	MMM. Bis(2-Chloroisopropyl)ether	MMMM. Caprolactam	M1. 1,4-Naphthoquinone
N. 2-Nitrophenol	NN. Fluorene	NNN. Aniline	NNNN. 2,6-Dichlorophenol	N1. N-Nitro-o-toluidine
O. 2,4-Dimethylphenol	OO. 4-Nitroaniline	OOO. N-Nitrosodimethylamine	OOOO. 1,2-Diphenylhydrazine	O1. 1,3,5-Trinitrobenzene
P. Bis(2-chloroethoxy)methane	PP. 4,6-Dinitro-2-methylphenol	PPP. Benzoic Acid	PPPP. 3-Methylphenol	P1. Pentachlorobenzene
Q. 2,4-Dichlorophenol	QQ. N-Nitrosodiphenylamine	QQQ. Benzyl alcohol	QQQQ. 3&4-Methylphenol	Q1. 4-Aminobiphenyl
R. 1,2,4-Trichlorobenzene	RR. 4-Bromophenyl-phenylether	RRR. Pyridine	RRRR. 4-Dimethyldibenzothiophene (4MDT)	R1. 2-Naphthylamine
S. Naphthalene	SS. Hexachlorobenzene	SSS. Benzidine	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	S1. Triphenylene
T. 4-Chloroaniline	TT. Pentachlorophenol	TTT. 1-Methylnaphthalene	TTTT. 1-Methyldibenzothiophene (1MDT)	T1. Octachlorostyrene
U. Hexachlorobutadiene	UU. Phenanthrene	UUU.Benzo(b)thiophene	UUUU.. 2,3,4,6-Tetrachlorophenol	U1. Famphur
V. 4-Chloro-3-methylphenol	VV. Anthracene	VVV.Benzonaphthothiophene	VVVV. 1,2,4,5-Tetrachlorobenzene	V1. 1,4-phenylenediamine
W. 2-Methylnaphthalene	WW. Carbazole	WWW.Benzo(e)pyrene	WWWW.. 2-Picoline	W1. Methapyrilene
X. Hexachlorocyclopentadiene	XX. Di-n-butylphthalate	XXX. 2,6-Dimethylnaphthalene	XXXX. 3-Methylcholanthrene	X1. Pentachloroethane
Y. 2,4,6-Trichlorophenol	YY. Fluoranthene	YYY. 2,3,5-Trimethylnaphthalene	YYYY. a,a-Dimethylphenethylamine	Y1. 3,3'-Dimethylbenzidine
Z. 2,4,5-Trichlorophenol	ZZ. Pyrene	ZZZ. Perylene	ZZZZ. Hexachloropropene	Z1. o-Toluidine

A2. Benzofluoranthenes, Total

LDC #: 48785 A2a

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS)

METHOD: GC/MS BNA (EPA SW 846 Method 8270~~C~~E)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

[✓ Y] N N/A Was a LCS required?
Y [✓ N] N/A Were the LCS/LCSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#	LCS/LCSD ID	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	BIF0484-SRM1	VV	52.2 (57-143)	( )	( )	All (ND + Det)	J/UJ/P
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
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			( )	( )	( )		
			( )	( )	( )		

LDC#: 48785A2a

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: JVG
2nd Reviewer:

METHOD: GCMS SVOA (EPA SW 846 Method 8270E)

(Y) N NA Were field duplicate pairs identified in this SDG?
(Y) N NA Were target analytes detected in the field duplicate pairs?

Compound	Concentration (ug/Kg)		RPD
	2	3	
S	31.5U	19.4	NC
W	31.5U	12.4	NC
UU	85.9	109	24
VV	15.9	12.8	22
YY	208	177	16
ZZ	202	182	10
AAA	2.8	14.7	136
CCC	70.9	59.5	17
DDD	107	99.6	7
EEE	113	104	8
A2	219	191	14
III	85.6	75.4	13
JJJ	64.5	55.4	15
KKK	18.0	14.0	25
LLL	78.4	61.6	24

Compound	Concentration (ug/Kg)		RPD
	4	5	
UU	13.0	15.7	19
YY	33.8	32.8	3
ZZ	34.9	33.7	3
CCC	12.5	13.2	5
DDD	18.3	17.8	3
EEE	49.8U	32.8	NC
A2	36.6	35.1	4
III	15.5	14.6	6
JJJ	11.2	10.7	5
LLL	13.3	12.4	7

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 20, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0114

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC322	20F0114-07	Sediment	06/05/20
LDW20-SC336	20F0114-08	Sediment	06/05/20
LDW20-SC336FD	20F0114-09	Sediment	06/05/20
LDW20-IT365	20F0114-10	Sediment	06/05/20
LDW20-IT365FD	20F0114-11	Sediment	06/05/20
LDW20-IT361	20F0114-12	Sediment	06/05/20
LDW20-SC322MS	20F0114-07MS	Sediment	06/05/20
LDW20-SC322MSD	20F0114-07MSD	Sediment	06/05/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). 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:

Semivolatile Organic Compounds (SVOCs) by Environmental Protection Agency (EPA) SW 846 Method 8270E in Selected Ion Monitoring (SIM) mode

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 9.1°C and 18.8°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For compounds where average relative response factors (RRFs) were utilized, percent relative standard deviations (%RSD) were less than or equal to 20.0%.

In the case where the laboratory used a calibration curve to evaluate the compounds, all coefficients of determination (r^2) were greater than or equal to 0.990.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all compounds with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
02/28/20	N-Nitrosodiphenylamine	34.4	All samples in SDG 20F0114	J (all detects) UJ (all non-detects)	A

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
06/24/20	Benzoic acid	31.0	All samples in SDG 20F0114	J (all detects)	A

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples/Standard Reference Materials

The laboratory has indicated that there were no laboratory control samples (LCS) analyses performed. No data were qualified since the standard reference materials (SRM) were reported.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

X. Field Duplicates

Samples LDW20-SC336 and LDW20-SC336FD and samples LDW20-IT365 and LDW20-IT365FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/Kg)		RPD
	LDW20-SC336	LDW20-SC336FD	
Benzyl alcohol	29.9	32.8	9
Benzoic acid	153	56.0	93
N-Nitrosodiphenylamine	7.9U	3.1	Not calculable

Compound	Concentration (ug/Kg)		RPD
	LDW20-IT365	LDW20-IT365FD	
1,4-Dichlorobenzene	5.0U	1.1	Not calculable
Benzoic acid	30.8	19.7	44

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

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

Due to ICV %D and continuing calibration %D, data were qualified as estimated in six samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4
Semivolatiles – Data Qualification Summary - SDG 20F0114

Sample	Compound	Flag	A or P	Reason
LDW20-SC322 LDW20-SC336 LDW20-SC336FD LDW20-IT365 LDW20-IT365FD LDW20-IT361	N-Nitrosodiphenylamine	J (all detects) UJ (all non-detects)	A	Initial calibration verification (%D)
LDW20-SC322 LDW20-SC336 LDW20-SC336FD LDW20-IT365 LDW20-IT365FD LDW20-IT361	Benzoic acid	J (all detects)	A	Continuing calibration (%D)

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0114

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0114

No Sample Data Qualified in this SDG

LDC #: 48785A2b

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 08/14/20

SDG #: 20F0114

Page: 1 of 1

Laboratory: Analytical Resources, Inc.

Reviewer: JW

2nd Reviewer: 4

METHOD: GC/MS ~~Polynuclear Aromatic Hydrocarbons~~ SVOA (EPA SW 846 Method 8270E-SIM)

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 (Insufficient time to cool)
I.	Sample receipt/Technical holding times	SW/A	Cooler temp = 18.8°C, 16.2°C, 12.6°C, 15.5°C, 9.1°C, 14.3°C; 9.7°C; 10.2°C; 11.8°C
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/SW	ICAL ≤ 20? r ICV ≤ 30%
IV.	Continuing calibration	SW	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	SW	no LCS, SRM
X.	Field duplicates	SW	D = 2/3, 4/5
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	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:

	Client ID		Lab ID	Matrix	Date
1	LDW20-SC322		20F0114-07	Sediment	06/05/20
2	LDW20-SC336	D_1	20F0114-08	Sediment	06/05/20
3	LDW20-SC336FD	D_1	20F0114-09	Sediment	06/05/20
4	LDW20-IT365	D_2	20F0114-10	Sediment	06/05/20
5	LDW20-IT365FD	D_2	20F0114-11	Sediment	06/05/20
6	LDW20-IT361		20F0114-12	Sediment	06/05/20
7	LDW20-SC322MS		20F0114-07MS	Sediment	06/05/20
8	LDW20-SC322MSD		20F0114-07MSD	Sediment	06/05/20
9					
10					

Notes:

	R-IF0484_BMK						

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

A. Phenol	AA. 2-Chloronaphthalene	AAA. Butylbenzylphthalate	AAAA. Dibenzothiophene	A1. N-Nitrosodiethylamine
B. Bis (2-chloroethyl) ether	BB. 2-Nitroaniline	BBB. 3,3'-Dichlorobenzidine	BBBB. Benzo(a)fluoranthene	B1. N-Nitrosodi-n-butylamine
C. 2-Chlorophenol	CC. Dimethylphthalate	CCC. Benzo(a)anthracene	CCCC. Benzo(b)fluorene	C1. N-Nitrosomethylethylamine
D. 1,3-Dichlorobenzene	DD. Acenaphthylene	DDD. Chrysene	DDDD. cis/trans-Decalin	D1. N-Nitrosomorpholine
E. 1,4-Dichlorobenzene	EE. 2,6-Dinitrotoluene	EEE. Bis(2-ethylhexyl)phthalate	EEEE. Biphenyl	E1. N-Nitrosopyrrolidine
F. 1,2-Dichlorobenzene	FF. 3-Nitroaniline	FFF. Di-n-octylphthalate	FFFF. Retene	F1. Phenacetin
G. 2-Methylphenol	GG. Acenaphthene	GGG. Benzo(b)fluoranthene	GGGG. C30-Hopane	G1. 2-Acetylaminofluorene
H. 2,2'-Oxybis(1-chloropropane)	HH. 2,4-Dinitrophenol	HHH. Benzo(k)fluoranthene	HHHH. 1-Methylphenanthrene	H1. Pronamide
I. 4-Methylphenol	II. 4-Nitrophenol	III. Benzo(a)pyrene	IIII. 1,4-Dioxane	I1. Methyl methanesulfonate
J. N-Nitroso-di-n-propylamine	JJ. Dibenzofuran	JJJ. Indeno(1,2,3-cd)pyrene	JJJJ. Acetophenone	J1. Ethyl methanesulfonate
K. Hexachloroethane	KK. 2,4-Dinitrotoluene	KKK. Dibenz(a,h)anthracene	KKKK. Atrazine	K1. o,o',o''-Triethylphosphorothioate
L. Nitrobenzene	LL. Diethylphthalate	LLL. Benzo(g,h,i)perylene	LLLL. Benzaldehyde	L1. n-Phenylene diamine
M. Isophorone	MM. 4-Chlorophenyl-phenyl ether	MMM. Bis(2-Chloroisopropyl)ether	MMMM. Caprolactam	M1. 1,4-Naphthoquinone
N. 2-Nitrophenol	NN. Fluorene	NNN. Aniline	NNNN. 2,6-Dichlorophenol	N1. N-Nitro-o-toluidine
O. 2,4-Dimethylphenol	OO. 4-Nitroaniline	OOO. N-Nitrosodimethylamine	OOOO. 1,2-Diphenylhydrazine	O1. 1,3,5-Trinitrobenzene
P. Bis(2-chloroethoxy)methane	PP. 4,6-Dinitro-2-methylphenol	PPP. Benzoic Acid	PPPP. 3-Methylphenol	P1. Pentachlorobenzene
Q. 2,4-Dichlorophenol	QQ. N-Nitrosodiphenylamine	QQQ. Benzyl alcohol	QQQQ. 3&4-Methylphenol	Q1. 4-Aminobiphenyl
R. 1,2,4-Trichlorobenzene	RR. 4-Bromophenyl-phenylether	RRR. Pyridine	RRRR. 4-Dimethyldibenzothiophene (4MDT)	R1. 2-Naphthylamine
S. Naphthalene	SS. Hexachlorobenzene	SSS. Benzidine	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	S1. Triphenylene
T. 4-Chloroaniline	TT. Pentachlorophenol	TTT. 1-Methylnaphthalene	TTTT. 1-Methyldibenzothiophene (1MDT)	T1. Octachlorostyrene
U. Hexachlorobutadiene	UU. Phenanthrene	UUU.Benzo(b)thiophene	UUUU.. 2,3,4,6-Tetrachlorophenol	U1. Famphur
V. 4-Chloro-3-methylphenol	VV. Anthracene	VVV.Benzonaphthothiophene	VVVV. 1,2,4,5-Tetrachlorobenzene	V1. 1,4-phenylenediamine
W. 2-Methylnaphthalene	WW. Carbazole	WWW.Benzo(e)pyrene	WWWW.. 2-Picoline	W1. Methapyrilene
X. Hexachlorocyclopentadiene	XX. Di-n-butylphthalate	XXX. 2,6-Dimethylnaphthalene	XXXX. 3-Methylcholanthrene	X1. Pentachloroethane
Y. 2,4,6-Trichlorophenol	YY. Fluoranthene	YYY. 2,3,5-Trimethylnaphthalene	YYYY. a,a-Dimethylphenethylamine	Y1. 3,3'-Dimethylbenzidine
Z. 2,4,5-Trichlorophenol	ZZ. Pyrene	ZZZ. Perylene	ZZZZ. Hexachloropropene	Z1. o-Toluidine

LDC #: 48785A2b

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC/MS SVOA (EPA SW 846 Method 8270~~D~~ E-SIM)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

(Y) N N/A Was an initial calibration verification standard analyzed after each ICAL for each instrument?

Y (N) N/A Were all %D within the validation criteria of ≤~~20~~/30% %D ?

#	Date	Standard ID	Compound	Finding %D (Limit: ≤~~20.0%~~/30%)	Associated Samples	Qualifications
	02/28/20	SIC0029-SCV1	QQ	34.4	All (ND + Det)	J/UJ/A

LDC #: 48785A26

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD: GC/MS BNA (EPA SW 846 Method 8270 ~~D~~ SIM)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

(Y) N N/A Was a continuing calibration standard analyzed at least once every 12 hours of sample analysis for each instrument?

Y N N/A Were percent differences (%D) and relative response factors (RRF) within method criteria for all CCC's and SPCC's ?

Y (N) N/A Were all %D and RRFs within the validation criteria of ≤20 %D and ≥0.05 RRF ?

#	Date	Standard ID	Compound	Finding %D (Limit: ≤20.0%)	Finding RRF (Limit: ≥0.05)	Associated Samples	Qualifications
	06/24/20	NT100624035	PPP	31.0		All (Det)	J/UJ/A

CONCAL.wpd

LDC #: 48785A2b

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS)

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD: GC/MS BNA (EPA SW 846 Method 8270 E-SIM)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

[✓ Y] N N/A Was a LCS required?

Y [✓ N] N/A Were the LCS/LCSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#	LCS/LCSD ID	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	No LCS performed, no data qualified since SRM was reported						Text
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
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			( )	( )	( )		
			( )	( )	( )		

LDC#: 48785A2b

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: JVG
2nd Reviewer:

METHOD: GCMS SVOA (EPA SW 846 Method 8270E-SIM)

Y N NA Were field duplicate pairs identified in this SDG?
Y N NA Were target analytes detected in the field duplicate pairs?

Compound	Concentration (ug/Kg)		RPD
	2	3	
QQQ	29.9	32.8	9
PPP	153	56.0	93
QQ	7.9U	3.1	NC

Compound	Concentration (ug/Kg)		RPD
	4	5	
E	5.0U	1.1	NC
PPP	30.8	19.7	44

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 19, 2020

Parameters: Hexachlorobenzene

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0114

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC322	20F0114-07	Sediment	06/05/20
LDW20-SC336	20F0114-08	Sediment	06/05/20
LDW20-SC336FD	20F0114-09	Sediment	06/05/20
LDW20-IT365	20F0114-10	Sediment	06/05/20
LDW20-IT365FD	20F0114-11	Sediment	06/05/20
LDW20-IT361	20F0114-12	Sediment	06/05/20
LDW20-SC322MS	20F0114-07MS	Sediment	06/05/20
LDW20-SC322MSD	20F0114-07MSD	Sediment	06/05/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). 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:

Hexachlorobenzene by Environmental Protection Agency (EPA) SW 846 Method 8081B

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 9.1°C and 18.8°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC Instrument Performance Check

Instrument performance was checked at 12 hour intervals.

The individual 4,4'-DDT and Endrin breakdowns (%BD) were less than or equal to 15.0%.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0%.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0%.

IV. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0%.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

All internal standard areas and retention times were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

X. Field Duplicates

Samples LDW20-SC336 and LDW20-SC336FD and samples LDW20-IT365 and LDW20-IT365FD were identified as field duplicates. No results were detected in any of the samples.

XI. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

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

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4
Hexachlorobenzene - Data Qualification Summary - SDG 20F0114

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Laboratory Blank Data Qualification Summary - SDG 20F0114

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Field Blank Data Qualification Summary - SDG 20F0114

No Sample Data Qualified in this SDG

LDC #: 48785A3a
SDG #: 20F0114
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 08/14/20
Page: 1 of 1
Reviewer: DC
2nd Reviewer: [illegible]

METHOD: GC Hexachlorobenzene (EPA SW846 Method 8081B)

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 (Insufficient time to cool)
I.	Sample receipt/Technical holding times	SW/A	Cooler temp. = 18.8°C, 16.2°C, 12.6°C, 15.5°C, 9.1°C, 14.3°C; 9.7°C; 10.2°C; 11.8°C
II.	GC Instrument Performance Check	N	
III.	Initial calibration/ICV	A/A	ICAL ≤ 20% ICV ≤ 20%
IV.	Continuing calibration	A	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes /1S	A/A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	A	LCS/D
X.	Field duplicates	ND	D = 2/3, 4/5
XI.	Compound quantitation/RL/LOQ/LODs	N	
XII.	Target compound 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:

	Client ID		Lab ID	Matrix	Date
1	LDW20-SC322		20F0114-07	Sediment	06/05/20
2	LDW20-SC336	D1	20F0114-08	Sediment	06/05/20
3	LDW20-SC336FD	D1	20F0114-09	Sediment	06/05/20
4	LDW20-IT365	D2	20F0114-10	Sediment	06/05/20
5	LDW20-IT365FD	D2	20F0114-11	Sediment	06/05/20
6	LDW20-IT361		20F0114-12	Sediment	06/05/20
7	LDW20-SC322MS		20F0114-07MS	Sediment	06/05/20
8	LDW20-SC322MSD		20F0114-07MSD	Sediment	06/05/20
9					
10					
11					

Notes:

	BIF0497-BLK1						

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 19, 2020

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0114

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC169	20F0114-01	Sediment	06/05/20
LDW20-IT215	20F0114-03	Sediment	06/05/20
LDW20-IT240	20F0114-04	Sediment	06/05/20
LDW20-IT247	20F0114-05	Sediment	06/05/20
LDW20-IT310	20F0114-06	Sediment	06/05/20
LDW20-SC322	20F0114-07	Sediment	06/05/20
LDW20-SC336	20F0114-08	Sediment	06/05/20
LDW20-SC336FD	20F0114-09	Sediment	06/05/20
LDW20-IT365	20F0114-10	Sediment	06/05/20
LDW20-IT365FD	20F0114-11	Sediment	06/05/20
LDW20-IT361	20F0114-12	Sediment	06/05/20
LDW20-SC169MS	20F0114-01MS	Sediment	06/05/20
LDW20-SC169MSD	20F0114-01MSD	Sediment	06/05/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). 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) by Environmental Protection Agency (EPA) SW 846 Method 8082A

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 9.1°C and 18.8°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Standard	Column	Compound	%D	Associated Samples	Flag	A or P
06/10/20	SIF0176-SCV1	2C	Aroclor-1260	21.0	All samples in SDG 20F0114	J (all detects)	A

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

All internal standard areas and retention times were within QC limits.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VIII. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

Samples LDW20-SC336 and LDW20-SC336FD and samples LDW20-IT365 and LDW20-IT365FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/Kg)		RPD
	LDW20-SC336	LDW20-SC336FD	
Aroclor-1248	31.0	28.3	9
Aroclor-1254	37.0	38.0	3
Aroclor-1260	36.9	34.7	6

Compound	Concentration (ug/Kg)		RPD
	LDW20-IT365	LDW20-IT365FD	
Aroclor-1248	5.8	4.7	21
Aroclor-1254	5.2	6.0	14
Aroclor-1260	4.5	4.7	4

X. Compound Quantitation

The sample results for detected compounds from the two columns were within 40% relative percent difference (RPD) with the following exceptions:

Sample	Compound	RPD	Flag	A or P
LDW20-SC169	Aroclor-1248	61.3	J (all detects)	A
LDW20-IT247	Aroclor-1248	59.5	J (all detects)	A
LDW20-SC336FD	Aroclor-1248	41.7	J (all detects)	A
LDW20-IT365FD	Aroclor-1254	62.9	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XI. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XII. Overall Assessment of Data

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

Due to ICV %D and RPD between two columns, data were qualified as estimated in eleven samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4
Polychlorinated Biphenyls - Data Qualification Summary - SDG 20F0114

Sample	Compound	Flag	A or P	Reason
LDW20-SC169 LDW20-IT215 LDW20-IT240 LDW20-IT247 LDW20-IT310 LDW20-SC322 LDW20-SC336 LDW20-SC336FD LDW20-IT365 LDW20-IT365FD LDW20-IT361	Aroclor-1260	J (all detects)	A	Initial calibration verification (%D)
LDW20-SC169 LDW20-IT247 LDW20-SC336FD	Aroclor-1248	J (all detects)	A	Compound quantitation (RPD between two columns)
LDW20-IT365FD	Aroclor-1254	J (all detects)	A	Compound quantitation (RPD between two columns)

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 20F0114

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 20F0114

No Sample Data Qualified in this SDG

LDC #: 48785A3b

SDG #: 20F0114

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 08/14/20

Page: 1 of 1

Reviewer: SW

2nd Reviewer: CT

METHOD: GC Polychlorinated Biphenyls (EPA SW846 Method 8082A)

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 (Insufficient time to cool)
I.	Sample receipt/Technical holding times	SW/A	Cooler temp. = 18.8°C, 16.2°C, 12.6°C, 15.5°C, 9.1°C, 14.3°C; 9.7°C; 10.2°C; 11.8°C
II.	Initial calibration/ICV	A/SW	ICAL ≤ 20%? ICV ≤ 20%
III.	Continuing calibration	A	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes /15	A/A	
VII.	Matrix spike/Matrix spike duplicates	A	
VIII.	Laboratory control samples	A	LCS/D SRM
IX.	Field duplicates	SW	D = 7/8, 9/10
X.	Compound quantitation/RL/LOQ/LODs	SW	
XI.	Target compound identification	N	
XII.	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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SC169	20F0114-01	Sediment	06/05/20
2	LDW20-IT215	20F0114-03	Sediment	06/05/20
3	LDW20-IT240	20F0114-04	Sediment	06/05/20
4	LDW20-IT247	20F0114-05	Sediment	06/05/20
5	LDW20-IT310	20F0114-06	Sediment	06/05/20
6	LDW20-SC322	20F0114-07	Sediment	06/05/20
7	LDW20-SC336 D1	20F0114-08	Sediment	06/05/20
8	LDW20-SC336FD D1	20F0114-09	Sediment	06/05/20
9	LDW20-IT365 D2	20F0114-10	Sediment	06/05/20
10	LDW20-IT365FD D✓	20F0114-11	Sediment	06/05/20
11	LDW20-IT361	20F0114-12	Sediment	06/05/20
12	LDW20-SC169MS	20F0114-01MS	Sediment	06/05/20
13	LDW20-SC169MSD	20F0114-01MSD	Sediment	06/05/20
14				
15				
16				
17	BIF0479-BLK1			

VALIDATION FINDINGS WORKSHEET

METHOD: Pesticide/PCBs (EPASW 846 Method 8081/8082)

A. alpha-BHC	K. Endrin	U. Toxaphene	EE. 2,4'-DDT	OO. trans–Heptachlor epoxide
B. beta-BHC	L. Endosulfan II	V. Aroclor-1016	FF. Hexachlorobenzene	PP. Mirex
C. delta-BHC	M. 4,4'-DDD	W. Aroclor-1221	GG. Chlordane	QQ cis-Chlordane
D. gamma-BHC	N. Endosulfan sulfate	X. Aroclor-1232	HH. Chlordane (Technical)	RR. trans-Chlordane
E. Heptachlor	O. 4,4'-DDT	Y. Aroclor-1242	II. Aroclor 1262	SS.
F. Aldrin	P. Methoxychlor	Z. Aroclor-1248	JJ. Aroclor 1268	TT.
G. Heptachlor epoxide	Q. Endrin ketone	AA. Aroclor-1254	KK. Oxychlordane	UU.
H. Endosulfan I	R. Endrin aldehyde	BB. Aroclor-1260	LL. trans-Nonachlor	VV
I. Dieldrin	S. alpha-Chlordane	CC. 2,4'-DDD	MM. cis-Nonachlor	WW.
J. 4,4'-DDE	T. gamma-Chlordane	DD. 2,4'-DDE	NN. cis–Heptachlor epoxide	XX.

Notes:_____

_____

_____

LDC #: 48785A36

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

Reviewer: JVG
2nd Reviewer:

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".
What type of initial calibration verification calculation was performed? %D or ___%R
Y N N/A Was an initial calibration verification standard analyzed after each ICAL for each instrument?
Y N N/A Did the initial calibration verification standards meet the %D / %R validation criteria of ≤20.0% / 80-120%?

#	Date	Standard ID	Detector/ Column	Compound	%D (Limit ≤ 20.0)	Associated Samples	Qualifications
	06/10/20	SIF0176-SCV1	2C	BB	21.0	All (Det)	J/UJ/A (qual BB only)

LDC#: 48785A3b

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: JVG
2nd Reviewer:

METHOD: GC PCB (EPA SW 846 Method 8082A)

Y N NA Were field duplicate pairs identified in this SDG?
Y N NA Were target analytes detected in the field duplicate pairs?

Compound	Concentration (ug/Kg)		RPD
	7	8	
Aroclor 1248	31.0	28.3	9
Aroclor 1254	37.0	38.0	3
Aroclor 1260	36.9	34.7	6

Compound	Concentration (ug/Kg)		RPD
	9	10	
Aroclor 1248	5.8	4.7	21
Aroclor 1254	5.2	6.0	14
Aroclor 1260	4.5	4.7	4

V:\Josephine\FIELD DUPLICATES\48785A3b windward duwamish.wpd

LDC #: 48785A3b

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Reviewer: JVG
2nd Reviewer:

METHOD: / GC __ HPLC

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Level IV/D Only

Y N N/A Were CRQLs adjusted for sample dilutions, dry weight factors, etc.?
Y N N/A Did the reported results for detected target compounds agree within 10.0% of the recalculated results?
Y N N/A Did the percent difference of detected compounds between two columns./detectors ≤40%?
If no, please see findings bellow.

#	Compound Name	Sample ID	%RPD/%D Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	Aroclor 1248	1	61.3	J dets /A
		4	59.5	
		8	41.7	
	Aroclor 1254	10	62.9	

Comments: See sample calculation verification worksheet for recalculations

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 20, 2020

Parameters: Metals

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0114

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT215	20F0114-03	Sediment	06/05/20
LDW20-IT240	20F0114-04	Sediment	06/05/20
LDW20-IT247	20F0114-05	Sediment	06/05/20
LDW20-IT310	20F0114-06	Sediment	06/05/20
LDW20-SC322	20F0114-07	Sediment	06/05/20
LDW20-SC336	20F0114-08	Sediment	06/05/20
LDW20-SC336FD	20F0114-09	Sediment	06/05/20
LDW20-IT365	20F0114-10	Sediment	06/05/20
LDW20-IT365FD	20F0114-11	Sediment	06/05/20
LDW20-IT361	20F0114-12	Sediment	06/05/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). 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 methods:

Arsenic, Cadmium, Chromium, Copper, Lead, Silver, and Zinc by Environmental Protection Agency (EPA) SW 846 Method 6020A
Mercury by EPA SW 846 Method 7471B

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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.

All technical holding time requirements were met.

II. ICPMS Tune

The mass calibration was within 0.1 AMU and the percent relative standard deviation (%RSD) was less than or equal to 5%.

III. Instrument Calibration

Initial and continuing calibrations were performed as required by the methods.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

IV. ICP Interference Check Sample Analysis

The frequency of interference check sample (ICS) analysis was met. All criteria were within QC limits.

V. Laboratory Blanks

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

Blank ID	Analyte	Maximum Concentration	Associated Samples
ICB/CCB	Cadmium	0.034 ug/L	LDW20-SC322 LDW20-SC336 LDW20-SC336FD LDW20-IT365 LDW20-IT365FD LDW20-IT361

Data qualification by the laboratory blanks was based on the maximum contaminant concentration in the laboratory blanks in the analysis of each analyte. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Analyte	Reported Concentration	Modified Final Concentration
LDW20-SC336FD	Cadmium	0.21 mg/Kg	0.21U mg/Kg
LDW20-IT365	Cadmium	0.11 mg/Kg	0.11U mg/Kg

Sample	Analyte	Reported Concentration	Modified Final Concentration
LDW20-IT365FD	Cadmium	0.11 mg/Kg	0.11U mg/Kg
LDW20-IT361	Cadmium	0.07 mg/Kg	0.07U mg/Kg

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. Duplicate Sample Analysis

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

IX. Serial Dilution

Serial dilution was not performed for this SDG.

X. Laboratory Control Samples/Standard Reference Materials

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

Standard reference materials (SRM) were analyzed as required by the methods. The results were within QC limits.

XI. Field Duplicates

Samples LDW20-SC336 and LDW20-SC336FD and samples LDW20-IT365 and LDW20-IT365FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (mg/Kg)		RPD
	LDW20-SC336	LDW20-SC336FD	
Arsenic	9.99	11.4	13
Cadmium	0.23	0.21	9

Analyte	Concentration (mg/Kg)		RPD
	LDW20-SC336	LDW20-SC336FD	
Chromium	25.8	26.3	2
Copper	46.3	44.9	3
Lead	17.0	17.1	1
Mercury	0.141	0.118	18
Silver	0.16	0.17	6
Zinc	98.6	98.5	0

Analyte	Concentration (mg/Kg)		RPD
	LDW20-IT365	LDW20-IT365FD	
Arsenic	4.53	4.39	3
Cadmium	0.11	0.11	0
Chromium	17.0	16.1	5
Copper	19.4	19.6	1
Lead	12.3	8.25	39
Mercury	0.0350	0.0425	19
Silver	0.08	0.09	12
Zinc	59.2	57.3	3

XII. Internal Standards (ICP-MS)

Raw data were not reviewed for Stage 2B validation.

XIII. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

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

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

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4
Metals - Data Qualification Summary - SDG 20F0114

No Sample Data Qualified in this SDG

Duwamish AOC4
Metals - Laboratory Blank Data Qualification Summary - SDG 20F0114

Sample	Analyte	Modified Final Concentration	A or P
LDW20-SC336FD	Cadmium	0.21U mg/Kg	A
LDW20-IT365	Cadmium	0.11U mg/Kg	A
LDW20-IT365FD	Cadmium	0.11U mg/Kg	A
LDW20-IT361	Cadmium	0.07U mg/Kg	A

Duwamish AOC4
Metals - Field Blank Data Qualification Summary - SDG 20F0114

No Sample Data Qualified in this SDG

LDC #: 48785A4a

SDG #: 20F0114

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 8/18/20

Page: 1 of 1

Reviewer: CF

2nd Reviewer: MC

METHOD: Metals (EPA SW 846 Method 6020A/7471B)

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.	ICP/MS Tune	A	
III.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	SW	
VI.	Field Blanks	N	
VII.	Matrix Spike/Matrix Spike Duplicates	N	
VIII.	Duplicate sample analysis	N	
IX.	Serial Dilution	N	
X.	Laboratory control samples	A	LCS, SRM
XI.	Field Duplicates	SW	(6,7) (8,9)
XII.	Internal Standard (ICP-MS)	N	not reviewed
XIII.	Sample Result Verification	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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-IT215	20F0114-03	Sediment	06/05/20
2	LDW20-IT240	20F0114-04	Sediment	06/05/20
3	LDW20-IT247	20F0114-05	Sediment	06/05/20
4	LDW20-IT310	20F0114-06	Sediment	06/05/20
5	LDW20-SC322	20F0114-07	Sediment	06/05/20
6	LDW20-SC336	20F0114-08	Sediment	06/05/20
7	LDW20-SC336FD	20F0114-09	Sediment	06/05/20
8	LDW20-IT365	20F0114-10	Sediment	06/05/20
9	LDW20-IT365FD	20F0114-11	Sediment	06/05/20
10	LDW20-IT361	20F0114-12	Sediment	06/05/20
11				
12				
13				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
5 to 10	As, Cd, Cr, Cu, Pb, Ag, Zn, Hg
1 to 4	As

Analysis Method

ICP	
ICP-MS	As, Cd, Cr, Cu, Pb, Ag, Zn
CVAA	Hg

VALIDATION FINDINGS WORKSHEET
Laboratory Blank Contamination (PB/ICB/CCB)

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)
Soil preparation factor applied (if applicable):

Sample Concentration, unless otherwise noted: mg/Kg Associated Samples: 5-10

				Sample Identification								
Analyte	**PB (units)**	**Maximum ICB/CCB (ug/L)**	**Action Level**	7	8	9	10					
Cd		0.034		0.21	0.11	0.11	0.07					

Comments: The listed analyte concentrtaion is the highest ICB or CCB detected in the analysis. The action level, when applicable, is established at 5X the highest ICB, CCB, or PB concentration.

Method: Metals

Analyte	Concentration (mg/Kg)		RPD
	6	7	
Arsenic	9.99	11.4	13
Cadmium	0.23	0.21	9
Chromium	25.8	26.3	2
Copper	46.3	44.9	3
Lead	17.0	17.1	1
Mercury	0.141	0.118	18
Silver	0.16	0.17	6
Zinc	98.6	98.5	0

Analyte	Concentration (mg/Kg)		RPD
	8	9	
Arsenic	4.53	4.39	3
Cadmium	0.11	0.11	0
Chromium	17.0	16.1	5
Copper	19.4	19.6	1
Lead	12.3	8.25	39
Mercury	0.0350	0.0425	19
Silver	0.08	0.09	12
Zinc	59.2	57.3	3

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 20, 2020

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0114

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC169	20F0114-01	Sediment	06/05/20
LDW20-IT215	20F0114-03	Sediment	06/05/20
LDW20-IT240	20F0114-04	Sediment	06/05/20
LDW20-IT247	20F0114-05	Sediment	06/05/20
LDW20-IT310	20F0114-06	Sediment	06/05/20
LDW20-SC322	20F0114-07	Sediment	06/05/20
LDW20-SC336	20F0114-08	Sediment	06/05/20
LDW20-SC336FD	20F0114-09	Sediment	06/05/20
LDW20-IT365	20F0114-10	Sediment	06/05/20
LDW20-IT365FD	20F0114-11	Sediment	06/05/20
LDW20-IT361	20F0114-12	Sediment	06/05/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). 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 methods:

Total Organic Carbon by Environmental Protection Agency (EPA) SW 846 Method 9060A
Total Solids by Standard Method 2540G

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration of each method were met.

III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met for each method when applicable.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. 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.

VII. Duplicate Sample Analysis

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

VIII. Laboratory Control Samples/Standard Reference Materials

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

Standard reference materials (SRM) were analyzed as required by the methods. The results were within QC limits.

IX. Field Duplicates

Samples LDW20-SC336 and LDW20-SC336FD and samples LDW20-IT365 and LDW20-IT365FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (%)		RPD
	LDW20-SC336	LDW20-SC336FD	
Total solids	45.69	46.44	2
Total organic carbon	2.38	2.29	4

Analyte	Concentration (%)		RPD
	LDW20-IT365	LDW20-IT365FD	
Total solids	70.53	69.99	1
Total organic carbon	0.66	0.65	2

X. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

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

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4
Wet Chemistry - Data Qualification Summary - SDG 20F0114

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 20F0114

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 20F0114

No Sample Data Qualified in this SDG

LDC #: 48785A6
SDG #: 20F0114
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 8/18/20
Page: 1 of 1
Reviewer: CA
2nd Reviewer: CA

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM 2540G)

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	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	A	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	
VII.	Duplicate sample analysis	N	
VIII.	Laboratory control samples	A	LCS, SRM
IX.	Field duplicates	SW	(7,8) (9,10)
X.	Sample result verification	N	
XI	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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SC169	20F0114-01	Sediment	06/05/20
2	LDW20-IT215	20F0114-03	Sediment	06/05/20
3	LDW20-IT240	20F0114-04	Sediment	06/05/20
4	LDW20-IT247	20F0114-05	Sediment	06/05/20
5	LDW20-IT310	20F0114-06	Sediment	06/05/20
6	LDW20-SC322	20F0114-07	Sediment	06/05/20
7	LDW20-SC336	20F0114-08	Sediment	06/05/20
8	LDW20-SC336FD	20F0114-09	Sediment	06/05/20
9	LDW20-IT365	20F0114-10	Sediment	06/05/20
10	LDW20-IT365FD	20F0114-11	Sediment	06/05/20
11	LDW20-IT361	20F0114-12	Sediment	06/05/20
12				
13				
14				
15				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1 to 11	Total solids, TOC

Field Duplicates

METHOD: Inorganics

Analyte	Concentration (%)		RPD
	7	8	
Total solids	45.69	46.44	2
TOC	2.38	2.29	4

Analyte	Concentration (%)		RPD
	9	10	
Total solids	70.53	69.99	1
TOC	0.66	0.65	2

LDC Report# 48785A21

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 19, 2020

Parameters: Polychlorinated Dioxins/Dibenzofurans

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0114

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT215	20F0114-03	Sediment	06/05/20
LDW20-IT247	20F0114-05	Sediment	06/05/20
LDW20-SC336	20F0114-08	Sediment	06/05/20
LDW20-SC336FD	20F0114-09	Sediment	06/05/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for High Resolution Superfund Methods Data Review (April 2016). 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 Dioxins/Dibenzofurans by Environmental Protection Agency (EPA) Method 1613B

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 9.1°C and 18.8°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required frequency.

Retention time windows were established for all homologues. The chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomer was less than or equal to 25%.

The static resolving power was at least 10,000 (10% valley definition).

III. Initial Calibration and Initial Calibration Verification

A five point initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for unlabeled compounds and less than or equal to 35.0% for labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were within the QC limits for unlabeled compounds and labeled compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

All of the continuing calibration results were within the QC limits for unlabeled compounds and labeled compounds with the following exceptions:

Date	Compound	Concentration (Limits)	Associated Samples	Affected Compound	Flag	A or P
06/25/20	13C12-1,2,3,4,7,8,9-HpCDF	73.9 ng/mL (77-129)	LDW20-IT215 LDW20-IT247	1,2,3,4,7,8,9-HpCDF	J (all detects)	P
06/26/20	13C12-1,2,3,6,7,8-HxCDD	79.0 ng/mL (85-118)	LDW20-SC336 LDW20-SC336FD	1,2,3,6,7,8-HxCDD	J (all detects)	P

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

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	Compound	Concentration	Associated Samples
BIF0465-BLK1	06/22/20	1,2,3,7,8-PeCDD 2,3,4,6,7,8-HxCDF 1,2,3,4,6,7,8-HpCDF OCDF OCDD Total PeCDD Total HpCDF	0.175 ng/Kg 0.0946 ng/Kg 0.166 ng/Kg 0.521 ng/Kg 1.32 ng/Kg 0.175 ng/Kg 0.166 ng/Kg	All samples in SDG 20F0114

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Compound	Reported Concentration	Modified Final Concentration
LDW20-IT215	1,2,3,7,8-PeCDD 2,3,4,6,7,8-HxCDF	0.768 ng/Kg 0.203 ng/Kg	0.768U ng/Kg 0.203U ng/Kg
LDW20-IT247	1,2,3,7,8-PeCDD 2,3,4,6,7,8-HxCDF	0.525 ng/Kg 0.416 ng/Kg	0.525U ng/Kg 0.416U ng/Kg
LDW20-SC336FD	1,2,3,7,8-PeCDD	0.777 ng/Kg	0.777U ng/Kg

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/Standard Reference Materials

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

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

Samples LDW20-SC336 and LDW20-SC336FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ng/Kg)		RPD
	LDW20-SC336	LDW20-SC336FD	
2,3,7,8-TCDF	0.729	0.606	18
2,3,7,8-TCDD	0.356	0.996U	Not calculable
1,2,3,7,8-PeCDF	0.612	0.430	35
2,3,4,7,8-PeCDF	0.847	0.710	18
1,2,3,7,8-PeCDD	0.913	0.777	16
1,2,3,4,7,8-HxCDF	2.30	1.67	32
1,2,3,6,7,8-HxCDF	0.965	0.822	16
2,3,4,6,7,8-HxCDF	0.612	1.04	52
1,2,3,7,8,9-HxCDF	0.575	0.452	24
1,2,3,4,7,8-HxCDD	1.11	0.915	19
1,2,3,6,7,8-HxCDD	3.53	3.23	9
1,2,3,7,8,9-HxCDD	2.45	2.23	9
1,2,3,4,6,7,8-HpCDF	19.1	15.4	21
1,2,3,4,7,8,9-HpCDF	1.60	1.25	25
1,2,3,4,6,7,8-HpCDD	104	94.5	10
OCDF	45.8	44.9	2
OCDD	802	747	7
Total TCDF	6.68	3.17	71
Total TCDD	3.47	1.32	90

Compound	Concentration (ng/Kg)		RPD
	LDW20-SC336	LDW20-SC336FD	
Total PeCDF	6.83	5.89	15
Total PeCDD	1.70	1.58	7
Total HxCDF	26.5	23.4	12
Total HxCDD	28.9	27.8	4
Total HpCDF	63.1	54.6	14
Total HpCDD	242	243	0

X. Labeled Compounds

All percent recoveries (%R) for labeled compounds used to quantitate target compounds were within QC limits.

XI. Compound Quantitation

All compound quantitations were within validation criteria with the following exceptions:

Sample	Compound	Flag	A or P
All samples in SDG 20F0114	All compounds reported as estimated maximum possible concentration (EMPC) and greater than the reporting limit.	J (all detects)	A
All samples in SDG 20F0114	All compounds reported as estimated maximum possible concentration (EMPC) and less than the reporting limit.	U (all non-detects)	A

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B 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 continuing calibration concentration and compounds reported as EMPC, data were qualified as estimated or not detected in four samples.

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

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Data Qualification Summary - SDG 20F0114

Sample	Compound	Flag	A or P	Reason
LDW20-IT215 LDW20-IT247	1,2,3,4,7,8,9-HpCDF	J (all detects)	P	Continuing calibration (concentration)
LDW20-SC336 LDW20-SC336FD	1,2,3,6,7,8-HxCDD	J (all detects)	P	Continuing calibration (concentration)
LDW20-IT215 LDW20-IT247 LDW20-SC336 LDW20-SC336FD	All compounds reported as estimated maximum possible concentration (EMPC) and greater than the reporting limit.	J (all detects)	A	Compound quantitation (EMPC)
LDW20-IT215 LDW20-IT247 LDW20-SC336 LDW20-SC336FD	All compounds reported as estimated maximum possible concentration (EMPC) and less than the reporting limit.	U (all non-detects)	A	Compound quantitation (EMPC)

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG 20F0114

Sample	Compound	Modified Final Concentration	A or P
LDW20-IT215	1,2,3,7,8-PeCDD 2,3,4,6,7,8-HxCDF	0.768U ng/Kg 0.203U ng/Kg	A
LDW20-IT247	1,2,3,7,8-PeCDD 2,3,4,6,7,8-HxCDF	0.525U ng/Kg 0.416U ng/Kg	A
LDW20-SC336FD	1,2,3,7,8-PeCDD	0.777U ng/Kg	A

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Field Blank Data Qualification Summary - SDG 20F0114

No Sample Data Qualified in this SDG

LDC #: 48785A21 **VALIDATION COMPLETENESS WORKSHEET** Date: 08/14/20
SDG #: 20F0114 Stage 2B Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer: SW
2nd Reviewer:

METHOD: HRGC/HRMS Polychlorinated Dioxins/Dibenzofurans (EPA Method 1613B)

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 (Insufficient time to cool)
I.	Sample receipt/Technical holding times	SW / A	cooler temp. = 18.8°C, 16.2°C, 12.6°C, 15.5°C, 9.1°C, 14.3°C, 9.7°C, 10.2°C, 11.8°C
II.	HRGC/HRMS Instrument performance check	A	
III.	Initial calibration/ICV	A / A	ICAL ≤ 20/35%. ICV ≤ QC limits
IV.	Continuing calibration	SW	CCV ≤ QC limits
V.	Laboratory Blanks	SW	
VI.	Field blanks	N	
VII.	Matrix spike/Matrix spike duplicates	N	
VIII.	Laboratory control samples	A	LCS, SRM
IX.	Field duplicates	SW	D = 3/4
X.	Labeled Compounds	A	
XI.	Compound quantitation RL/LOQ/LODs	N	EMPC = J dets (>RL); U (<RL)
XII.	Target compound 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:

	Client ID		Lab ID	Matrix	Date
1	LDW20-IT215		20F0114-03	Sediment	06/05/20
2	LDW20-IT247		20F0114-05	Sediment	06/05/20
3	LDW20-SC336	D	20F0114-08	Sediment	06/05/20
4	LDW20-SC336FD	D	20F0114-09	Sediment	06/05/20
5					
6					
7					
8					
9					
10					

Notes:

	BIF0465_BLKA						

VALIDATION FINDINGS WORKSHEET

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

A. 2,3,7,8-TCDD	F. 1,2,3,4,6,7,8-HpCDD	K. 1,2,3,4,7,8-HxCDF	P. 1,2,3,4,7,8,9-HpCDF	U. Total HpCDD
B. 1,2,3,7,8-PeCDD	G. OCDD	L. 1,2,3,6,7,8-HxCDF	Q. OCDF	V. Total TCDF
C. 1,2,3,4,7,8-HxCDD	H. 2,3,7,8-TCDF	M. 2,3,4,6,7,8-HxCDF	R. Total TCDD	W. Total PeCDF
D. 1,2,3,6,7,8-HxCDD	I. 1,2,3,7,8-PeCDF	N. 1,2,3,7,8,9-HxCDF	S. Total PeCDD	X. Total HxCDF
E. 1,2,3,7,8,9-HxCDD	J. 2,3,4,7,8-PeCDF	O. 1,2,3,4,6,7,8-HpCDF	T. Total HxCDD	Y. Total HpCDF

Notes:_____

LDC #: 48785A21

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Reviewer: JVG
2nd Reviewer:

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)
Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y Was a routine calibration performed at the beginning of each 12 hour period?
N Were all concentrations within method QC limits for unlabeled and labeled compounds?
Y Did all routine calibration standards meet the Ion Abundance Ratio criteria?

#	Date	Standard ID	Compound	Conc:ng/mL (Limits)	Finding Ion Abundance Ratio	Associated Samples	Qualifications
	06/25/20	SIF0380-ICV1	13C12-P	73.9 (77-129)		1, 2, BLK (Det)	J/UJ/P (qual P)
	06/26/20	SIF0380-CCV1	13C12-D	79.0 (85-118)		3, 4 (Det)	J/UJ/P (qual D)

LDC #: 48785A21

VALIDATION FINDINGS WORKSHEET
Blanks

Reviewer: JVG
2nd Reviewer:

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y Were all samples associated with a method blank?
Y Was a method blank performed for each matrix and whenever a sample extraction was performed?
Y Was the method blank contaminated?

Blank extraction date: 06/22/20 **Blank analysis date:** 06/25/20 **Associated samples:** All

Conc. units: ng/Kg

Compound	Blank ID		Sample Identification								
	BIF0465-BLK1	(5x)		1	2	4					
B	0.175	0.88		0.768/U	0.525/U	0.777/U					
M	0.0946*	0.47		0.203/J	0.416*/J						
O	0.166	0.83									
Q	0.521*	2.61									
G	1.32	6.60									
S	0.175	0.88									
Y	0.166	0.83									

*EMPC

LDC#: 48785A21

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD: HRGC/HRMS PCDD/PCDF (EPA Method 1613B)

Y N NA Were field duplicate pairs identified in this SDG?
Y N NA Were target analytes detected in the field duplicate pairs?

Compound	Concentration (ng/Kg)		RPD
	3	4	
H	0.729	0.606	18
A	0.356*	0.996U	NC
I	0.612	0.430	35
J	0.847	0.710	18
B	0.913*	0.777	16
K	2.30	1.67	32
L	0.965	0.822	16
M	0.612*	1.04	52
N	0.575*	0.452	24
C	1.11	0.915	19
D	3.53	3.23	9
E	2.45	2.23	9
O	19.1	15.4	21
P	1.60	1.25	25
F	104	94.5	10
Q	45.8	44.9	2
G	802	747	7
V	6.68	3.17	71
R	3.47	1.32	90
W	6.83	5.89	15
S	1.70	1.58	7
X	26.5	23.4	12
T	28.9	27.8	4
Y	63.1	54.6	14
U	242	243	0

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 19, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0118

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS159	20F0118-01	Sediment	06/05/20
LDW20-SS167	20F0118-02	Sediment	06/05/20
LDW20-SS158	20F0118-03	Sediment	06/05/20
LDW20-SS154	20F0118-04	Sediment	06/05/20
LDW20-SS168	20F0118-05	Sediment	06/05/20
LDW20-SS101	20F0118-06	Sediment	06/05/20
LDW20-SS102	20F0118-07	Sediment	06/05/20
LDW20-SS102-FD	20F0118-08	Sediment	06/05/20
LDW20-SS102-FDRE	20F0118-08RE	Sediment	06/05/20
LDW20-SS109	20F0118-09	Sediment	06/05/20
LDW20-SS109-FD	20F0118-10	Sediment	06/05/20
LDW20-SS117	20F0118-12	Sediment	06/05/20
LDW20-SS159MS	20F0118-01MS	Sediment	06/05/20
LDW20-SS159MSD	20F0118-01MSD	Sediment	06/05/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). 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:

Semivolatile Organic Compounds (SVOCs) by Environmental Protection Agency (EPA) SW 846 Method 8270E

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 9.1°C and 18.8°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples/Standard Reference Materials

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

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits with the following exceptions:

SRM ID	Compound	%R (Limits)	Associated Samples	Flag	A or P
BIF0487-SRM1	Anthracene Bis(2-ethylhexyl)phthalate Benzo(a)pyrene	49.6 (57-143) 61.1 (62-138) 48.4 (54-146)	All samples in SDG 20F0118	J (all detects) UJ (all non-detects)	P

X. Field Duplicates

Samples LDW20-SS102 and LDW20-SS102-FD, samples LDW20-SS102 and LDW20-SS102-FDRE, and samples LDW20-SS109 and LDW20-SS109-FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/Kg)		RPD
	LDW20-SS102	LDW20-SS102-FD	
Phenanthrene	28.2	36.7	26
Anthracene	14.1	10.0	34
Fluoranthene	72.5	70.9	2
Pyrene	74.2	73.2	1
Benzo(a)anthracene	35.9	30.7	16
Chrysene	68.2	43.5	44

Compound	Concentration (ug/Kg)		RPD
	LDW20-SS102	LDW20-SS102-FD	
Bis(2-ethylhexyl)phthalate	69.0	60.6	13
Benzofluoranthenes, total	103	89.3	14
Benzo(a)pyrene	38.7	31.0	22
Indeno(1,2,3-cd)pyrene	27.1	24.7	9
Benzo(g,h,i)perylene	19.9U	28.1	Not calculable

Compound	Concentration (ug/Kg)		RPD
	LDW20-SS102	LDW20-SS102-FDRE	
Phenol	19.9U	9.0	Not calculable
Naphthalene	19.9U	4.5	Not calculable
2-Methylnaphthalene	19.9U	4.7	Not calculable
Acenaphthylene	19.9U	2.7	Not calculable
Acenaphthene	19.9U	4.5	Not calculable
Dibenzofuran	19.9U	4.3	Not calculable
Fluorene	19.9U	4.1	Not calculable
Phenanthrene	28.2	31.9	12
Anthracene	14.1	7.8	58
Fluoranthene	72.5	56.7	24
Pyrene	74.2	57.1	26
Butylbenzylphthalate	19.9U	4.2	Not calculable
Benzo(a)anthracene	35.9	23.6	41
Chrysene	68.2	34.7	65
Bis(2-ethylhexyl)phthalate	69.0	49.4	33

Compound	Concentration (ug/Kg)		RPD
	LDW20-SS102	LDW20-SS102-FDRE	
Benzofluoranthenes, total	103	74.6	32
Benzo(a)pyrene	38.7	25.1	43
Indeno(1,2,3-cd)pyrene	27.1	20.1	30
Dibenzo(a,h)anthracene	19.9U	8.4	Not calculable
Benzo(g,h,i)perylene	19.9U	24.6	21

Compound	Concentration (ug/Kg)		RPD
	LDW20-SS109	LDW20-SS109-FD	
Phenanthrene	28.8	31.3	8
Anthracene	11.1	14.3	25
Fluoranthene	65.6	59.4	10
Pyrene	65.5	57.8	12
Butylbenzylphthalate	20.0U	11.3	56
Benzo(a)anthracene	28.7	29.6	3
Chrysene	44.7	45.9	3
Bis(2-ethylhexyl)phthalate	74.3	63.8	15
Benzofluoranthenes, total	93.7	89.5	5
Benzo(a)pyrene	31.4	33.3	6
Indeno(1,2,3-cd)pyrene	22.4	21.9	2
Benzo(g,h,i)perylene	25.4	25.5	0

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

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

In the case where more than one result was reported for an individual sample, the least technically acceptable results were deemed not reportable as follows:

Sample	Compound	Reason	Flag	A or P
LDW20-SS102-FDRE	All compounds	Results from original analyses were more usable.	Not reportable	A

Due to SRM %R, data were qualified as estimated in eleven samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4
Semivolatiles - Data Qualification Summary - SDG 20F0118

Sample	Compound	Flag	A or P	Reason
LDW20-SS159 LDW20-SS167 LDW20-SS158 LDW20-SS154 LDW20-SS168 LDW20-SS101 LDW20-SS102 LDW20-SS102-FD LDW20-SS109 LDW20-SS109-FD LDW20-SS117	Anthracene Bis(2-ethylhexyl)phthalate Benzo(a)pyrene	J (all detects) UJ (all non-detects)	P	Standard reference materials (%R)
LDW20-SS102-FDRE	All compounds	Not reportable	A	Overall assessment of data

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0118

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0118

No Sample Data Qualified in this SDG

LDC #: 48785B2a

SDG #: 20F0118

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 08/19/20

Page: 1 of 1

Reviewer: SM

2nd Reviewer:

METHOD: GC/MS Semivolatiles (EPA SW 846 Method 8270E)

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 (Insufficient time to cool)
I.	Sample receipt/Technical holding times	SW / A	Cooler temp. = 18.8°C, 16.2°C, 12.6°C, 15.5°C, 9.1°C, 14.3°C, 9.7°C, 10.2°C, 11.8°C
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A / A	ICALS 20% ICVS 30%
IV.	Continuing calibration	A	CCVS 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	SW	LCS, SRM
X.	Field duplicates	SW	D = 7/8, 7/9, 10/11
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	SW	

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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS159	20F0118-01	Sediment	06/05/20
2	LDW20-SS167	20F0118-02	Sediment	06/05/20
3	LDW20-SS158	20F0118-03	Sediment	06/05/20
4	LDW20-SS154	20F0118-04	Sediment	06/05/20
5	LDW20-SS168	20F0118-05	Sediment	06/05/20
6	LDW20-SS101	20F0118-06	Sediment	06/05/20
7	LDW20-SS102	20F0118-07	Sediment	06/05/20
8	LDW20-SS102-FD	20F0118-08	Sediment	06/05/20
9	LDW20-SS102-FDRE	20F0118-08RE	Sediment	06/05/20
10	LDW20-SS109	20F0118-09	Sediment	06/05/20
11	LDW20-SS109-FD	20F0118-10	Sediment	06/05/20
12	LDW20-SS117	20F0118-12	Sediment	06/05/20
13	LDW20-SS159MS	20F0118-01MS	Sediment	06/05/20
14	LDW20-SS159MSD	20F0118-01MSD	Sediment	06/05/20

D1, D2 (row 7); D1 (row 8); D2 (row 9); D3 (row 10); D3 (row 11)

1. BIF0487-BLK1

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

A. Phenol	AA. 2-Chloronaphthalene	AAA. Butylbenzylphthalate	AAAA. Dibenzothiophene	A1. N-Nitrosodiethylamine
B. Bis (2-chloroethyl) ether	BB. 2-Nitroaniline	BBB. 3,3'-Dichlorobenzidine	BBBB. Benzo(a)fluoranthene	B1. N-Nitrosodi-n-butylamine
C. 2-Chlorophenol	CC. Dimethylphthalate	CCC. Benzo(a)anthracene	CCCC. Benzo(b)fluorene	C1. N-Nitrosomethylethylamine
D. 1,3-Dichlorobenzene	DD. Acenaphthylene	DDD. Chrysene	DDDD. cis/trans-Decalin	D1. N-Nitrosomorpholine
E. 1,4-Dichlorobenzene	EE. 2,6-Dinitrotoluene	EEE. Bis(2-ethylhexyl)phthalate	EEEE. Biphenyl	E1. N-Nitrosopyrrolidine
F. 1,2-Dichlorobenzene	FF. 3-Nitroaniline	FFF. Di-n-octylphthalate	FFFF. Retene	F1. Phenacetin
G. 2-Methylphenol	GG. Acenaphthene	GGG. Benzo(b)fluoranthene	GGGG. C30-Hopane	G1. 2-Acetylaminofluorene
H. 2,2'-Oxybis(1-chloropropane)	HH. 2,4-Dinitrophenol	HHH. Benzo(k)fluoranthene	HHHH. 1-Methylphenanthrene	H1. Pronamide
I. 4-Methylphenol	II. 4-Nitrophenol	III. Benzo(a)pyrene	IIII. 1,4-Dioxane	I1. Methyl methanesulfonate
J. N-Nitroso-di-n-propylamine	JJ. Dibenzofuran	JJJ. Indeno(1,2,3-cd)pyrene	JJJJ. Acetophenone	J1. Ethyl methanesulfonate
K. Hexachloroethane	KK. 2,4-Dinitrotoluene	KKK. Dibenz(a,h)anthracene	KKKK. Atrazine	K1. o,o',o''-Triethylphosphorothioate
L. Nitrobenzene	LL. Diethylphthalate	LLL. Benzo(g,h,i)perylene	LLLL. Benzaldehyde	L1. n-Phenylene diamine
M. Isophorone	MM. 4-Chlorophenyl-phenyl ether	MMM. Bis(2-Chloroisopropyl)ether	MMMM. Caprolactam	M1. 1,4-Naphthoquinone
N. 2-Nitrophenol	NN. Fluorene	NNN. Aniline	NNNN. 2,6-Dichlorophenol	N1. N-Nitro-o-toluidine
O. 2,4-Dimethylphenol	OO. 4-Nitroaniline	OOO. N-Nitrosodimethylamine	OOOO. 1,2-Diphenylhydrazine	O1. 1,3,5-Trinitrobenzene
P. Bis(2-chloroethoxy)methane	PP. 4,6-Dinitro-2-methylphenol	PPP. Benzoic Acid	PPPP. 3-Methylphenol	P1. Pentachlorobenzene
Q. 2,4-Dichlorophenol	QQ. N-Nitrosodiphenylamine	QQQ. Benzyl alcohol	QQQQ. 3&4-Methylphenol	Q1. 4-Aminobiphenyl
R. 1,2,4-Trichlorobenzene	RR. 4-Bromophenyl-phenylether	RRR. Pyridine	RRRR. 4-Dimethyldibenzothiophene (4MDT)	R1. 2-Naphthylamine
S. Naphthalene	SS. Hexachlorobenzene	SSS. Benzidine	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	S1. Triphenylene
T. 4-Chloroaniline	TT. Pentachlorophenol	TTT. 1-Methylnaphthalene	TTTT. 1-Methyldibenzothiophene (1MDT)	T1. Octachlorostyrene
U. Hexachlorobutadiene	UU. Phenanthrene	UUU.Benzo(b)thiophene	UUUU.. 2,3,4,6-Tetrachlorophenol	U1. Famphur
V. 4-Chloro-3-methylphenol	VV. Anthracene	VVV.Benzonaphthothiophene	VVVV. 1,2,4,5-Tetrachlorobenzene	V1. 1,4-phenylenediamine
W. 2-Methylnaphthalene	WW. Carbazole	WWW.Benzo(e)pyrene	WWWW.. 2-Picoline	W1. Methapyrilene
X. Hexachlorocyclopentadiene	XX. Di-n-butylphthalate	XXX. 2,6-Dimethylnaphthalene	XXXX. 3-Methylcholanthrene	X1. Pentachloroethane
Y. 2,4,6-Trichlorophenol	YY. Fluoranthene	YYY. 2,3,5-Trimethylnaphthalene	YYYY. a,a-Dimethylphenethylamine	Y1. 3,3'-Dimethylbenzidine
Z. 2,4,5-Trichlorophenol	ZZ. Pyrene	ZZZ. Perylene	ZZZZ. Hexachloropropene	Z1. o-Toluidine

LDC #: 48785 B2a

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS) /SRM

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD: GC/MS BNA (EPA SW 846 Method 8270~~C~~E)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

[✓ Y] N N/A Was a LCS required?

[✓ Y] N N/A Were the LCS/LCSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#	LCS/LCSD ID	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	BIF0487-SRM1	VV	49.6 (57-143)	( )	( )	All (ND + Det)	J/UJ/P
		EEE	61.1 (62-138)	( )	( )		
		III	48.4 (54-146)	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
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			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		

LDC#: 48785B2a

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: JVG
2nd Reviewer:

METHOD: GCMS SVOA (EPA SW 846 Method 8270E)

Y N NA Were field duplicate pairs identified in this SDG?
Y N NA Were target analytes detected in the field duplicate pairs?

Compound	Concentration (ug/Kg)		RPD
	7	8	
UU	28.2	36.7	26
VV	14.1	10.0	34
YY	72.5	70.9	2
ZZ	74.2	73.2	1
CCC	35.9	30.7	16
DDD	68.2	43.5	44
EEE	69.0	60.6	13
A2	103	89.3	14
III	38.7	31.0	22
JJJ	27.1	24.7	9
LLL	19.9U	28.1	NC

Compound	Concentration (ug/Kg)		RPD
	7	9	
A	19.9U	9.0	NC
S	19.9U	4.5	NC
W	19.9U	4.7	NC
DD	19.9U	2.7	NC
GG	19.9U	4.5	NC
JJ	19.9U	4.3	NC
NN	19.9U	4.1	NC
UU	28.2	31.9	12
VV	14.1	7.8	58
YY	72.5	56.7	24
ZZ	74.2	57.1	26
AAA	19.9U	4.2	NC
CCC	35.9	23.6	41
DDD	68.2	34.7	65
EEE	69.0	49.4	33
A2	103	74.6	32
III	38.7	25.1	43
JJJ	27.1	20.1	30
KKK	19.9U	8.4	NC
LLL	19.9U	24.6	21

VALIDATION FINDINGS WORKSHEET
Field Duplicates

METHOD: GC MS SVOA (EPA SW 846 Method 8270E)

Y N NA Were field duplicate pairs identified in this SDG?
Y N NA Were target analytes detected in the field duplicate pairs?

Compound	Concentration (ug/Kg)		RPD
	10	11	
UU	28.8	31.3	8
VV	11.1	14.3	25
YY	65.6	59.4	10
ZZ	65.5	57.8	12
AAA	20.0U	11.3	56
CCC	28.7	29.6	3
DDD	44.7	45.9	3
EEE	74.3	63.8	15
A2	93.7	89.5	5
III	31.4	33.3	6
JJJ	22.4	21.9	2
LLL	25.4	25.5	0

LDC #: 48785 B2a

VALIDATION FINDINGS WORKSHEET
Overall Assessment of Data

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD: GC/MS BNA (EPA SW 846 Method 8270C) E

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".
All available information pertaining to the data were reviewed using professional judgement to compliment the determination of the overall quality of the data.

(Y) N N/A Was the overall quality and usability of the data acceptable?

#	Date	Sample ID	Compound	Finding	Qualifications
		9	All	Conf.	NR/A

Comments: _____

OVR.wpd

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 20, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0118

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS159	20F0118-01	Sediment	06/05/20
LDW20-SS167	20F0118-02	Sediment	06/05/20
LDW20-SS158	20F0118-03	Sediment	06/05/20
LDW20-SS154	20F0118-04	Sediment	06/05/20
LDW20-SS168	20F0118-05	Sediment	06/05/20
LDW20-SS101	20F0118-06	Sediment	06/05/20
LDW20-SS102	20F0118-07	Sediment	06/05/20
LDW20-SS102-FD	20F0118-08	Sediment	06/05/20
LDW20-SS102-FDRE	20F0118-08RE	Sediment	06/05/20
LDW20-SS109	20F0118-09	Sediment	06/05/20
LDW20-SS109-FD	20F0118-10	Sediment	06/05/20
LDW20-SS117	20F0118-12	Sediment	06/05/20
LDW20-SS159MS	20F0118-01MS	Sediment	06/05/20
LDW20-SS159MSD	20F0118-01MSD	Sediment	06/05/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). 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:

Semivolatile Organic Compounds (SVOCs) by Environmental Protection Agency (EPA) SW 846 Method 8270E in Selected Ion Monitoring (SIM) mode

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 9.1°C and 18.8°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For compounds where average relative response factors (RRFs) were utilized, percent relative standard deviations (%RSD) were less than or equal to 20.0%.

In the case where the laboratory used a calibration curve to evaluate the compounds, all coefficients of determination (r^2) were greater than or equal to 0.990.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all compounds with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
06/26/20	N-Nitrosodiphenylamine	41.9	All samples in SDG 20F0118	J (all detects) UJ (all non-detects)	A

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
06/26/20	Pentachlorophenol	23.0	LDW20-SS159 LDW20-SS167 LDW20-SS158 LDW20-SS154 LDW20-SS168 LDW20-SS101 LDW20-SS102 LDW20-SS102-FD LDW20-SS109 LDW20-SS109-FD LDW20-SS117	J (all detects) UJ (all non-detects)	A
07/09/20	Benzoic acid Pentachlorophenol	33.8 40.3	LDW20-SS102-FDRE	J (all detects) J (all detects)	A

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples/Standard Reference Materials

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

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits with the following exceptions:

SRM ID	Compound	%R (Limits)	Associated Samples	Flag	A or P
BIF0487-SRM2	1,4-Dichlorobenzene 1,2-Dichlorobenzene 2,4-Dimethylphenol	28.7 (34-166) 29.1 (36-164) 39.2 (40-160)	All samples in SDG 20F0118	J (all detects) UJ (all non-detects)	P

X. Field Duplicates

Samples LDW20-SS102 and LDW20-SS102-FD, samples LDW20-SS102 and LDW20-SS102-FDRE, and samples LDW20-SS109 and LDW20-SS109-FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/Kg)		RPD
	LDW20-SS102	LDW20-SS102-FD	
Benzyl alcohol	10.8	7.4	37
Benzoic acid	47.0	69.0	38

Compound	Concentration (ug/Kg)		RPD
	LDW20-SS102	LDW20-SS102-FDRE	
Benzyl alcohol	10.8	6.6	48
Benzoic acid	47.0	69.0	38
1,4-Dichlorobenzene	5.0U	0.7	Not calculable
N-Nitrosodiphenylamine	5.0U	0.7	Not calculable
Pentachlorophenol	19.9U	2.0	Not calculable

Compound	Concentration (ug/Kg)		RPD
	LDW20-SS109	LDW20-SS109-FD	
Benzyl alcohol	18.1	4.9	115
Benzoic acid	33.2	37.2	11

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

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

In the case where more than one result was reported for an individual sample, the least technically acceptable results were deemed not reportable as follows:

Sample	Compound	Reason	Flag	A or P
LDW20-SS102-FDRE	All compounds	Results from original analyses were more usable.	Not reportable	A

Due to ICV %D, continuing calibration %D, and SRM %R, data were qualified as estimated in eleven samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4
Semivolatiles – Data Qualification Summary - SDG 20F0118

Sample	Compound	Flag	A or P	Reason
LDW20-SS159 LDW20-SS167 LDW20-SS158 LDW20-SS154 LDW20-SS168 LDW20-SS101 LDW20-SS102 LDW20-SS102-FD LDW20-SS109 LDW20-SS109-FD LDW20-SS117	N-Nitrosodiphenylamine	J (all detects) UJ (all non-detects)	A	Initial calibration verification (%D)
LDW20-SS159 LDW20-SS167 LDW20-SS158 LDW20-SS154 LDW20-SS168 LDW20-SS101 LDW20-SS102 LDW20-SS102-FD LDW20-SS109 LDW20-SS109-FD LDW20-SS117	Pentachlorophenol	J (all detects) UJ (all non-detects)	A	Continuing calibration (%D)
LDW20-SS159 LDW20-SS167 LDW20-SS158 LDW20-SS154 LDW20-SS168 LDW20-SS101 LDW20-SS102 LDW20-SS102-FD LDW20-SS109 LDW20-SS109-FD LDW20-SS117	1,4-Dichlorobenzene 1,2-Dichlorobenzene 2,4-Dimethylphenol	J (all detects) UJ (all non-detects)	P	Standard reference materials (%R)
LDW20-SS102-FDRE	All compounds	Not reportable	A	Overall assessment of data

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0118

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0118

No Sample Data Qualified in this SDG

LDC #: 48785B2b

SDG #: 20F0118

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 08/14/20

Page: 1 of 1

Reviewer: SMP

2nd Reviewer: CL

METHOD: GC/MS ~~Polynuclear Aromatic Hydrocarbons~~ SVOA (EPA SW 846 Method 8270E-SIM)

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 (Insufficient time to cool)
I.	Sample receipt/Technical holding times	SW/A	Cooler temp. = 18.8°C, 16.2°C, 12.6°C, 15.5°C, 9.1°C, 14.3°C, 9.7°C, 10.2°C, 11.8°C
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/SW	ICAL ≤ 20%, r² ICV ≤ 30%
IV.	Continuing calibration	SW	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	ND	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	SW	LCS, SRM
X.	Field duplicates	SW	D = 7/8, 7/9, 10/11
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	SW	

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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS159	20F0118-01	Sediment	06/05/20
2	LDW20-SS167	20F0118-02	Sediment	06/05/20
3	LDW20-SS158	20F0118-03	Sediment	06/05/20
4	LDW20-SS154	20F0118-04	Sediment	06/05/20
5	LDW20-SS168	20F0118-05	Sediment	06/05/20
6	LDW20-SS101	20F0118-06	Sediment	06/05/20
7	LDW20-SS102 D1, D2	20F0118-07	Sediment	06/05/20
8	LDW20-SS102-FD D1	20F0118-08	Sediment	06/05/20
9	LDW20-SS102-FDRE D2	20F0118-08RE	Sediment	06/05/20
10	LDW20-SS109 D3	20F0118-09	Sediment	06/05/20
11	LDW20-SS109-FD D3	20F0118-10	Sediment	06/05/20
12	LDW20-SS117	20F0118-12	Sediment	06/05/20
13	LDW20-SS159MS	20F0118-01MS	Sediment	06/05/20
14	LDW20-SS159MSD	20F0118-01MSD	Sediment	06/05/20

1. BIF0487-BLK2 2. BIF0487-BLK3

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

A. Phenol	AA. 2-Chloronaphthalene	AAA. Butylbenzylphthalate	AAAA. Dibenzothiophene	A1. N-Nitrosodiethylamine
B. Bis (2-chloroethyl) ether	BB. 2-Nitroaniline	BBB. 3,3'-Dichlorobenzidine	BBBB. Benzo(a)fluoranthene	B1. N-Nitrosodi-n-butylamine
C. 2-Chlorophenol	CC. Dimethylphthalate	CCC. Benzo(a)anthracene	CCCC. Benzo(b)fluorene	C1. N-Nitrosomethylethylamine
D. 1,3-Dichlorobenzene	DD. Acenaphthylene	DDD. Chrysene	DDDD. cis/trans-Decalin	D1. N-Nitrosomorpholine
E. 1,4-Dichlorobenzene	EE. 2,6-Dinitrotoluene	EEE. Bis(2-ethylhexyl)phthalate	EEEE. Biphenyl	E1. N-Nitrosopyrrolidine
F. 1,2-Dichlorobenzene	FF. 3-Nitroaniline	FFF. Di-n-octylphthalate	FFFF. Retene	F1. Phenacetin
G. 2-Methylphenol	GG. Acenaphthene	GGG. Benzo(b)fluoranthene	GGGG. C30-Hopane	G1. 2-Acetylaminofluorene
H. 2,2'-Oxybis(1-chloropropane)	HH. 2,4-Dinitrophenol	HHH. Benzo(k)fluoranthene	HHHH. 1-Methylphenanthrene	H1. Pronamide
I. 4-Methylphenol	II. 4-Nitrophenol	III. Benzo(a)pyrene	IIII. 1,4-Dioxane	I1. Methyl methanesulfonate
J. N-Nitroso-di-n-propylamine	JJ. Dibenzofuran	JJJ. Indeno(1,2,3-cd)pyrene	JJJJ. Acetophenone	J1. Ethyl methanesulfonate
K. Hexachloroethane	KK. 2,4-Dinitrotoluene	KKK. Dibenz(a,h)anthracene	KKKK. Atrazine	K1. o,o',o''-Triethylphosphorothioate
L. Nitrobenzene	LL. Diethylphthalate	LLL. Benzo(g,h,i)perylene	LLLL. Benzaldehyde	L1. n-Phenylene diamine
M. Isophorone	MM. 4-Chlorophenyl-phenyl ether	MMM. Bis(2-Chloroisopropyl)ether	MMMM. Caprolactam	M1. 1,4-Naphthoquinone
N. 2-Nitrophenol	NN. Fluorene	NNN. Aniline	NNNN. 2,6-Dichlorophenol	N1. N-Nitro-o-toluidine
O. 2,4-Dimethylphenol	OO. 4-Nitroaniline	OOO. N-Nitrosodimethylamine	OOOO. 1,2-Diphenylhydrazine	O1. 1,3,5-Trinitrobenzene
P. Bis(2-chloroethoxy)methane	PP. 4,6-Dinitro-2-methylphenol	PPP. Benzoic Acid	PPPP. 3-Methylphenol	P1. Pentachlorobenzene
Q. 2,4-Dichlorophenol	QQ. N-Nitrosodiphenylamine	QQQ. Benzyl alcohol	QQQQ. 3&4-Methylphenol	Q1. 4-Aminobiphenyl
R. 1,2,4-Trichlorobenzene	RR. 4-Bromophenyl-phenylether	RRR. Pyridine	RRRR. 4-Dimethyldibenzothiophene (4MDT)	R1. 2-Naphthylamine
S. Naphthalene	SS. Hexachlorobenzene	SSS. Benzidine	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	S1. Triphenylene
T. 4-Chloroaniline	TT. Pentachlorophenol	TTT. 1-Methylnaphthalene	TTTT. 1-Methyldibenzothiophene (1MDT)	T1. Octachlorostyrene
U. Hexachlorobutadiene	UU. Phenanthrene	UUU.Benzo(b)thiophene	UUUU.. 2,3,4,6-Tetrachlorophenol	U1. Famphur
V. 4-Chloro-3-methylphenol	VV. Anthracene	VVV.Benzonaphthothiophene	VVVV. 1,2,4,5-Tetrachlorobenzene	V1. 1,4-phenylenediamine
W. 2-Methylnaphthalene	WW. Carbazole	WWW.Benzo(e)pyrene	WWWW.. 2-Picoline	W1. Methapyrilene
X. Hexachlorocyclopentadiene	XX. Di-n-butylphthalate	XXX. 2,6-Dimethylnaphthalene	XXXX. 3-Methylcholanthrene	X1. Pentachloroethane
Y. 2,4,6-Trichlorophenol	YY. Fluoranthene	YYY. 2,3,5-Trimethylnaphthalene	YYYY. a,a-Dimethylphenethylamine	Y1. 3,3'-Dimethylbenzidine
Z. 2,4,5-Trichlorophenol	ZZ. Pyrene	ZZZ. Perylene	ZZZZ. Hexachloropropene	Z1. o-Toluidine

A2. Benzofluoranthenes, Total

LDC #: 48785B26

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: Q

METHOD: GC/MS SVOA (EPA SW 846 Method 8270C)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

(Y) N N/A Was an initial calibration verification standard analyzed after each ICAL for each instrument?

Y (N) N/A Were all %D within the validation criteria of ≤~~20~~ (30%) %D ?

#	Date	Standard ID	Compound	Finding %D (Limit: ~~≤20.0%~~ (30%))	Associated Samples	Qualifications
	06/26/20	SIF0393 SCV1	QQ	41.9	All (ND + Det)	J/UJ/A

ICVsvoa.wpd

LDC #: 48785 B26

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD: GC/MS BNA (EPA SW 846 Method 8270C)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Was a continuing calibration standard analyzed at least once every 12 hours of sample analysis for each instrument?

Y N N/A Were percent differences (%D) and relative response factors (RRF) within method criteria for all CCC's and SPCC's ?

Y N N/A Were all %D and RRFs within the validation criteria of ≤20 %D and ≥0.05 RRF ?

#	Date	Standard ID	Compound	Finding %D (Limit: <20.0%)	Finding RRF (Limit: >0.05)	Associated Samples	Qualifications
	06/26/20	NT100626155	TT	23.0		1-8, 10-14, MB1	(ND+Det) J/UJ/A
	07/09/20	NT10200709035	PPP	33.8		9, MB2 (Det)	
			TT	40.3			

LDC #: 48785 B2b

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS) /SRM

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD: GC/MS BNA (EPA SW 846 Method 8270~~E)~~-SIM)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

[✓ Y] N N/A Was a LCS required?

[✓ Y] [✓ N] N/A Were the LCS/LCSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#	LCS/LCSD ID	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	BIF0487-SRM2	E	28.7 (34-166)	( )	( )	All (ND + Det)	J/UJ/P
		F	29.1 (36-164)	( )	( )	↓	↓
		O	39.2 (40-160)	( )	( )	↓	↓
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
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			( )	( )	( )		
			( )	( )	( )		

LDC#: 48785B2b

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: JVG
2nd Reviewer:

METHOD: GCMS SVOA (EPA SW 846 Method 8270E-SIM)

Y N NA Were field duplicate pairs identified in this SDG?
Y N NA Were target analytes detected in the field duplicate pairs?

Compound	Concentration (ug/Kg)		RPD
	7	8	
QQQ	10.8	7.4	37
PPP	47.0	69.0	38

Compound	Concentration (ug/Kg)		RPD
	7	9	
QQQ	10.8	6.6	48
PPP	47.0	69.0	38
E	5.0U	0.7	NC
QQ	5.0U	0.7	NC
TT	19.9U	2.0	NC

Compound	Concentration (ug/Kg)		RPD
	10	11	
QQQ	18.1	4.9	115
PPP	33.2	37.2	11

LDC #: 48785B26

VALIDATION FINDINGS WORKSHEET
Overall Assessment of Data

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD: GC/MS BNA (EPA SW 846 Method 8270C)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".
All available information pertaining to the data were reviewed using professional judgement to compliment the determination of the overall quality of the data.

Y N N/A Was the overall quality and usability of the data acceptable?

#	Date	Sample ID	Compound	Finding	Qualifications
		9	All	Conf.	NR/A

Comments: _____

OVR.wpd

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 20, 2020

Parameters: Hexachlorobenzene

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0118

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS159	20F0118-01	Sediment	06/05/20
LDW20-SS167	20F0118-02	Sediment	06/05/20
LDW20-SS158	20F0118-03	Sediment	06/05/20
LDW20-SS154	20F0118-04	Sediment	06/05/20
LDW20-SS168	20F0118-05	Sediment	06/05/20
LDW20-SS101	20F0118-06	Sediment	06/05/20
LDW20-SS102	20F0118-07	Sediment	06/05/20
LDW20-SS102-FD	20F0118-08	Sediment	06/05/20
LDW20-SS109	20F0118-09	Sediment	06/05/20
LDW20-SS109-FD	20F0118-10	Sediment	06/05/20
LDW20-SS117	20F0118-12	Sediment	06/05/20
LDW20-SS159MS	20F0118-01MS	Sediment	06/05/20
LDW20-SS159MSD	20F0118-01MSD	Sediment	06/05/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). 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:

Hexachlorobenzene by Environmental Protection Agency (EPA) SW 846 Method 8081B

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 9.1°C and 18.8°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC Instrument Performance Check

Instrument performance was checked at 12 hour intervals.

The individual 4,4'-DDT and Endrin breakdowns (%BD) were less than or equal to 15.0%.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0%.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0%.

IV. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0%.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

All internal standard areas and retention times were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

X. Field Duplicates

Samples LDW20-SS102 and LDW20-SS102-FD and samples LDW20-SS109 and LDW20-SS109-FD were identified as field duplicates. No results were detected in any of the samples.

XI. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

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

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4
Hexachlorobenzene - Data Qualification Summary - SDG 20F0118

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Laboratory Blank Data Qualification Summary - SDG 20F0118

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Field Blank Data Qualification Summary - SDG 20F0118

No Sample Data Qualified in this SDG

LDC #: 48785B3a

SDG #: 20F0118

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 08/14/20

Page: 1 of 1

Reviewer: JW

2nd Reviewer: Q

METHOD: GC Hexachlorobenzene (EPA SW846 Method 8081B)

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 (Insufficient time to cool)
I.	Sample receipt/Technical holding times	SW/A	Cooler temp. = 18.8°C, 16.2°C, 12.6°C, 15.5°C, 9.1°C
II.	GC Instrument Performance Check	N	14.3°C, 9.7°C, 10.2°C, 11.8°C
III.	Initial calibration/ICV	A/A	ICAL ≤ 20% ICV ≤ 20%
IV.	Continuing calibration	A	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes /IS	A/A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	A	LCS/D
X.	Field duplicates	ND	D = 7/8, 9/10
XI.	Compound quantitation/RL/LOQ/LODs	N	
XII.	Target compound 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:

	Client ID		Lab ID	Matrix	Date
1	LDW20-SS159		20F0118-01	Sediment	06/05/20
2	LDW20-SS167		20F0118-02	Sediment	06/05/20
3	LDW20-SS158		20F0118-03	Sediment	06/05/20
4	LDW20-SS154		20F0118-04	Sediment	06/05/20
5	LDW20-SS168		20F0118-05	Sediment	06/05/20
6	LDW20-SS101		20F0118-06	Sediment	06/05/20
7	LDW20-SS102	D1	20F0118-07	Sediment	06/05/20
8	LDW20-SS102-FD	D1	20F0118-08	Sediment	06/05/20
9	LDW20-SS109	D✓	20F0118-09	Sediment	06/05/20
10	LDW20-SS109-FD	D✓	20F0118-10	Sediment	06/05/20
11	LDW20-SS117		20F0118-12	Sediment	06/05/20
12	LDW20-SS159MS		20F0118-01MS	Sediment	06/05/20
13	LDW20-SS159MSD		20F0118-01MSD	Sediment	06/05/20
14					
15	BIF0464-Blk1				

LDC Report# 48785B3b

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 19, 2020

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0118

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS159	20F0118-01	Sediment	06/05/20
LDW20-SS167	20F0118-02	Sediment	06/05/20
LDW20-SS158	20F0118-03	Sediment	06/05/20
LDW20-SS154	20F0118-04	Sediment	06/05/20
LDW20-SS168	20F0118-05	Sediment	06/05/20
LDW20-SS101	20F0118-06	Sediment	06/05/20
LDW20-SS102	20F0118-07	Sediment	06/05/20
LDW20-SS102-FD	20F0118-08	Sediment	06/05/20
LDW20-SS109	20F0118-09	Sediment	06/05/20
LDW20-SS109-FD	20F0118-10	Sediment	06/05/20
LDW20-SS117	20F0118-12	Sediment	06/05/20
LDW20-SS159MS	20F0118-01MS	Sediment	06/05/20
LDW20-SS159MSD	20F0118-01MSD	Sediment	06/05/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). 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) by Environmental Protection Agency (EPA) SW 846 Method 8082A

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 9.1°C and 18.8°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Standard	Column	Compound	%D	Associated Samples	Flag	A or P
06/10/20	SIF0176-SCV1	2C	Aroclor-1260	21.0	All samples in SDG 20F0118	J (all detects)	A

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

All internal standard areas and retention times were within QC limits.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

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

Samples LDW20-SS102 and LDW20-SS102-FD and samples LDW20-SS109 and LDW20-SS109-FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/Kg)		RPD
	LDW20-SS102	LDW20-SS102-FD	
Aroclor-1248	21.1	26.5	23
Aroclor-1254	27.4	36.3	28
Aroclor-1260	59.1	45.2	27

Compound	Concentration (ug/Kg)		RPD
	LDW20-SS109	LDW20-SS109-FD	
Aroclor-1248	22.4	18.8	17
Aroclor-1254	32.0	27.6	15
Aroclor-1260	35.4	30.1	16

X. Compound Quantitation

The sample results for detected compounds from the two columns were within 40% relative percent difference (RPD) with the following exceptions:

Sample	Compound	RPD	Flag	A or P
LDW20-SS159	Aroclor-1248	42.9	J (all detects)	A

Sample	Compound	RPD	Flag	A or P
LDW20-SS167	Aroclor-1248	42.6	J (all detects)	A
LDW20-SS158	Aroclor-1248	50.6	J (all detects)	A
LDW20-SS154	Aroclor-1248	48.6	J (all detects)	A
LDW20-SS168	Aroclor-1248	60.6	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XI. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XII. Overall Assessment of Data

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

Due to ICV %D and RPD between two columns, data were qualified as estimated in eleven samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4
Polychlorinated Biphenyls - Data Qualification Summary - SDG 20F0118

Sample	Compound	Flag	A or P	Reason
LDW20-SS159 LDW20-SS167 LDW20-SS158 LDW20-SS154 LDW20-SS168 LDW20-SS101 LDW20-SS102 LDW20-SS102-FD LDW20-SS109 LDW20-SS109-FD LDW20-SS117	Aroclor-1260	J (all detects)	A	Initial calibration verification (%D)
LDW20-SS159 LDW20-SS167 LDW20-SS158 LDW20-SS154 LDW20-SS168	Aroclor-1248	J (all detects)	A	Compound quantitation (RPD between two columns)

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 20F0118

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 20F0118

No Sample Data Qualified in this SDG

LDC #: 48785B3b

SDG #: 20F0118

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 08/19/20

Page: 1 of 1

Reviewer: JH

2nd Reviewer:

METHOD: GC Polychlorinated Biphenyls (EPA SW846 Method 8082A)

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 (Insufficient time to cool)
I.	Sample receipt/Technical holding times	SW / A	Cooler temp. = 18.8°C, 16.2°C, 15.5°C, 9.1°C, 14.3°C, 12.6°C, 9.7°C, 10.2°C, 11.8°C
II.	Initial calibration/ICV	A / SW	ICV ≤ 20%
III.	Continuing calibration	A	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes /15	A/A	
VII.	Matrix spike/Matrix spike duplicates	A	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	SW	D = 7/8, 9/10
X.	Compound quantitation/RL/LOQ/LODs	SW	
XI.	Target compound identification	N	
XII.	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:

	Client ID		Lab ID	Matrix	Date
1	LDW20-SS159		20F0118-01	Sediment	06/05/20
2	LDW20-SS167		20F0118-02	Sediment	06/05/20
3	LDW20-SS158		20F0118-03	Sediment	06/05/20
4	LDW20-SS154		20F0118-04	Sediment	06/05/20
5	LDW20-SS168		20F0118-05	Sediment	06/05/20
6	LDW20-SS101		20F0118-06	Sediment	06/05/20
7	LDW20-SS102	D1	20F0118-07	Sediment	06/05/20
8	LDW20-SS102-FD	D1	20F0118-08	Sediment	06/05/20
9	LDW20-SS109	D2	20F0118-09	Sediment	06/05/20
10	LDW20-SS109-FD	D2	20F0118-10	Sediment	06/05/20
11	LDW20-SS117		20F0118-12	Sediment	06/05/20
12	LDW20-SS159MS		20F0118-01MS	Sediment	06/05/20
13	LDW20-SS159MSD		20F0118-01MSD	Sediment	06/05/20
14					
15					
16					
17	BJ F0486 - Blk 1				

VALIDATION FINDINGS WORKSHEET

METHOD: Pesticide/PCBs (EPASW 846 Method 8081/8082)

A. alpha-BHC	K. Endrin	U. Toxaphene	EE. 2,4'-DDT	OO. trans–Heptachlor epoxide
B. beta-BHC	L. Endosulfan II	V. Aroclor-1016	FF. Hexachlorobenzene	PP. Mirex
C. delta-BHC	M. 4,4'-DDD	W. Aroclor-1221	GG. Chlordane	QQ cis-Chlordane
D. gamma-BHC	N. Endosulfan sulfate	X. Aroclor-1232	HH. Chlordane (Technical)	RR. trans-Chlordane
E. Heptachlor	O. 4,4'-DDT	Y. Aroclor-1242	II. Aroclor 1262	SS.
F. Aldrin	P. Methoxychlor	Z. Aroclor-1248	JJ. Aroclor 1268	TT.
G. Heptachlor epoxide	Q. Endrin ketone	AA. Aroclor-1254	KK. Oxychlordane	UU.
H. Endosulfan I	R. Endrin aldehyde	BB. Aroclor-1260	LL. trans-Nonachlor	VV
I. Dieldrin	S. alpha-Chlordane	CC. 2,4'-DDD	MM. cis-Nonachlor	WW.
J. 4,4'-DDE	T. gamma-Chlordane	DD. 2,4'-DDE	NN. cis–Heptachlor epoxide	XX.

Notes:_____

_____

_____

LDC #: 48785 B36

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

Reviewer: JVG
2nd Reviewer: [signature]

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".
What type of initial calibration verification calculation was performed? ✓ %D or ___ %R
(Y) N N/A Was an initial calibration verification standard analyzed after each ICAL for each instrument?
Y (N) N/A Did the initial calibration verification standards meet the %D / %R validation criteria of ≤20.0% / 80-120%?

#	Date	Standard ID	Detector/ Column	Compound	%D (Limit ≤ 20.0)	Associated Samples	Qualifications
	6/10/20	SIF0176-SCV1	2C	BB	21.0	All (Det)	J/UJ/A (qual BB only)

LDC#: 48785B3b

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: JVC
2nd Reviewer: N

METHOD: GC PCB (EPA SW 846 Method 8082A)

Y N NA Were field duplicate pairs identified in this SDG?
Y N NA Were target analytes detected in the field duplicate pairs?

Compound	Concentration (ug/Kg)		RPD
	7	8	
Aroclor 1248	21.1	26.5	23
Aroclor 1254	27.4	36.3	28
Aroclor 1260	59.1	45.2	27

Compound	Concentration (ug/Kg)		RPD
	9	10	
Aroclor 1248	22.4	18.8	17
Aroclor 1254	32.0	27.6	15
Aroclor 1260	35.4	30.1	16

LDC #: 48785B36

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: / GC __ HPLC

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Level IV/D Only

X N N/A Were CRQLs adjusted for sample dilutions, dry weight factors, etc.?
Y N N/A Did the reported results for detected target compounds agree within 10.0% of the recalculated results?
Y (N) N/A Did the percent difference of detected compounds between two columns./detectors ≤40%?
If no, please see findings bellow.

#	Compound Name	Sample ID	%RPD/%D Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	Aroclor 1248	1	42.9	J dets/A
		2	42.6	
		3	50.6	
		4	48.6	
		5	60.6	

Comments: See sample calculation verification worksheet for recalculations

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 20, 2020

Parameters: Metals

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0118

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS159	20F0118-01	Sediment	06/05/20
LDW20-SS167	20F0118-02	Sediment	06/05/20
LDW20-SS158	20F0118-03	Sediment	06/05/20
LDW20-SS154	20F0118-04	Sediment	06/05/20
LDW20-SS168	20F0118-05	Sediment	06/05/20
LDW20-SS101	20F0118-06	Sediment	06/05/20
LDW20-SS102	20F0118-07	Sediment	06/05/20
LDW20-SS102-FD	20F0118-08	Sediment	06/05/20
LDW20-SS109	20F0118-09	Sediment	06/05/20
LDW20-SS109-FD	20F0118-10	Sediment	06/05/20
LDW20-SS117	20F0118-12	Sediment	06/05/20
LDW20-SS159MS	20F0118-01MS	Sediment	06/05/20
LDW20-SS159MSD	20F0118-01MSD	Sediment	06/05/20
LDW20-SS159DUP	20F0118-01DUP	Sediment	06/05/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). 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 methods:

Arsenic, Cadmium, Chromium, Copper, Lead, Silver, and Zinc by Environmental Protection Agency (EPA) SW 846 Method 6020A
Mercury by EPA SW 846 Method 7471B

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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.

All technical holding time requirements were met.

II. ICPMS Tune

The mass calibration was within 0.1 AMU and the percent relative standard deviation (%RSD) was less than or equal to 5%.

III. Instrument Calibration

Initial and continuing calibrations were performed as required by the methods.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

IV. ICP Interference Check Sample Analysis

The frequency of interference check sample (ICS) analysis was met. All criteria were within QC limits.

V. Laboratory Blanks

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

Blank ID	Analyte	Maximum Concentration	Associated Samples
PB (prep blank)	Zinc	2.3 mg/Kg	All samples in SDG 20F0118
ICB/CCB	Arsenic	0.028 ug/L	LDW20-SS167 LDW20-SS158 LDW20-SS154 LDW20-SS168 LDW20-SS101 LDW20-SS102 LDW20-SS102-FD LDW20-SS109 LDW20-SS109-FD LDW20-SS117

Data qualification by the laboratory blanks was based on the maximum contaminant concentration in the laboratory blanks in the analysis of each analyte. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW20-SS159MS/MSD (All samples in SDG 20F0118)	Mercury	144 (75-125)	150 (75-125)	J (all detects)	A

Relative percent differences (RPD) were within QC limits.

VIII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

IX. Serial Dilution

Serial dilution was not performed for this SDG.

X. Laboratory Control Samples/Standard Reference Materials

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

Standard reference materials (SRM) were analyzed as required by the methods. The results were within QC limits.

XI. Field Duplicates

Samples LDW20-SS102 and LDW20-SS102-FD and samples LDW20-SS109 and LDW20-SS109-FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (mg/Kg)		RPD
	LDW20-SS102	LDW20-SS102-FD	
Arsenic	8.60	6.10	34
Cadmium	0.12	0.15	22

Analyte	Concentration (mg/Kg)		RPD
	LDW20-SS102	LDW20-SS102-FD	
Chromium	21.9	21.7	1
Copper	26.9	26.0	3
Lead	11.5	11.2	3
Mercury	0.189	0.110	53
Silver	0.30	0.12	86
Zinc	65.7	63.3	4

Analyte	Concentration (mg/Kg)		RPD
	LDW20-SS109	LDW20-SS109-FD	
Arsenic	9.15	9.67	6
Cadmium	0.13	0.15	14
Chromium	20.5	20.6	0
Copper	30.5	34.5	12
Lead	12.7	12.8	1
Mercury	0.104	0.0916	13
Silver	0.14	0.14	0
Zinc	70.7	71.9	2

XII. Internal Standards (ICP-MS)

Raw data were not reviewed for Stage 2B validation.

XIII. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

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

Due to MS/MSD %R, data were qualified as estimated in twelve samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4
Metals - Data Qualification Summary - SDG 20F0118

Sample	Analyte	Flag	A or P	Reason
LDW20-SS159 LDW20-SS167 LDW20-SS158 LDW20-SS154 LDW20-SS168 LDW20-SS101 LDW20-SS102 LDW20-SS102-FD LDW20-SS109 LDW20-SS109-FD LDW20-SS117 LDW20-SS159DUP	Mercury	J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)

Duwamish AOC4
Metals - Laboratory Blank Data Qualification Summary - SDG 20F0118

No Sample Data Qualified in this SDG

Duwamish AOC4
Metals - Field Blank Data Qualification Summary - SDG 20F0118

No Sample Data Qualified in this SDG

LDC #: 48785B4a

SDG #: 20F0118

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 8/19/20

Page: 1 of 1

Reviewer: QA

2nd Reviewer: A

METHOD: Metals (EPA SW 846 Method 6020A/7471B)

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.	ICP/MS Tune	A	
III.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	SW	
VI.	Field Blanks	N	
VII.	Matrix Spike/Matrix Spike Duplicates	SW	
VIII.	Duplicate sample analysis	A	
IX.	Serial Dilution	N	
X.	Laboratory control samples	A	LCS, SRM
XI.	Field Duplicates	SW	(7,8) (9,10)
XII.	Internal Standard (ICP-MS)	N	not reviewed
XIII.	Sample Result Verification	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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS159	20F0118-01	Sediment	06/05/20
2	LDW20-SS167	20F0118-02	Sediment	06/05/20
3	LDW20-SS158	20F0118-03	Sediment	06/05/20
4	LDW20-SS154	20F0118-04	Sediment	06/05/20
5	LDW20-SS168	20F0118-05	Sediment	06/05/20
6	LDW20-SS101	20F0118-06	Sediment	06/05/20
7	LDW20-SS102	20F0118-07	Sediment	06/05/20
8	LDW20-SS102-FD	20F0118-08	Sediment	06/05/20
9	LDW20-SS109	20F0118-09	Sediment	06/05/20
10	LDW20-SS109-FD	20F0118-10	Sediment	06/05/20
11	LDW20-SS117	20F0118-12	Sediment	06/05/20
12	LDW20-SS159MS	20F0118-01MS	Sediment	06/05/20
13	LDW20-SS159MSD	20F0118-01MSD	Sediment	06/05/20
14	LDW20-SS159DUP	20F0118-01DUP	Sediment	06/05/20
15				

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1 to 11	As, Cd, Cr, Cu, Pb, Ag, Zn, Hg
QC: 12-14	As, Cd, Cr, Cu, Pb, Ag, Zn, Hg

Analysis Method

ICP	
ICP-MS	As, Cd, Cr, Cu, Pb, Ag, Zn
CVAA	Hg

VALIDATION FINDINGS WORKSHEET
Laboratory Blank Contamination (PB/ICB/CCB)

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)
Soil preparation factor applied (if applicable):

Sample Concentration, unless otherwise noted: mg/Kg Associated Samples: All

				Sample Identification								
Analyte	**PB (mg/Kg)**	**Maximum ICB/CCB (ug/L)**	**Action Level**	No qualifiers								
Zn	2.3											

Sample Concentration, unless otherwise noted: mg/Kg Associated Samples: 2-11

				Sample Identification								
Analyte	**PB (mg/Kg)**	**Maximum ICB/CCB (ug/L)**	**Action Level**	No qualifiers								
As		0.028										

Comments: The listed analyte concentrtaion is the highest ICB or CCB detected in the analysis. The action level, when applicable, is established at 5X the highest ICB, CCB, or PB concentration.

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)

MS/MSD analysis was performed by the laboratory. All MS/MSD percent recoveries (%R) and relative percent differences (RPDs) were within the acceptable limits with the following exceptions:

MS/MSD ID	Matrix	Analyte	MS %R	MSD %R	%R Limit	RPD	RPD Limit	Associated Samples	Qualification	Det/ND
12, 13	s	Hg	144	150	75-125			All	Jdet/A	Det

Comments:

Method: Metals

Analyte	Concentration (mg/Kg)		RPD
	7	8	
Arsenic	8.60	6.10	34
Cadmium	0.12	0.15	22
Chromium	21.9	21.7	1
Copper	26.9	26.0	3
Lead	11.5	11.2	3
Mercury	0.189	0.110	53
Silver	0.30	0.12	86
Zinc	65.7	63.3	4

Analyte	Concentration (mg/Kg)		RPD
	9	10	
Arsenic	9.15	9.67	6
Cadmium	0.13	0.15	14
Chromium	20.5	20.6	0
Copper	30.5	34.5	12
Lead	12.7	12.8	1
Mercury	0.104	0.0916	13
Silver	0.14	0.14	0
Zinc	70.7	71.9	2

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 20, 2020

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0118

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS159	20F0118-01	Sediment	06/05/20
LDW20-SS167	20F0118-02	Sediment	06/05/20
LDW20-SS158	20F0118-03	Sediment	06/05/20
LDW20-SS154	20F0118-04	Sediment	06/05/20
LDW20-SS168	20F0118-05	Sediment	06/05/20
LDW20-SS101	20F0118-06	Sediment	06/05/20
LDW20-SS102	20F0118-07	Sediment	06/05/20
LDW20-SS102-FD	20F0118-08	Sediment	06/05/20
LDW20-SS109	20F0118-09	Sediment	06/05/20
LDW20-SS109-FD	20F0118-10	Sediment	06/05/20
LDW20-SS117	20F0118-12	Sediment	06/05/20
LDW20-SS159DUP	20F0118-01DUP	Sediment	06/05/20
LDW20-SS102-FDMS	20F0118-08MS	Sediment	06/05/20
LDW20-SS102-FDDUP	20F0118-08DUP	Sediment	06/05/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). 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 methods:

Total Organic Carbon by Environmental Protection Agency (EPA) SW 846 Method 9060A
Total Solids by Standard Method 2540G

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration of each method were met.

III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met for each method when applicable.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits.

VII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

VIII. Laboratory Control Samples/Standard Reference Materials

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

Standard reference materials (SRM) were analyzed as required by the methods. The results were within QC limits.

IX. Field Duplicates

Samples LDW20-SS102 and LDW20-SS102-FD and samples LDW20-SS109 and LDW20-SS109-FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (%)		RPD
	LDW20-SS102	LDW20-SS102-FD	
Total solids	68.17	68.32	0
Total organic carbon	0.87	0.86	1

Analyte	Concentration (%)		RPD
	LDW20-SS109	LDW20-SS109-FD	
Total solids	63.30	64.65	2
Total organic carbon	1.28	1.13	12

X. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

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

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4
Wet Chemistry - Data Qualification Summary - SDG 20F0118

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 20F0118

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 20F0118

No Sample Data Qualified in this SDG

LDC #: 48785B6 **VALIDATION COMPLETENESS WORKSHEET** Date: 8/19/20
SDG #: 20F0118 Stage 2B Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer: GA
2nd Reviewer: GA

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM 2540G)

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	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	A	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	A	
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	A	LCS, SRM
IX.	Field duplicates	SW	(7,8)(9,10)
X.	Sample result verification	N	
XI	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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS159	20F0118-01	Sediment	06/05/20
2	LDW20-SS167	20F0118-02	Sediment	06/05/20
3	LDW20-SS158	20F0118-03	Sediment	06/05/20
4	LDW20-SS154	20F0118-04	Sediment	06/05/20
5	LDW20-SS168	20F0118-05	Sediment	06/05/20
6	LDW20-SS101	20F0118-06	Sediment	06/05/20
7	LDW20-SS102	20F0118-07	Sediment	06/05/20
8	LDW20-SS102-FD	20F0118-08	Sediment	06/05/20
9	LDW20-SS109	20F0118-09	Sediment	06/05/20
10	LDW20-SS109-FD	20F0118-10	Sediment	06/05/20
11	LDW20-SS117	20F0118-12	Sediment	06/05/20
12	LDW20-SS159DUP	20F0118-01DUP	Sediment	06/05/20
13	LDW20-SS102-FDMS	20F0118-08MS	Sediment	06/05/20
14	LDW20-SS102-FDDUP	20F0118-08DUP	Sediment	06/05/20
15				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1 to 11	Total solids, TOC
QC: 12	TS
13, 14	TOC

METHOD: Inorganics

Analyte	Concentration (%)		RPD
	7	8	
Total solids	68.17	68.32	0
TOC	0.87	0.86	1

Analyte	Concentration (%)		RPD
	9	10	
Total solids	63.30	64.65	2
TOC	1.28	1.13	12

LDC Report# 48785B21

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 19, 2020

Parameters: Polychlorinated Dioxins/Dibenzofurans

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0118

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS159	20F0118-01	Sediment	06/05/20
LDW20-SS109	20F0118-09	Sediment	06/05/20
LDW20-SS109-FD	20F0118-10	Sediment	06/05/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for High Resolution Superfund Methods Data Review (April 2016). 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 Dioxins/Dibenzofurans by Environmental Protection Agency (EPA) Method 1613B

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 9.1°C and 18.8°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required frequency.

Retention time windows were established for all homologues. The chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomer was less than or equal to 25%.

The static resolving power was at least 10,000 (10% valley definition).

III. Initial Calibration and Initial Calibration Verification

A five point initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for unlabeled compounds and less than or equal to 35.0% for labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were within the QC limits for unlabeled compounds and labeled compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

All of the continuing calibration results were within the QC limits for unlabeled compounds and labeled compounds with the following exceptions:

Date	Compound	Concentration (Limits)	Associated Samples	Affected Compound	Flag	A or P
06/26/20	13C12-1,2,3,6,7,8-HxCDD	79.0 ng/mL (85-118)	All samples in SDG 20F0118	1,2,3,6,7,8-HxCDD	J (all detects)	P

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

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	Compound	Concentration	Associated Samples
BIF0465-BLK1	06/22/20	1,2,3,7,8-PeCDD 2,3,4,6,7,8-HxCDF 1,2,3,4,6,7,8-HpCDF OCDF OCDD Total PeCDD Total HpCDF	0.175 ng/Kg 0.0946 ng/Kg 0.166 ng/Kg 0.521 ng/Kg 1.32 ng/Kg 0.175 ng/Kg 0.166 ng/Kg	All samples in SDG 20F0118

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Compound	Reported Concentration	Modified Final Concentration
LDW20-SS159	1,2,3,7,8-PeCDD Total PeCDD	0.400 ng/Kg 0.700 ng/Kg	0.400U ng/Kg 0.700J ng/Kg
LDW20-SS109	1,2,3,7,8-PeCDD 2,3,4,6,7,8-HxCDF	0.557 ng/Kg 0.371 ng/Kg	0.557U ng/Kg 0.371U ng/Kg
LDW20-SS109-FD	1,2,3,7,8-PeCDD 2,3,4,6,7,8-HxCDF	0.472 ng/Kg 0.403 ng/Kg	0.472U ng/Kg 0.403U ng/Kg

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/Standard Reference Materials

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

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

Samples LDW20-SS109 and LDW20-SS109-FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ng/Kg)		RPD
	LDW20-SS109	LDW20-SS109-FD	
2,3,7,8-TCDF	0.502	0.395	24
2,3,7,8-TCDD	0.271	0.273	Not calculable
1,2,3,7,8-PeCDF	0.346	0.384	10
2,3,4,7,8-PeCDF	0.585	0.647	10
1,2,3,7,8-PeCDD	0.557	0.472	17
1,2,3,4,7,8-HxCDF	1.99	2.12	6
1,2,3,6,7,8-HxCDF	0.682	0.744	9
2,3,4,6,7,8-HxCDF	0.371	0.403	8
1,2,3,7,8,9-HxCDF	0.411	0.352	15
1,2,3,4,7,8-HxCDD	0.632	0.609	4
1,2,3,6,7,8-HxCDD	2.54	2.43	4
1,2,3,7,8,9-HxCDD	1.57	1.53	3
1,2,3,4,6,7,8-HpCDF	18.3	18.4	1
1,2,3,4,7,8,9-HpCDF	1.47	1.27	15
1,2,3,4,6,7,8-HpCDD	85.2	69.9	20
OCDF	91.2	138	41
OCDD	675	210	105
Total TCDF	5.033	3.55	35
Total TCDD	1.79	0.549	106

Compound	Concentration (ng/Kg)		RPD
	LDW20-SS109	LDW20-SS109-FD	
Total PeCDF	4.46	4.95	10
Total PeCDD	1.82	1.91	5
Total HxCDF	23.4	22.3	5
Total HxCDD	19.3	19.3	0
Total HpCDF	80.5	58.0	32
Total HpCDD	187	157	17

X. Labeled Compounds

All percent recoveries (%R) for labeled compounds used to quantitate target compounds were within QC limits.

XI. Compound Quantitation

All compound quantitations were within validation criteria with the following exceptions:

Sample	Compound	Flag	A or P
All samples in SDG 20F0118	All compounds reported as estimated maximum possible concentration (EMPC) and greater than the reporting limit.	J (all detects)	A
All samples in SDG 20F0118	All compounds reported as estimated maximum possible concentration (EMPC) and less than the reporting limit.	U (all non-detects)	A

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B 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 continuing calibration concentration and compounds reported as EMPC, data were qualified as estimated or not detected in three samples.

Due to laboratory blank contamination, data were qualified as not detected or estimated in three samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Data Qualification Summary - SDG 20F0118

Sample	Compound	Flag	A or P	Reason
LDW20-SS159 LDW20-SS109 LDW20-SS109-FD	1,2,3,6,7,8-HxCDD	J (all detects)	P	Continuing calibration (concentration)
LDW20-SS159 LDW20-SS109 LDW20-SS109-FD	All compounds reported as estimated maximum possible concentration (EMPC) and greater than the reporting limit.	J (all detects)	A	Compound quantitation (EMPC)
LDW20-SS159 LDW20-SS109 LDW20-SS109-FD	All compounds reported as estimated maximum possible concentration (EMPC) and less than the reporting limit.	U (all non-detects)	A	Compound quantitation (EMPC)

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG 20F0118

Sample	Compound	Modified Final Concentration	A or P
LDW20-SS159	1,2,3,7,8-PeCDD Total PeCDD	0.400U ng/Kg 0.700J ng/Kg	A
LDW20-SS109	1,2,3,7,8-PeCDD 2,3,4,6,7,8-HxCDF	0.557U ng/Kg 0.371U ng/Kg	A
LDW20-SS109-FD	1,2,3,7,8-PeCDD 2,3,4,6,7,8-HxCDF	0.472U ng/Kg 0.403U ng/Kg	A

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Field Blank Data Qualification Summary - SDG 20F0118

No Sample Data Qualified in this SDG

LDC #: 48785B21 **VALIDATION COMPLETENESS WORKSHEET** Date: 08/14/20
SDG #: 20F0118 Stage 2B Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer: SW
2nd Reviewer:

METHOD: HRGC/HRMS Polychlorinated Dioxins/Dibenzofurans (EPA Method 1613B)

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 (Insufficient time to cool)
I.	Sample receipt/Technical holding times	SW / A	Cooler temp = 18.8°C, 16.2°C, 12.6°C, 15.5°C, 9.1°C, 14.3°C; 9.7°C; 10.2°C; 11.8°C
II.	HRGC/HRMS Instrument performance check	A	
III.	Initial calibration/ICV	A / A	ICAL ≤ 20/35 % ICV ≤ QC limits
IV.	Continuing calibration	SW	CCV ≤ QC limits
V.	Laboratory Blanks	SW	
VI.	Field blanks	N	
VII.	Matrix spike/Matrix spike duplicates	N	
VIII.	Laboratory control samples	A	LCS SRM
IX.	Field duplicates	SW	D = 2/3
X.	Labeled Compounds	A	
XI.	Compound quantitation RL/LOQ/LODs	N	EMPC = J dets (>RL); U (<RL)
XII.	Target compound 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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS159	20F0118-01	Sediment	06/05/20
2	LDW20-SS109	20F0118-09	Sediment	06/05/20
3	LDW20-SS109-FD	20F0118-10	Sediment	06/05/20
4				
5				
6				
7				
8				
9				
10				

Notes:

VALIDATION FINDINGS WORKSHEET

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

A. 2,3,7,8-TCDD	F. 1,2,3,4,6,7,8-HpCDD	K. 1,2,3,4,7,8-HxCDF	P. 1,2,3,4,7,8,9-HpCDF	U. Total HpCDD
B. 1,2,3,7,8-PeCDD	G. OCDD	L. 1,2,3,6,7,8-HxCDF	Q. OCDF	V. Total TCDF
C. 1,2,3,4,7,8-HxCDD	H. 2,3,7,8-TCDF	M. 2,3,4,6,7,8-HxCDF	R. Total TCDD	W. Total PeCDF
D. 1,2,3,6,7,8-HxCDD	I. 1,2,3,7,8-PeCDF	N. 1,2,3,7,8,9-HxCDF	S. Total PeCDD	X. Total HxCDF
E. 1,2,3,7,8,9-HxCDD	J. 2,3,4,7,8-PeCDF	O. 1,2,3,4,6,7,8-HpCDF	T. Total HxCDD	Y. Total HpCDF

Notes:_____

_____

_____

LDC #: 48785B21

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Reviewer: JVG
2nd Reviewer:

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)
Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y Was a routine calibration performed at the beginning of each 12 hour period?
N Were all concentrations within method QC limits for unlabeled and labeled compounds?
Y Did all routine calibration standards meet the Ion Abundance Ratio criteria?

#	Date	Standard ID	Compound	Conc:ng/mL (Limits)	Finding Ion Abundance Ratio	Associated Samples	Qualifications
	06/25/20	SIF0380-ICV1	13C12-P	73.9 (77-129)		BLK	NQ (QC only)
	06/26/20	SIF0380-CCV1	13C12-D	79.0 (85-118)		All (-blk) (Det)	J/UJ/P (qual D)

LDC #: 48785B21

VALIDATION FINDINGS WORKSHEET
Blanks

Reviewer: JVG
2nd Reviewer:

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y Were all samples associated with a method blank?
Y Was a method blank performed for each matrix and whenever a sample extraction was performed?
Y Was the method blank contaminated?

Blank extraction date: 06/22/20 **Blank analysis date:** 06/25/20 **Associated samples:** All

Conc. units: ng/Kg

Compound	Blank ID		Sample Identification								
	BIF0465-BLK1	(5x)		1	2	3					
B	0.175	0.88		0.400 /U	0.557 /U	0.472 /U					
M	0.0946*	0.47			0.371 / J	0.403 / J					
O	0.166	0.83									
Q	0.521*	2.61									
G	1.32	6.60									
S	0.175	0.88		0.700 / J							
Y	0.166	0.83									

*EMPC

LDC#: 48785B21 **VALIDATION FINDINGS WORKSHEET** Page: 1 of 1
Field Duplicates Reviewer: JVG
2nd Reviewer: S

METHOD: HRGC/HRMS PCDD/PCDF (EPA Method 1613B)
Y N NA Were field duplicate pairs identified in this SDG?
Y N NA Were target analytes detected in the field duplicate pairs?

Compound	Concentration (ng/Kg)		RPD
	2	3	
H	0.502	0.395	24
A	0.271*	0.273*	NC
I	0.346*	0.384*	10
J	0.585	0.647*	10
B	0.557	0.472	17
K	1.99	2.12	6
L	0.682	0.744	9
M	0.371	0.403	8
N	0.411	0.352	15
C	0.632*	0.609	4
D	2.54	2.43	4
E	1.57	1.53	3
O	18.3	18.4	1
P	1.47	1.27	15
F	85.2	69.9	20
Q	91.2	138	41
G	675	210	105
V	5.033	3.55	35
R	1.79	0.549	106
W	4.46	4.95	10
S	1.82	1.91	5
X	23.4	22.3	5
T	19.3	19.3	0
Y	80.5	58.0	32
U	187	157	17

LDC Report# 48785C2a

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 19, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0339

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS324	20F0339-01	Sediment	06/17/20
LDW20-SS326	20F0339-02	Sediment	06/17/20
LDW20-SS365	20F0339-03	Sediment	06/17/20
LDW20-SS368	20F0339-04	Sediment	06/17/20
LDW20-SS372	20F0339-05	Sediment	06/17/20
LDW20-SS426	20F0339-06	Sediment	06/17/20
LDW20-SS421	20F0339-07	Sediment	06/17/20
LDW20-SS327	20F0339-08	Sediment	06/17/20
LDW20-SS331	20F0339-09	Sediment	06/17/20
LDW20-SS332	20F0339-10	Sediment	06/17/20
LDW20-SS324MS	20F0339-01MS	Sediment	06/17/20
LDW20-SS324MSD	20F0339-01MSD	Sediment	06/17/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). 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:

Semivolatile Organic Compounds (SVOCs) by Environmental Protection Agency (EPA) SW 846 Method 8270E

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 12.6°C and 13.3°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples/Standard Reference Materials

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

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

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

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4
Semivolatiles - Data Qualification Summary - SDG 20F0339

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0339

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0339

No Sample Data Qualified in this SDG

LDC #: 48785C2a

SDG #: 20F0339

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 08/14/20

Page: 1 of 1

Reviewer: JW

2nd Reviewer:

METHOD: GC/MS Semivolatiles (EPA SW 846 Method 8270E)

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	SW/A	cooler temp. = 13.3°C, 12.6°C (Insufficient time to cool)
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	ICAL ≤ 20%, ICV ≤ 30%
IV.	Continuing calibration	A	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	A	LCS, SRM
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS324	20F0339-01	Sediment	06/17/20
2	LDW20-SS326	20F0339-02	Sediment	06/17/20
3	LDW20-SS365	20F0339-03	Sediment	06/17/20
4	LDW20-SS368	20F0339-04	Sediment	06/17/20
5	LDW20-SS372	20F0339-05	Sediment	06/17/20
6	LDW20-SS426	20F0339-06	Sediment	06/17/20
7	LDW20-SS421	20F0339-07	Sediment	06/17/20
8	LDW20-SS327	20F0339-08	Sediment	06/17/20
9	LDW20-SS331	20F0339-09	Sediment	06/17/20
10	LDW20-SS332	20F0339-10	Sediment	06/17/20
11	LDW20-SS324MS	20F0339-01MS	Sediment	06/17/20
12	LDW20-SS324MSD	20F0339-01MSD	Sediment	06/17/20
13				
14	BIF0912-BLK1			

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 20, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0339

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS324	20F0339-01	Sediment	06/17/20
LDW20-SS326	20F0339-02	Sediment	06/17/20
LDW20-SS365	20F0339-03	Sediment	06/17/20
LDW20-SS368	20F0339-04	Sediment	06/17/20
LDW20-SS372	20F0339-05	Sediment	06/17/20
LDW20-SS426	20F0339-06	Sediment	06/17/20
LDW20-SS421	20F0339-07	Sediment	06/17/20
LDW20-SS327	20F0339-08	Sediment	06/17/20
LDW20-SS331	20F0339-09	Sediment	06/17/20
LDW20-SS332	20F0339-10	Sediment	06/17/20
LDW20-SS324MS	20F0339-01MS	Sediment	06/17/20
LDW20-SS324MSD	20F0339-01MSD	Sediment	06/17/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). 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:

Semivolatile Organic Compounds (SVOCs) by Environmental Protection Agency (EPA) SW 846 Method 8270E in Selected Ion Monitoring (SIM) mode

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 12.6°C and 13.3°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For compounds where average relative response factors (RRFs) were utilized, percent relative standard deviations (%RSD) were less than or equal to 20.0%.

In the case where the laboratory used a calibration curve to evaluate the compounds, all coefficients of determination (r^2) were greater than or equal to 0.990.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all compounds with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
06/26/20	N-Nitrosodiphenylamine	41.9	All samples in SDG 20F0339	J (all detects) UJ (all non-detects)	A

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
07/08/20	Benzoic acid	21.8	All samples in SDG 20F0339	J (all detects) UJ (all non-detects)	A
	Pentachlorophenol	29.8		J (all detects) UJ (all non-detects)	

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples/Standard Reference Materials

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

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

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

Due to ICV %D and continuing calibration %D, data were qualified as estimated in ten samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4
Semivolatiles – Data Qualification Summary - SDG 20F0339

Sample	Compound	Flag	A or P	Reason
LDW20-SS324 LDW20-SS326 LDW20-SS365 LDW20-SS368 LDW20-SS372 LDW20-SS426 LDW20-SS421 LDW20-SS327 LDW20-SS331 LDW20-SS332	N-Nitrosodiphenylamine	J (all detects) UJ (all non-detects)	A	Initial calibration verification (%D)
LDW20-SS324 LDW20-SS326 LDW20-SS365 LDW20-SS368 LDW20-SS372 LDW20-SS426 LDW20-SS421 LDW20-SS327 LDW20-SS331 LDW20-SS332	Benzoic acid Pentachlorophenol	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	A	Continuing calibration (%D)

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0339

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0339

No Sample Data Qualified in this SDG

LDC #: 48785C2b

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 08/19/20

SDG #: 20F0339

Page: 1 of 1

Laboratory: Analytical Resources, Inc.

Reviewer: SJG

2nd Reviewer: CF

METHOD: GC/MS ~~Polynuclear Aromatic Hydrocarbon~~SVOA s (EPA SW 846 Method 8270E-SIM)

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	SW / A	Cooler temp. = 13.3°C, 12.6°C (Insufficient time to cool)
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A / SW	ICAL ≤ 20% r ICVS 30%
IV.	Continuing calibration	SW	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	A	LCS, SRM
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS324	20F0339-01	Sediment	06/17/20
2	LDW20-SS326	20F0339-02	Sediment	06/17/20
3	LDW20-SS365	20F0339-03	Sediment	06/17/20
4	LDW20-SS368	20F0339-04	Sediment	06/17/20
5	LDW20-SS372	20F0339-05	Sediment	06/17/20
6	LDW20-SS426	20F0339-06	Sediment	06/17/20
7	LDW20-SS421	20F0339-07	Sediment	06/17/20
8	LDW20-SS327	20F0339-08	Sediment	06/17/20
9	LDW20-SS331	20F0339-09	Sediment	06/17/20
10	LDW20-SS332	20F0339-10	Sediment	06/17/20
11	LDW20-SS324MS	20F0339-01MS	Sediment	06/17/20
12	LDW20-SS324MSD	20F0339-01MSD	Sediment	06/17/20
13				
14	BIF0912-BLK2			

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

A. Phenol	AA. 2-Chloronaphthalene	AAA. Butylbenzylphthalate	AAAA. Dibenzothiophene	A1. N-Nitrosodiethylamine
B. Bis (2-chloroethyl) ether	BB. 2-Nitroaniline	BBB. 3,3'-Dichlorobenzidine	BBBB. Benzo(a)fluoranthene	B1. N-Nitrosodi-n-butylamine
C. 2-Chlorophenol	CC. Dimethylphthalate	CCC. Benzo(a)anthracene	CCCC. Benzo(b)fluorene	C1. N-Nitrosomethylethylamine
D. 1,3-Dichlorobenzene	DD. Acenaphthylene	DDD. Chrysene	DDDD. cis/trans-Decalin	D1. N-Nitrosomorpholine
E. 1,4-Dichlorobenzene	EE. 2,6-Dinitrotoluene	EEE. Bis(2-ethylhexyl)phthalate	EEEE. Biphenyl	E1. N-Nitrosopyrrolidine
F. 1,2-Dichlorobenzene	FF. 3-Nitroaniline	FFF. Di-n-octylphthalate	FFFF. Retene	F1. Phenacetin
G. 2-Methylphenol	GG. Acenaphthene	GGG. Benzo(b)fluoranthene	GGGG. C30-Hopane	G1. 2-Acetylaminofluorene
H. 2,2'-Oxybis(1-chloropropane)	HH. 2,4-Dinitrophenol	HHH. Benzo(k)fluoranthene	HHHH. 1-Methylphenanthrene	H1. Pronamide
I. 4-Methylphenol	II. 4-Nitrophenol	III. Benzo(a)pyrene	IIII. 1,4-Dioxane	I1. Methyl methanesulfonate
J. N-Nitroso-di-n-propylamine	JJ. Dibenzofuran	JJJ. Indeno(1,2,3-cd)pyrene	JJJJ. Acetophenone	J1. Ethyl methanesulfonate
K. Hexachloroethane	KK. 2,4-Dinitrotoluene	KKK. Dibenz(a,h)anthracene	KKKK. Atrazine	K1. o,o',o''-Triethylphosphorothioate
L. Nitrobenzene	LL. Diethylphthalate	LLL. Benzo(g,h,i)perylene	LLLL. Benzaldehyde	L1. n-Phenylene diamine
M. Isophorone	MM. 4-Chlorophenyl-phenyl ether	MMM. Bis(2-Chloroisopropyl)ether	MMMM. Caprolactam	M1. 1,4-Naphthoquinone
N. 2-Nitrophenol	NN. Fluorene	NNN. Aniline	NNNN. 2,6-Dichlorophenol	N1. N-Nitro-o-toluidine
O. 2,4-Dimethylphenol	OO. 4-Nitroaniline	OOO. N-Nitrosodimethylamine	OOOO. 1,2-Diphenylhydrazine	O1. 1,3,5-Trinitrobenzene
P. Bis(2-chloroethoxy)methane	PP. 4,6-Dinitro-2-methylphenol	PPP. Benzoic Acid	PPPP. 3-Methylphenol	P1. Pentachlorobenzene
Q. 2,4-Dichlorophenol	QQ. N-Nitrosodiphenylamine	QQQ. Benzyl alcohol	QQQQ. 3&4-Methylphenol	Q1. 4-Aminobiphenyl
R. 1,2,4-Trichlorobenzene	RR. 4-Bromophenyl-phenylether	RRR. Pyridine	RRRR. 4-Dimethyldibenzothiophene (4MDT)	R1. 2-Naphthylamine
S. Naphthalene	SS. Hexachlorobenzene	SSS. Benzidine	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	S1. Triphenylene
T. 4-Chloroaniline	TT. Pentachlorophenol	TTT. 1-Methylnaphthalene	TTTT. 1-Methyldibenzothiophene (1MDT)	T1. Octachlorostyrene
U. Hexachlorobutadiene	UU. Phenanthrene	UUU.Benzo(b)thiophene	UUUU.. 2,3,4,6-Tetrachlorophenol	U1. Famphur
V. 4-Chloro-3-methylphenol	VV. Anthracene	VVV.Benzonaphthothiophene	VVVV. 1,2,4,5-Tetrachlorobenzene	V1. 1,4-phenylenediamine
W. 2-Methylnaphthalene	WW. Carbazole	WWW.Benzo(e)pyrene	WWWW.. 2-Picoline	W1. Methapyrilene
X. Hexachlorocyclopentadiene	XX. Di-n-butylphthalate	XXX. 2,6-Dimethylnaphthalene	XXXX. 3-Methylcholanthrene	X1. Pentachloroethane
Y. 2,4,6-Trichlorophenol	YY. Fluoranthene	YYY. 2,3,5-Trimethylnaphthalene	YYYY. a,a-Dimethylphenethylamine	Y1. 3,3'-Dimethylbenzidine
Z. 2,4,5-Trichlorophenol	ZZ. Pyrene	ZZZ. Perylene	ZZZZ. Hexachloropropene	Z1. o-Toluidine

LDC #: 48785C26

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

Reviewer: JVG

2nd Reviewer: [illegible]

METHOD: GC/MS SVOA (EPA SW 846 Method 8270~~C~~E)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

(Y) N N/A Was an initial calibration verification standard analyzed after each ICAL for each instrument?

Y (N) N/A Were all %D within the validation criteria of ≤~~20~~/30% %D ?

#	Date	Standard ID	Compound	Finding %D (Limit: ≤~~20.0%~~/30%)	Associated Samples	Qualifications
	06/26/20	SIF0393-SCV1	QQ	41.9	All (ND + Det)	J/UJ/A

LDC #: 48785C26

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD: GC/MS BNA (EPA SW 846 Method 8270C)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Was a continuing calibration standard analyzed at least once every 12 hours of sample analysis for each instrument?
Y N N/A Were percent differences (%D) and relative response factors (RRF) within method criteria for all CCC's and SPCC's ?
Y N N/A Were all %D and RRFs within the validation criteria of ≤20 %D and ≥0.05 RRF ?

#	Date	Standard ID	Compound	Finding %D (Limit: <20.0%)	Finding RRF (Limit: >0.05)	Associated Samples	Qualifications
	07/08/20	NT10200708035	PPP	21.8		All (ND + Det)	J (UJ/A
			TT	29.8			

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 20, 2020

Parameters: Hexachlorobenzene

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0339

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS324	20F0339-01	Sediment	06/17/20
LDW20-SS326	20F0339-02	Sediment	06/17/20
LDW20-SS365	20F0339-03	Sediment	06/17/20
LDW20-SS368	20F0339-04	Sediment	06/17/20
LDW20-SS372	20F0339-05	Sediment	06/17/20
LDW20-SS426	20F0339-06	Sediment	06/17/20
LDW20-SS421	20F0339-07	Sediment	06/17/20
LDW20-SS327	20F0339-08	Sediment	06/17/20
LDW20-SS331	20F0339-09	Sediment	06/17/20
LDW20-SS332	20F0339-10	Sediment	06/17/20
LDW20-SS324MS	20F0339-01MS	Sediment	06/17/20
LDW20-SS324MSD	20F0339-01MSD	Sediment	06/17/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). 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:

Hexachlorobenzene by Environmental Protection Agency (EPA) SW 846 Method 8081B

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 12.6°C and 13.3°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC Instrument Performance Check

Instrument performance was checked at 12 hour intervals.

The individual 4,4'-DDT and Endrin breakdowns (%BD) were less than or equal to 15.0%.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0%.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0%.

IV. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0%.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

All internal standard areas and retention times were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples

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

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

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

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4
Hexachlorobenzene - Data Qualification Summary - SDG 20F0339

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Laboratory Blank Data Qualification Summary - SDG 20F0339

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Field Blank Data Qualification Summary - SDG 20F0339

No Sample Data Qualified in this SDG

LDC #: 48785C3a

VALIDATION COMPLETENESS WORKSHEET

SDG #: 20F0339

Stage 2B

Laboratory: Analytical Resources, Inc.

Date: 08/14/20

Page: 1 of 1

Reviewer: JM

2nd Reviewer: [illegible]

METHOD: GC Hexachlorobenzene (EPA SW846 Method 8081B)

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	SW/A	Cooler temp = 13.3°C, 12.6°C (Insufficient time to cool)
II.	GC Instrument Performance Check	N	
III.	Initial calibration/ICV	A/A	ICAL ≤ 20%. ICV ≤ 20%
IV.	Continuing calibration	A	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes / IS	A/A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	A	LCS
X.	Field duplicates	N	
XI.	Compound quantitation/RL/LOQ/LODs	N	
XII.	Target compound 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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS324	20F0339-01	Sediment	06/17/20
2	LDW20-SS326	20F0339-02	Sediment	06/17/20
3	LDW20-SS365	20F0339-03	Sediment	06/17/20
4	LDW20-SS368	20F0339-04	Sediment	06/17/20
5	LDW20-SS372	20F0339-05	Sediment	06/17/20
6	LDW20-SS426	20F0339-06	Sediment	06/17/20
7	LDW20-SS421	20F0339-07	Sediment	06/17/20
8	LDW20-SS327	20F0339-08	Sediment	06/17/20
9	LDW20-SS331	20F0339-09	Sediment	06/17/20
10	LDW20-SS332	20F0339-10	Sediment	06/17/20
11	LDW20-SS324MS	20F0339-01MS	Sediment	06/17/20
12	LDW20-SS324MSD	20F0339-01MSD	Sediment	06/17/20
13				
14				
15	BI F0907-BLK1			

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 19, 2020

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0339

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS324	20F0339-01	Sediment	06/17/20
LDW20-SS326	20F0339-02	Sediment	06/17/20
LDW20-SS365	20F0339-03	Sediment	06/17/20
LDW20-SS368	20F0339-04	Sediment	06/17/20
LDW20-SS372	20F0339-05	Sediment	06/17/20
LDW20-SS426	20F0339-06	Sediment	06/17/20
LDW20-SS421	20F0339-07	Sediment	06/17/20
LDW20-SS327	20F0339-08	Sediment	06/17/20
LDW20-SS331	20F0339-09	Sediment	06/17/20
LDW20-SS332	20F0339-10	Sediment	06/17/20
LDW20-SS326MS	20F0339-02MS	Sediment	06/17/20
LDW20-SS326MSD	20F0339-02MSD	Sediment	06/17/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). 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) by Environmental Protection Agency (EPA) SW 846 Method 8082A

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 12.6°C and 13.3°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Standard	Column	Compound	%D	Associated Samples	Flag	A or P
07/02/20	SIG0056-SCV1	1C	Aroclor-1260	21.8	All samples in SDG 20F0339	J (all detects)	A

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

All internal standard areas and retention times were within QC limits.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VIII. Laboratory Control Samples/Standard Reference Materials

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

LCS ID	Compound	%R (Limits)	Associated Samples	Affected Compound	Flag	A or P
BIF0913-BS1	Aroclor-1260	123 (56-120)	All samples in SDG 20F0339	Aroclor-1248 Aroclor-1254 Aroclor-1260	J (all detects) J (all detects) J (all detects)	P

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Compound Quantitation

The sample results for detected compounds from the two columns were within 40% relative percent difference (RPD) with the following exceptions:

Sample	Compound	RPD	Flag	A or P
LDW20-SS421	Aroclor-1248	50	J (all detects)	A
LDW20-SS327	Aroclor-1248	43.5	J (all detects)	A
LDW20-SS331	Aroclor-1254 Aroclor-1260	69.1 41.2	J (all detects) J (all detects)	A
LDW20-SS332	Aroclor-1248 Aroclor-1260	64.3 50.7	J (all detects) J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XI. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XII. Overall Assessment of Data

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

Due to ICV %D, LCS %R, and RPD between two columns, data were qualified as estimated in ten samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4
Polychlorinated Biphenyls - Data Qualification Summary - SDG 20F0339

Sample	Compound	Flag	A or P	Reason
LDW20-SS324 LDW20-SS326 LDW20-SS365 LDW20-SS368 LDW20-SS372 LDW20-SS426 LDW20-SS421 LDW20-SS327 LDW20-SS331 LDW20-SS332	Aroclor-1260	J (all detects)	A	Initial calibration verification (%D)
LDW20-SS324 LDW20-SS326 LDW20-SS365 LDW20-SS368 LDW20-SS372 LDW20-SS426 LDW20-SS421 LDW20-SS327 LDW20-SS331 LDW20-SS332	Aroclor-1248 Aroclor-1254 Aroclor-1260	J (all detects) J (all detects) J (all detects)	P	Laboratory control samples (%R)
LDW20-SS421 LDW20-SS327	Aroclor-1248	J (all detects)	A	Compound quantitation (RPD between two columns)
LDW20-SS331	Aroclor-1254 Aroclor-1260	J (all detects) J (all detects)	A	Compound quantitation (RPD between two columns)
LDW20-SS332	Aroclor-1248 Aroclor-1260	J (all detects) J (all detects)	A	Compound quantitation (RPD between two columns)

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 20F0339

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 20F0339

No Sample Data Qualified in this SDG

LDC #: 48785C3b
SDG #: 20F0339
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 08/14/20
Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD: GC Polychlorinated Biphenyls (EPA SW846 Method 8082A)

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	SW / A	cooler temp. = 13.3°C, 12.6°C (Insufficient time to cool)
II.	Initial calibration/ICV	A / SW	ICAL ≤ 20% ICV ≤ 20%
III.	Continuing calibration	A	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes /IS	A / A	
VII.	Matrix spike/Matrix spike duplicates	A	
VIII.	Laboratory control samples	SW	LCS, SRM
IX.	Field duplicates	N	
X.	Compound quantitation/RL/LOQ/LODs	SW N	
XI.	Target compound identification	N	
XII.	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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS324	20F0339-01	Sediment	06/17/20
2	LDW20-SS326	20F0339-02	Sediment	06/17/20
3	LDW20-SS365	20F0339-03	Sediment	06/17/20
4	LDW20-SS368	20F0339-04	Sediment	06/17/20
5	LDW20-SS372	20F0339-05	Sediment	06/17/20
6	LDW20-SS426	20F0339-06	Sediment	06/17/20
7	LDW20-SS421	20F0339-07	Sediment	06/17/20
8	LDW20-SS327	20F0339-08	Sediment	06/17/20
9	LDW20-SS331	20F0339-09	Sediment	06/17/20
10	LDW20-SS332	20F0339-10	Sediment	06/17/20
11	LDW20-SS326MS	20F0339-02MS	Sediment	06/17/20
12	LDW20-SS326MSD	20F0339-02MSD	Sediment	06/17/20
13				
14				

Notes:

–	BIF0913-BLK1						

VALIDATION FINDINGS WORKSHEET

METHOD: Pesticide/PCBs (EPASW 846 Method 8081/8082)

A. alpha-BHC	K. Endrin	U. Toxaphene	EE. 2,4'-DDT	OO. trans–Heptachlor epoxide
B. beta-BHC	L. Endosulfan II	V. Aroclor-1016	FF. Hexachlorobenzene	PP. Mirex
C. delta-BHC	M. 4,4'-DDD	W. Aroclor-1221	GG. Chlordane	QQ çis-Chlordane
D. gamma-BHC	N. Endosulfan sulfate	X. Aroclor-1232	HH. Chlordane (Technical)	RR. trans-Chlordane
E. Heptachlor	O. 4,4'-DDT	Y. Aroclor-1242	II. Aroclor 1262	SS.
F. Aldrin	P. Methoxychlor	Z. Aroclor-1248	JJ. Aroclor 1268	TT.
G. Heptachlor epoxide	Q. Endrin ketone	AA. Aroclor-1254	KK. Oxychlordane	UU.
H. Endosulfan I	R. Endrin aldehyde	BB. Aroclor-1260	LL. trans-Nonachlor	VV
I. Dieldrin	S. alpha-Chlordane	CC. 2,4'-DDD	MM. cis-Nonachlor	WW.
J. 4,4'-DDE	T. gamma-Chlordane	DD. 2,4'-DDE	NN. cis–Heptachlor epoxide	XX.

Notes:_____

_____

_____

LDC #: 48785C36

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".
What type of initial calibration verification calculation was performed? ✓ %D or ___ %R
(Y) N N/A Was an initial calibration verification standard analyzed after each ICAL for each instrument?
Y (N) N/A Did the initial calibration verification standards meet the %D / %R validation criteria of ≤20.0% / 80-120%?

#	Date	Standard ID	Detector/ Column	Compound	%D (Limit ≤ 20.0)	Associated Samples	Qualifications
	07/02/20	SIG0056-SCV1	1C	BB	21.8	All (Det)	J/UJ/A (qual BB only)

LDC #: 48785C36

VALIDATION FINDINGS WORKSHEET

Laboratory Control Samples

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

[✓ Y] N N/A Were laboratory control samples (LCS) and laboratory control sample duplicate (LCSD) analyzed for each matrix in this SDG?

Y [✓ N] N/A Were the LCS percent recoveries (%R) and relative percent differences (RPD) within the QC limits?

#	LCS/LCSD ID	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	BIF0913-BS1	BB	123 (56-120)	( )	( )	All (Det)	J dets/P
			( )	( )	( )		(qual # Z, AA, BB)
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
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			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		

LDC #: 48785C3b

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported RLs

Reviewer: JVG
2nd Reviewer:

METHOD: GC

Y (N) N/A Were the relative percent difference of detected compounds between two columns <40%?

#	Sample ID	Compound Name	%RPD Between Two Columns (Limit < 40%)	Qualifications
	7	Z	50	J det/A
		↓		↓
	8		43.5	
	9	AA	69.1	
		BB	41.2	
	10	Z	64.3	
		BB	50.7	

Comments: See sample calculation verification worksheet for recalculations

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 20, 2020

Parameters: Metals

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0339

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS324	20F0339-01	Sediment	06/17/20
LDW20-SS326	20F0339-02	Sediment	06/17/20
LDW20-SS365	20F0339-03	Sediment	06/17/20
LDW20-SS368	20F0339-04	Sediment	06/17/20
LDW20-SS372	20F0339-05	Sediment	06/17/20
LDW20-SS426	20F0339-06	Sediment	06/17/20
LDW20-SS421	20F0339-07	Sediment	06/17/20
LDW20-SS327	20F0339-08	Sediment	06/17/20
LDW20-SS331	20F0339-09	Sediment	06/17/20
LDW20-SS332	20F0339-10	Sediment	06/17/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). 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 methods:

Arsenic, Cadmium, Chromium, Copper, Lead, Silver, and Zinc by Environmental Protection Agency (EPA) SW 846 Method 6020A
Mercury by EPA SW 846 Method 7471B

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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.

All technical holding time requirements were met.

II. ICPMS Tune

The mass calibration was within 0.1 AMU and the percent relative standard deviation (%RSD) was less than or equal to 5%.

III. Instrument Calibration

Initial and continuing calibrations were performed as required by the methods.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

IV. ICP Interference Check Sample Analysis

The frequency of interference check sample (ICS) analysis was met. All criteria were within QC limits.

V. Laboratory Blanks

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

Blank ID	Analyte	Maximum Concentration	Associated Samples
PB (prep blank)	Silver	0.02 mg/Kg	All samples in SDG 20F0339
ICB/CCB	Silver	0.02 ug/L	All samples in SDG 20F0339

Data qualification by the laboratory blanks was based on the maximum contaminant concentration in the laboratory blanks in the analysis of each analyte. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Analyte	Reported Concentration	Modified Final Concentration
LDW20-SS324	Silver	0.16 mg/Kg	0.16U mg/Kg
LDW20-SS326	Silver	0.11 mg/Kg	0.11U mg/Kg
LDW20-SS365	Silver	0.08 mg/Kg	0.08U mg/Kg

Sample	Analyte	Reported Concentration	Modified Final Concentration
LDW20-SS368	Silver	0.05 mg/Kg	0.05U mg/Kg
LDW20-SS372	Silver	0.15 mg/Kg	0.15U mg/Kg
LDW20-SS426	Silver	0.08 mg/Kg	0.08U mg/Kg
LDW20-SS421	Silver	0.09 mg/Kg	0.09U mg/Kg
LDW20-SS327	Silver	0.14 mg/Kg	0.14U mg/Kg
LDW20-SS331	Silver	0.11 mg/Kg	0.11U mg/Kg
LDW20-SS332	Silver	0.11 mg/Kg	0.11U mg/Kg

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. Duplicate Sample Analysis

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

IX. Serial Dilution

Serial dilution was not performed for this SDG.

X. Laboratory Control Samples/Standard Reference Materials

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

Standard reference materials (SRM) were analyzed as required by the methods. The results were within QC limits.

XI. Field Duplicates

No field duplicates were identified in this SDG.

XII. Internal Standards (ICP-MS)

Raw data were not reviewed for Stage 2B validation.

XIII. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

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

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

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4
Metals - Data Qualification Summary - SDG 20F0339

No Sample Data Qualified in this SDG

Duwamish AOC4
Metals - Laboratory Blank Data Qualification Summary - SDG 20F0339

Sample	Analyte	Modified Final Concentration	A or P
LDW20-SS324	Silver	0.16U mg/Kg	A
LDW20-SS326	Silver	0.11U mg/Kg	A
LDW20-SS365	Silver	0.08U mg/Kg	A
LDW20-SS368	Silver	0.05U mg/Kg	A
LDW20-SS372	Silver	0.15U mg/Kg	A
LDW20-SS426	Silver	0.08U mg/Kg	A
LDW20-SS421	Silver	0.09U mg/Kg	A
LDW20-SS327	Silver	0.14U mg/Kg	A
LDW20-SS331	Silver	0.11U mg/Kg	A
LDW20-SS332	Silver	0.11U mg/Kg	A

Duwamish AOC4
Metals - Field Blank Data Qualification Summary - SDG 20F0339

No Sample Data Qualified in this SDG

LDC #: 48785C4a

SDG #: 20F0339

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 8/19/20

Page: 1 of 1

Reviewer: CT

2nd Reviewer: AT

METHOD: Metals (EPA SW 846 Method 6020A/7471B)

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.	ICP/MS Tune	A	
III.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	SW	
VI.	Field Blanks	N	
VII.	Matrix Spike/Matrix Spike Duplicates	N	
VIII.	Duplicate sample analysis	N	
IX.	Serial Dilution	N	
X.	Laboratory control samples	A	LCS, SRM
XI.	Field Duplicates	N	
XII.	Internal Standard (ICP-MS)	N	not reviewed
XIII.	Sample Result Verification	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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS324	20F0339-01	Sediment	06/17/20
2	LDW20-SS326	20F0339-02	Sediment	06/17/20
3	LDW20-SS365	20F0339-03	Sediment	06/17/20
4	LDW20-SS368	20F0339-04	Sediment	06/17/20
5	LDW20-SS372	20F0339-05	Sediment	06/17/20
6	LDW20-SS426	20F0339-06	Sediment	06/17/20
7	LDW20-SS421	20F0339-07	Sediment	06/17/20
8	LDW20-SS327	20F0339-08	Sediment	06/17/20
9	LDW20-SS331	20F0339-09	Sediment	06/17/20
10	LDW20-SS332	20F0339-10	Sediment	06/17/20
11				
12				
13				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1 to 10	As, Cd, Cr, Cu, Pb, Ag, Zn, Hg

Analysis Method

ICP	
ICP-MS	As, Cd, Cr, Cu, Pb, Ag, Zn
CVAA	Hg

VALIDATION FINDINGS WORKSHEET
Laboratory Blank Contamination (PB/ICB/CCB)

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)
Soil preparation factor applied (if applicable):

Sample Concentration, unless otherwise noted: mg/Kg Associated Samples: All

				Sample Identification									
Analyte	**PB (mg/Kg)**	**Maximum ICB/CCB (ug/L)**	**Action Level**	1	2	3	4	5	6	7	8	9	10
Ag	0.02	0.02		0.16	0.11	0.08	0.05	0.15	0.08	0.09	0.14	0.11	0.11

Comments: The listed analyte concentrtaion is the highest ICB or CCB detected in the analysis. The action level, when applicable, is established at 5X the highest ICB, CCB, or PB concentration.

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 20, 2020

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0339

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS324	20F0339-01	Sediment	06/17/20
LDW20-SS326	20F0339-02	Sediment	06/17/20
LDW20-SS365	20F0339-03	Sediment	06/17/20
LDW20-SS368	20F0339-04	Sediment	06/17/20
LDW20-SS372	20F0339-05	Sediment	06/17/20
LDW20-SS426	20F0339-06	Sediment	06/17/20
LDW20-SS421	20F0339-07	Sediment	06/17/20
LDW20-SS327	20F0339-08	Sediment	06/17/20
LDW20-SS331	20F0339-09	Sediment	06/17/20
LDW20-SS332	20F0339-10	Sediment	06/17/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). 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 methods:

Total Organic Carbon by Environmental Protection Agency (EPA) SW 846 Method 9060A
Total Solids by Standard Method 2540G

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration of each method were met.

III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met for each method when applicable.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. 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.

VII. Duplicate Sample Analysis

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

VIII. Laboratory Control Samples/Standard Reference Materials

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

Standard reference materials (SRM) were analyzed as required by the methods. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

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

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4
Wet Chemistry - Data Qualification Summary - SDG 20F0339

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 20F0339

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 20F0339

No Sample Data Qualified in this SDG

LDC #: 48785C6 **VALIDATION COMPLETENESS WORKSHEET** Date 8/19/20
SDG #: 20F0339 Stage 2B Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer: G
2nd Reviewer: M

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM 2540G)

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	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	A	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	
VII.	Duplicate sample analysis	N	
VIII.	Laboratory control samples	A	LCS, SRM
IX.	Field duplicates	N	
X.	Sample result verification	N	
XI	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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS324	20F0339-01	Sediment	06/17/20
2	LDW20-SS326	20F0339-02	Sediment	06/17/20
3	LDW20-SS365	20F0339-03	Sediment	06/17/20
4	LDW20-SS368	20F0339-04	Sediment	06/17/20
5	LDW20-SS372	20F0339-05	Sediment	06/17/20
6	LDW20-SS426	20F0339-06	Sediment	06/17/20
7	LDW20-SS421	20F0339-07	Sediment	06/17/20
8	LDW20-SS327	20F0339-08	Sediment	06/17/20
9	LDW20-SS331	20F0339-09	Sediment	06/17/20
10	LDW20-SS332	20F0339-10	Sediment	06/17/20
11				
12				
13				
14				
15				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1 to 10	Total solids, TOC

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 19, 2020

Parameters: Polychlorinated Dioxins/Dibenzofurans

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0339

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS327	20F0339-08	Sediment	06/17/20
LDW20-SS332	20F0339-10	Sediment	06/17/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for High Resolution Superfund Methods Data Review (April 2016). 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 Dioxins/Dibenzofurans by Environmental Protection Agency (EPA) Method 1613B

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 12.6°C and 23.3°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required frequency.

Retention time windows were established for all homologues. The chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomer was less than or equal to 25%.

The static resolving power was at least 10,000 (10% valley definition).

III. Initial Calibration and Initial Calibration Verification

A five point initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for unlabeled compounds and less than or equal to 35.0% for labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were within the QC limits for unlabeled compounds and labeled compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

All of the continuing calibration results were within the QC limits for unlabeled compounds and labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

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	Compound	Concentration	Associated Samples
BIF0803-BLK1	07/06/20	1,2,3,4,6,7,8-HpCDF 1,2,3,4,7,8,9-HpCDF 1,2,3,4,6,7,8-HpCDD OCDF OCDD	0.140 ng/Kg 0.0330 ng/Kg 0.535 ng/Kg 1.37 ng/Kg 6.33 ng/Kg	All samples in SDG 20F0339

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks.

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/Standard Reference Materials

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

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Labeled Compounds

All percent recoveries (%R) for labeled compounds used to quantitate target compounds were within QC limits.

XI. Compound Quantitation

All compound quantitations were within validation criteria with the following exceptions:

Sample	Compound	Flag	A or P
All samples in SDG 20F0339	All compounds reported as estimated maximum possible concentration (EMPC) and greater than the reporting limit.	J (all detects)	A
All samples in SDG 20F0339	All compounds reported as estimated maximum possible concentration (EMPC) and less than the reporting limit.	U (all non-detects)	A
All samples in SDG 20F0339	All compounds flagged "X" due to chlorinated diphenyl ether (CDPE) interference.	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B 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 compounds reported as EMPC and CDPE interference, data were qualified as estimated or not detected in two samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Data Qualification Summary - SDG 20F0339

Sample	Compound	Flag	A or P	Reason
LDW20-SS327 LDW20-SS332	All compounds reported as estimated maximum possible concentration (EMPC) and greater than the reporting limit.	J (all detects)	A	Compound quantitation (EMPC)
LDW20-SS327 LDW20-SS332	All compounds reported as estimated maximum possible concentration (EMPC) and less than the reporting limit.	U (all non-detects)	A	Compound quantitation (EMPC)
LDW20-SS327 LDW20-SS332	All compounds flagged "X" due to chlorinated diphenyl ether (CDPE) interference.	J (all detects)	A	Compound quantitation (CDPE interference)

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG 20F0339

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Field Blank Data Qualification Summary - SDG 20F0339

No Sample Data Qualified in this SDG

LDC #: 48785C21 **VALIDATION COMPLETENESS WORKSHEET** Date: 08/19/20
SDG #: 20F0339 Stage 2B Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer: QV6
2nd Reviewer: CL

METHOD: HRGC/HRMS Polychlorinated Dioxins/Dibenzofurans (EPA Method 1613B)

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	SW / A	Cooler temp. = 13.3°C, 12.6°C (Insufficient time to cool)
II.	HRGC/HRMS Instrument performance check	A	
III.	Initial calibration/ICV	A / A	ICAL ≤ 20/35 % ICV = QC limits
IV.	Continuing calibration	A	CCV ≤ QC limits
V.	Laboratory Blanks	SW	
VI.	Field blanks	N	
VII.	Matrix spike/Matrix spike duplicates	N	
VIII.	Laboratory control samples	A	LCS, SRM
IX.	Field duplicates	N	
X.	Labeled Compounds	A	
XI.	Compound quantitation RL/LOQ/LODs	SW	EMPC = J dets (>RL); U (<RL)
XII.	Target compound 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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS327	20F0339-08	Sediment	06/17/20
2	LDW20-SS332	20F0339-10	Sediment	06/17/20
3				
4				
5				
6				
7				
8				
9				
10				

Notes:

	BI F0803-BLK1						

VALIDATION FINDINGS WORKSHEET

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

A. 2,3,7,8-TCDD	F. 1,2,3,4,6,7,8-HpCDD	K. 1,2,3,4,7,8-HxCDF	P. 1,2,3,4,7,8,9-HpCDF	U. Total HpCDD
B. 1,2,3,7,8-PeCDD	G. OCDD	L. 1,2,3,6,7,8-HxCDF	Q. OCDF	V. Total TCDF
C. 1,2,3,4,7,8-HxCDD	H. 2,3,7,8-TCDF	M. 2,3,4,6,7,8-HxCDF	R. Total TCDD	W. Total PeCDF
D. 1,2,3,6,7,8-HxCDD	I. 1,2,3,7,8-PeCDF	N. 1,2,3,7,8,9-HxCDF	S. Total PeCDD	X. Total HxCDF
E. 1,2,3,7,8,9-HxCDD	J. 2,3,4,7,8-PeCDF	O. 1,2,3,4,6,7,8-HpCDF	T. Total HxCDD	Y. Total HpCDF

Notes:_____

LDC #: 48785C21

VALIDATION FINDINGS WORKSHEET
Blanks

Reviewer: JVG
2nd Reviewer:

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were all samples associated with a method blank?
Y N N/A Was a method blank performed for each matrix and whenever a sample extraction was performed?
Y N N/A Was the method blank contaminated?

Blank extraction date: 07/06/20 **Blank analysis date:** 07/09/20 **Associated samples:** All (>5X)

Conc. units: ng/kg

Compound	Blank ID	Sample Identification								
	BIF0803-BLK1 (5X)									
O	0.140 *	0.70								
P	0.0330 *	0.165								
F	0.535 *	2.675								
Q	1.37	6.850								
G	6.33	31.65								

Blank extraction date: _____ **Blank analysis date:** _____

Conc. units: _____ Associated Samples: * EMPC

Compound	Blank ID	Sample Identification								

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
All contaminants within five times the method blank concentration were qualified as not detected, "U".

LDC #: 48785C21

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported RLs

Reviewer: JVG
2nd Reviewer: CV

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)
Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were the correct labeled compound, quantitation ions and relative response factors (RRF) used to quantitate the compound?
Y N N/A Compound quantitation and RLs were adjusted to reflect all sample dilutions and dry weight factors (if necessary).

#	Date	Sample ID	Compound	Finding	Qualifications
		All		All results flagged as EMPC > RL	Jdets/A
				< RL	U/A
		All		All results flagged "X" by the lab due to chlorinated	Jdets/A
				diphenyl ether (CDPE) interference	

Comments: _____

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 20, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0352

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS251	20F0352-01	Sediment	06/18/20
LDW20-SS264	20F0352-02	Sediment	06/18/20
LDW20-SS409	20F0352-03	Sediment	06/18/20
LDW20-SS310	20F0352-04	Sediment	06/18/20
LDW20-SS318	20F0352-05	Sediment	06/18/20
LDW20-SS322	20F0352-06	Sediment	06/18/20
LDW20-SS359	20F0352-07	Sediment	06/18/20
LDW20-SS377	20F0352-08	Sediment	06/18/20
LDW20-SS379	20F0352-09	Sediment	06/18/20
LDW20-SS379DL	20F0352-09DL	Sediment	06/18/20
LDW20-SS388	20F0352-10	Sediment	06/18/20
LDW20-SS251MS	20F0352-01MS	Sediment	06/18/20
LDW20-SS251MSD	20F0352-01MSD	Sediment	06/18/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). 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:

Semivolatile Organic Compounds (SVOCs) by Environmental Protection Agency (EPA) SW 846 Method 8270E

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 12.0°C and 19.2°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

All of the continuing calibration relative response factors (RRF) were within validation criteria.

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	Compound	Concentration	Associated Samples
BIG0057-BLK1	07/03/20	Benzo(g,h,i)perylene	14.4 ug/Kg	All samples in SDG 20F0352

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Compound	Reported Concentration	Modified Final Concentration
LDW20-SS359	Benzo(g,h,i)perylene	14.5 ug/Kg	14.5U ug/Kg

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples/Standard Reference Materials

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

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

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

In the case where more than one result was reported for an individual sample, the least technically acceptable results were deemed not reportable as follows:

Sample	Compound	Reason	Flag	A or P
LDW20-SS379	Phenanthrene Fluoranthene Pyrene Benzo(a)anthracene Chrysene	Results exceeded calibration range.	Not reportable	A
LDW20-SS379DL	All compounds except Phenanthrene Fluoranthene Pyrene Benzo(a)anthracene Chrysene	Results from undiluted analyses were more usable.	Not reportable	A

Due to laboratory blank contamination, data were qualified as not detected in one sample.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4
Semivolatiles - Data Qualification Summary - SDG 20F0352

Sample	Compound	Flag	A or P	Reason
LDW20-SS379	Phenanthrene Fluoranthene Pyrene Benzo(a)anthracene Chrysene	Not reportable	A	Overall assessment of data
LDW20-SS379DL	All compounds except Phenanthrene Fluoranthene Pyrene Benzo(a)anthracene Chrysene	Not reportable	A	Overall assessment of data

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0352

Sample	Compound	Modified Final Concentration	A or P
LDW20-SS359	Benzo(g,h,i)perylene	14.5U ug/Kg	A

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0352

No Sample Data Qualified in this SDG

LDC #: 48785D2a
SDG #: 20F0352
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 08/19/20
Page: 1 of 1
Reviewer: BJW
2nd Reviewer:

METHOD: GC/MS Semivolatiles (EPA SW 846 Method 8270E)

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 (Insufficient time to cool)
I.	Sample receipt/Technical holding times	SW, A	Cooler temp. = 19.2°C, 12.0°C
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A, A	ICAL ≤ 20%, ICV ≤ 30%
IV.	Continuing calibration	A	CCV ≤ 20%
V.	Laboratory Blanks	SW	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	A	LCS, SRM
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	SW	

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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS251	20F0352-01	Sediment	06/18/20
2	LDW20-SS264	20F0352-02	Sediment	06/18/20
3	LDW20-SS409	20F0352-03	Sediment	06/18/20
4	LDW20-SS310	20F0352-04	Sediment	06/18/20
5	LDW20-SS318	20F0352-05	Sediment	06/18/20
6	LDW20-SS322	20F0352-06	Sediment	06/18/20
7	LDW20-SS359	20F0352-07	Sediment	06/18/20
8	LDW20-SS377	20F0352-08	Sediment	06/18/20
9	LDW20-SS379	20F0352-09	Sediment	06/18/20
10	LDW20-SS379~~RE~~DL	20F0352-09~~RE~~DL	Sediment	06/18/20
11	LDW20-SS388	20F0352-10	Sediment	06/18/20
12	LDW20-SS251MS	20F0352-01MS	Sediment	06/18/20
13	LDW20-SS251MSD	20F0352-01MSD	Sediment	06/18/20
14				

BI G0057-BLK1

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

A. Phenol	AA. 2-Chloronaphthalene	AAA. Butylbenzylphthalate	AAAA. Dibenzothiophene	A1. N-Nitrosodiethylamine
B. Bis (2-chloroethyl) ether	BB. 2-Nitroaniline	BBB. 3,3'-Dichlorobenzidine	BBBB. Benzo(a)fluoranthene	B1. N-Nitrosodi-n-butylamine
C. 2-Chlorophenol	CC. Dimethylphthalate	CCC. Benzo(a)anthracene	CCCC. Benzo(b)fluorene	C1. N-Nitrosomethylethylamine
D. 1,3-Dichlorobenzene	DD. Acenaphthylene	DDD. Chrysene	DDDD. cis/trans-Decalin	D1. N-Nitrosomorpholine
E. 1,4-Dichlorobenzene	EE. 2,6-Dinitrotoluene	EEE. Bis(2-ethylhexyl)phthalate	EEEE. Biphenyl	E1. N-Nitrosopyrrolidine
F. 1,2-Dichlorobenzene	FF. 3-Nitroaniline	FFF. Di-n-octylphthalate	FFFF. Retene	F1. Phenacetin
G. 2-Methylphenol	GG. Acenaphthene	GGG. Benzo(b)fluoranthene	GGGG. C30-Hopane	G1. 2-Acetylaminofluorene
H. 2,2'-Oxybis(1-chloropropane)	HH. 2,4-Dinitrophenol	HHH. Benzo(k)fluoranthene	HHHH. 1-Methylphenanthrene	H1. Pronamide
I. 4-Methylphenol	II. 4-Nitrophenol	III. Benzo(a)pyrene	IIII. 1,4-Dioxane	I1. Methyl methanesulfonate
J. N-Nitroso-di-n-propylamine	JJ. Dibenzofuran	JJJ. Indeno(1,2,3-cd)pyrene	JJJJ. Acetophenone	J1. Ethyl methanesulfonate
K. Hexachloroethane	KK. 2,4-Dinitrotoluene	KKK. Dibenz(a,h)anthracene	KKKK. Atrazine	K1. o,o',o''-Triethylphosphorothioate
L. Nitrobenzene	LL. Diethylphthalate	LLL. Benzo(g,h,i)perylene	LLLL. Benzaldehyde	L1. n-Phenylene diamine
M. Isophorone	MM. 4-Chlorophenyl-phenyl ether	MMM. Bis(2-Chloroisopropyl)ether	MMMM. Caprolactam	M1. 1,4-Naphthoquinone
N. 2-Nitrophenol	NN. Fluorene	NNN. Aniline	NNNN. 2,6-Dichlorophenol	N1. N-Nitro-o-toluidine
O. 2,4-Dimethylphenol	OO. 4-Nitroaniline	OOO. N-Nitrosodimethylamine	OOOO. 1,2-Diphenylhydrazine	O1. 1,3,5-Trinitrobenzene
P. Bis(2-chloroethoxy)methane	PP. 4,6-Dinitro-2-methylphenol	PPP. Benzoic Acid	PPPP. 3-Methylphenol	P1. Pentachlorobenzene
Q. 2,4-Dichlorophenol	QQ. N-Nitrosodiphenylamine	QQQ. Benzyl alcohol	QQQQ. 3&4-Methylphenol	Q1. 4-Aminobiphenyl
R. 1,2,4-Trichlorobenzene	RR. 4-Bromophenyl-phenylether	RRR. Pyridine	RRRR. 4-Dimethyldibenzothiophene (4MDT)	R1. 2-Naphthylamine
S. Naphthalene	SS. Hexachlorobenzene	SSS. Benzidine	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	S1. Triphenylene
T. 4-Chloroaniline	TT. Pentachlorophenol	TTT. 1-Methylnaphthalene	TTTT. 1-Methyldibenzothiophene (1MDT)	T1. Octachlorostyrene
U. Hexachlorobutadiene	UU. Phenanthrene	UUU.Benzo(b)thiophene	UUUU.. 2,3,4,6-Tetrachlorophenol	U1. Famphur
V. 4-Chloro-3-methylphenol	VV. Anthracene	VVV.Benzonaphthothiophene	VVVV. 1,2,4,5-Tetrachlorobenzene	V1. 1,4-phenylenediamine
W. 2-Methylnaphthalene	WW. Carbazole	WWW.Benzo(e)pyrene	WWWW.. 2-Picoline	W1. Methapyrilene
X. Hexachlorocyclopentadiene	XX. Di-n-butylphthalate	XXX. 2,6-Dimethylnaphthalene	XXXX. 3-Methylcholanthrene	X1. Pentachloroethane
Y. 2,4,6-Trichlorophenol	YY. Fluoranthene	YYY. 2,3,5-Trimethylnaphthalene	YYYY. a,a-Dimethylphenethylamine	Y1. 3,3'-Dimethylbenzidine
Z. 2,4,5-Trichlorophenol	ZZ. Pyrene	ZZZ. Perylene	ZZZZ. Hexachloropropene	Z1. o-Toluidine

LDC #: 48785 D2a

VALIDATION FINDINGS WORKSHEET
Blanks

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD: GC/MS BNA (EPA SW 846 Method 8270C)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Was a method blank analyzed for each matrix?
Y N N/A Was a method blank analyzed for each concentration preparation level?
Y N N/A Was a method blank associated with every sample?
Y N N/A Was the blank contaminated? If yes, please see qualification below.

Blank extraction date: 07/03/20 **Blank analysis date:** 07/11/20
Conc. units: ug/kg Associated Samples: All

Compound	Blank ID								
	BIG0057-BLK1		7						
(4RL) LLL	14.4		14.5/U						

Blank extraction date: _____ **Blank analysis date:** _____
Conc. units: _____ Associated Samples: _____

Compound	Blank ID								

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
Common contaminants such as the phthalates and TICs noted above that were detected in samples within ten times the associated method blank concentration were qualified as not detected, "U". Other contaminants within five times the method blank concentration were also qualified as not detected, "U".

LDC #: 48785p2a

VALIDATION FINDINGS WORKSHEET
Overall Assessment of Data

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: _____

METHOD: GC/MS BNA (EPA SW 846 Method 8270~~C~~E

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".
All available information pertaining to the data were reviewed using professional judgement to compliment the determination of the overall quality of the data.

(Y) N N/A Was the overall quality and usability of the data acceptable?

#	Date	Sample ID	Compound	Finding	Qualifications
		9	UU, YY, ZZ, CCC, DDD	7 cal range	NR/A
					↓
		10	All except above	dil	↓

Comments: _____

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 20, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0352

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS251	20F0352-01	Sediment	06/18/20
LDW20-SS264	20F0352-02	Sediment	06/18/20
LDW20-SS409	20F0352-03	Sediment	06/18/20
LDW20-SS310	20F0352-04	Sediment	06/18/20
LDW20-SS318	20F0352-05	Sediment	06/18/20
LDW20-SS322	20F0352-06	Sediment	06/18/20
LDW20-SS359	20F0352-07	Sediment	06/18/20
LDW20-SS377	20F0352-08	Sediment	06/18/20
LDW20-SS379	20F0352-09	Sediment	06/18/20
LDW20-SS388	20F0352-10	Sediment	06/18/20
LDW20-SS251MS	20F0352-01MS	Sediment	06/18/20
LDW20-SS251MSD	20F0352-01MSD	Sediment	06/18/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). 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:

Semivolatile Organic Compounds (SVOCs) by Environmental Protection Agency (EPA) SW 846 Method 8270E in Selected Ion Monitoring (SIM) mode

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 12.0°C and 19.2°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For compounds where average relative response factors (RRFs) were utilized, percent relative standard deviations (%RSD) were less than or equal to 20.0%.

In the case where the laboratory used a calibration curve to evaluate the compounds, all coefficients of determination (r^2) were greater than or equal to 0.990.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all compounds with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
06/26/20	N-Nitrosodiphenylamine	41.9	All samples in SDG 20F0352	J (all detects) UJ (all non-detects)	A

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
07/11/20	Benzyl alcohol	21.1	All samples in SDG 20F0352	J (all detects) UJ (all non-detects)	A
	Pentachlorophenol	28.6		J (all detects) UJ (all non-detects)	

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples/Standard Reference Materials

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

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

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

Due to ICV %D and continuing calibration %D, data were qualified as estimated in ten samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4
Semivolatiles – Data Qualification Summary - SDG 20F0352

Sample	Compound	Flag	A or P	Reason
LDW20-SS251 LDW20-SS264 LDW20-SS409 LDW20-SS310 LDW20-SS318 LDW20-SS322 LDW20-SS359 LDW20-SS377 LDW20-SS379 LDW20-SS388	N-Nitrosodiphenylamine	J (all detects) UJ (all non-detects)	A	Initial calibration verification (%D)
LDW20-SS251 LDW20-SS264 LDW20-SS409 LDW20-SS310 LDW20-SS318 LDW20-SS322 LDW20-SS359 LDW20-SS377 LDW20-SS379 LDW20-SS388	Benzyl alcohol Pentachlorophenol	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	A	Continuing calibration (%D)

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0352

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0352

No Sample Data Qualified in this SDG

LDC #: 48785D2b

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 08/04/20

SDG #: 20F0352

Page: 1 of 1

Laboratory: Analytical Resources, Inc.

Reviewer: SW

2nd Reviewer:

METHOD: GC/MS ~~Polynuclear Aromatic Hydrocarbons~~ SVOA (EPA SW 846 Method 8270E-SIM)

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	SW / A	Cooler temp. = 19.2°C, 12.0°C (Insufficient time to cool)
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A / SW	ICAL ≤ 20% r ICV ≤ 30%
IV.	Continuing calibration	SW	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	A	LCS, SRM
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS251	20F0352-01	Sediment	06/18/20
2	LDW20-SS264	20F0352-02	Sediment	06/18/20
3	LDW20-SS409	20F0352-03	Sediment	06/18/20
4	LDW20-SS310	20F0352-04	Sediment	06/18/20
5	LDW20-SS318	20F0352-05	Sediment	06/18/20
6	LDW20-SS322	20F0352-06	Sediment	06/18/20
7	LDW20-SS359	20F0352-07	Sediment	06/18/20
8	LDW20-SS377	20F0352-08	Sediment	06/18/20
9	LDW20-SS379	20F0352-09	Sediment	06/18/20
10	LDW20-SS388	20F0352-10	Sediment	06/18/20
11	LDW20-SS251MS	20F0352-01MS	Sediment	06/18/20
12	LDW20-SS251MSD	20F0352-01MSD	Sediment	06/18/20
13				
14	BIG0057-BLK2			

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

A. Phenol	AA. 2-Chloronaphthalene	AAA. Butylbenzylphthalate	AAAA. Dibenzothiophene	A1. N-Nitrosodiethylamine
B. Bis (2-chloroethyl) ether	BB. 2-Nitroaniline	BBB. 3,3'-Dichlorobenzidine	BBBB. Benzo(a)fluoranthene	B1. N-Nitrosodi-n-butylamine
C. 2-Chlorophenol	CC. Dimethylphthalate	CCC. Benzo(a)anthracene	CCCC. Benzo(b)fluorene	C1. N-Nitrosomethylethylamine
D. 1,3-Dichlorobenzene	DD. Acenaphthylene	DDD. Chrysene	DDDD. cis/trans-Decalin	D1. N-Nitrosomorpholine
E. 1,4-Dichlorobenzene	EE. 2,6-Dinitrotoluene	EEE. Bis(2-ethylhexyl)phthalate	EEEE. Biphenyl	E1. N-Nitrosopyrrolidine
F. 1,2-Dichlorobenzene	FF. 3-Nitroaniline	FFF. Di-n-octylphthalate	FFFF. Retene	F1. Phenacetin
G. 2-Methylphenol	GG. Acenaphthene	GGG. Benzo(b)fluoranthene	GGGG. C30-Hopane	G1. 2-Acetylaminofluorene
H. 2,2'-Oxybis(1-chloropropane)	HH. 2,4-Dinitrophenol	HHH. Benzo(k)fluoranthene	HHHH. 1-Methylphenanthrene	H1. Pronamide
I. 4-Methylphenol	II. 4-Nitrophenol	III. Benzo(a)pyrene	IIII. 1,4-Dioxane	I1. Methyl methanesulfonate
J. N-Nitroso-di-n-propylamine	JJ. Dibenzofuran	JJJ. Indeno(1,2,3-cd)pyrene	JJJJ. Acetophenone	J1. Ethyl methanesulfonate
K. Hexachloroethane	KK. 2,4-Dinitrotoluene	KKK. Dibenz(a,h)anthracene	KKKK. Atrazine	K1. o,o',o''-Triethylphosphorothioate
L. Nitrobenzene	LL. Diethylphthalate	LLL. Benzo(g,h,i)perylene	LLLL. Benzaldehyde	L1. n-Phenylene diamine
M. Isophorone	MM. 4-Chlorophenyl-phenyl ether	MMM. Bis(2-Chloroisopropyl)ether	MMMM. Caprolactam	M1. 1,4-Naphthoquinone
N. 2-Nitrophenol	NN. Fluorene	NNN. Aniline	NNNN. 2,6-Dichlorophenol	N1. N-Nitro-o-toluidine
O. 2,4-Dimethylphenol	OO. 4-Nitroaniline	OOO. N-Nitrosodimethylamine	OOOO. 1,2-Diphenylhydrazine	O1. 1,3,5-Trinitrobenzene
P. Bis(2-chloroethoxy)methane	PP. 4,6-Dinitro-2-methylphenol	PPP. Benzoic Acid	PPPP. 3-Methylphenol	P1. Pentachlorobenzene
Q. 2,4-Dichlorophenol	QQ. N-Nitrosodiphenylamine	QQQ. Benzyl alcohol	QQQQ. 3&4-Methylphenol	Q1. 4-Aminobiphenyl
R. 1,2,4-Trichlorobenzene	RR. 4-Bromophenyl-phenylether	RRR. Pyridine	RRRR. 4-Dimethyldibenzothiophene (4MDT)	R1. 2-Naphthylamine
S. Naphthalene	SS. Hexachlorobenzene	SSS. Benzidine	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	S1. Triphenylene
T. 4-Chloroaniline	TT. Pentachlorophenol	TTT. 1-Methylnaphthalene	TTTT. 1-Methyldibenzothiophene (1MDT)	T1. Octachlorostyrene
U. Hexachlorobutadiene	UU. Phenanthrene	UUU.Benzo(b)thiophene	UUUU.. 2,3,4,6-Tetrachlorophenol	U1. Famphur
V. 4-Chloro-3-methylphenol	VV. Anthracene	VVV.Benzonaphthothiophene	VVVV. 1,2,4,5-Tetrachlorobenzene	V1. 1,4-phenylenediamine
W. 2-Methylnaphthalene	WW. Carbazole	WWW.Benzo(e)pyrene	WWWW.. 2-Picoline	W1. Methapyrilene
X. Hexachlorocyclopentadiene	XX. Di-n-butylphthalate	XXX. 2,6-Dimethylnaphthalene	XXXX. 3-Methylcholanthrene	X1. Pentachloroethane
Y. 2,4,6-Trichlorophenol	YY. Fluoranthene	YYY. 2,3,5-Trimethylnaphthalene	YYYY. a,a-Dimethylphenethylamine	Y1. 3,3'-Dimethylbenzidine
Z. 2,4,5-Trichlorophenol	ZZ. Pyrene	ZZZ. Perylene	ZZZZ. Hexachloropropene	Z1. o-Toluidine

LDC #: 48785D2b

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC/MS SVOA (EPA SW 846 Method 8270C)
Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Was an initial calibration verification standard analyzed after each ICAL for each instrument?
Y N N/A Were all %D within the validation criteria of ≤20/30% %D ?

#	Date	Standard ID	Compound	Finding %D (Limit: ≤~~20.0%~~/30%)	Associated Samples	Qualifications
	06/26/20	SIF0393-SCV1	QQ	41.9	All (ND + Det)	J/UJ/A

LDC #: 48785 D2b

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD: GC/MS BNA (EPA SW 846 Method 8270C)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Was a continuing calibration standard analyzed at least once every 12 hours of sample analysis for each instrument?
Y N N/A Were percent differences (%D) and relative response factors (RRF) within method criteria for all CCC's and SPCC's ?
Y N N/A Were all %D and RRFs within the validation criteria of ≤20 %D and ≥0.05 RRF ?

#	Date	Standard ID	Compound	Finding %D (Limit: <20.0%)	Finding RRF (Limit: >0.05)	Associated Samples	Qualifications
	07/11/20	ATI0200711035	QQQ	21.1		All (ND + Det)	J / UJ / A
			TT	28.6			

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 20, 2020

Parameters: Hexachlorobenzene

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0352

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS251	20F0352-01	Sediment	06/18/20
LDW20-SS264	20F0352-02	Sediment	06/18/20
LDW20-SS409	20F0352-03	Sediment	06/18/20
LDW20-SS310	20F0352-04	Sediment	06/18/20
LDW20-SS318	20F0352-05	Sediment	06/18/20
LDW20-SS322	20F0352-06	Sediment	06/18/20
LDW20-SS359	20F0352-07	Sediment	06/18/20
LDW20-SS377	20F0352-08	Sediment	06/18/20
LDW20-SS379	20F0352-09	Sediment	06/18/20
LDW20-SS388	20F0352-10	Sediment	06/18/20
LDW20-SS264MS	20F0352-02MS	Sediment	06/18/20
LDW20-SS264MSD	20F0352-02MSD	Sediment	06/18/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). 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:

Hexachlorobenzene by Environmental Protection Agency (EPA) SW 846 Method 8081B

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 12.0°C and 19.2°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC Instrument Performance Check

Instrument performance was checked at 12 hour intervals.

The individual 4,4'-DDT and Endrin breakdowns (%BD) were less than or equal to 15.0%.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0%.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0%.

IV. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0%.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

All internal standard areas and retention times were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples

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

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

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

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4
Hexachlorobenzene - Data Qualification Summary - SDG 20F0352

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Laboratory Blank Data Qualification Summary - SDG 20F0352

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Field Blank Data Qualification Summary - SDG 20F0352

No Sample Data Qualified in this SDG

LDC #: 48785D3a

SDG #: 20F0352

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 08/14/20

Page: 1 of 1

Reviewer: JVP

2nd Reviewer: CK

METHOD: GC Hexachlorobenzene (EPA SW846 Method 8081B)

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	SW / A	cooler temp = 19.2°C, 12.0°C (insufficient time to cool)
II.	GC Instrument Performance Check	A	
III.	Initial calibration/ICV	A / A	ICAL ≤ 20% ICV ≤ 20%
IV.	Continuing calibration	A	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes /IS	A / A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	A	LCS
X.	Field duplicates	N	
XI.	Compound quantitation/RL/LOQ/LODs	N	
XII.	Target compound 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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS251	20F0352-01	Sediment	06/18/20
2	LDW20-SS264	20F0352-02	Sediment	06/18/20
3	LDW20-SS409	20F0352-03	Sediment	06/18/20
4	LDW20-SS310	20F0352-04	Sediment	06/18/20
5	LDW20-SS318	20F0352-05	Sediment	06/18/20
6	LDW20-SS322	20F0352-06	Sediment	06/18/20
7	LDW20-SS359	20F0352-07	Sediment	06/18/20
8	LDW20-SS377	20F0352-08	Sediment	06/18/20
9	LDW20-SS379	20F0352-09	Sediment	06/18/20
10	LDW20-SS388	20F0352-10	Sediment	06/18/20
11	LDW20-SS264MS	20F0352-02MS	Sediment	06/18/20
12	LDW20-SS264MSD	20F0352-02MSD	Sediment	06/18/20
13				
14				
15	BIG0059-BLK1			

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 19, 2020

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0352

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS251	20F0352-01	Sediment	06/18/20
LDW20-SS264	20F0352-02	Sediment	06/18/20
LDW20-SS409	20F0352-03	Sediment	06/18/20
LDW20-SS310	20F0352-04	Sediment	06/18/20
LDW20-SS318	20F0352-05	Sediment	06/18/20
LDW20-SS322	20F0352-06	Sediment	06/18/20
LDW20-SS359	20F0352-07	Sediment	06/18/20
LDW20-SS377	20F0352-08	Sediment	06/18/20
LDW20-SS379	20F0352-09	Sediment	06/18/20
LDW20-SS388	20F0352-10	Sediment	06/18/20
LDW20-SS409MS	20F0352-03MS	Sediment	06/18/20
LDW20-SS409MSD	20F0352-03MSD	Sediment	06/18/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). 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) by Environmental Protection Agency (EPA) SW 846 Method 8082A

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 12.0°C and 19.2°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Standard	Column	Compound	%D	Associated Samples	Flag	A or P
07/02/20	SIG0056-SCV1	1C	Aroclor-1260	21.8	All samples in SDG 20F0352	J (all detects)	A

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

All internal standard areas and retention times were within QC limits.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VIII. Laboratory Control Samples/Standard Reference Materials

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

LCS ID	Compound	%R (Limits)	Associated Samples	Affected Compound	Flag	A or P
BIG0061-BS1	Aroclor-1260	121 (58-120)	All samples in SDG 20F0352	Aroclor-1248 Aroclor-1254 Aroclor-1260	J (all detects) J (all detects) J (all detects)	P

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Compound Quantitation

The sample results for detected compounds from the two columns were within 40% relative percent difference (RPD) with the following exceptions:

Sample	Compound	RPD	Flag	A or P
LDW20-SS251	Aroclor-1254	48.6	J (all detects)	A
LDW20-SS409	Aroclor-1248	57.4	J (all detects)	A
LDW20-SS310	Aroclor-1248	42.1	J (all detects)	A
LDW20-SS318	Aroclor-1248 Aroclor-1254	49.9 42.5	J (all detects) J (all detects)	A
LDW20-SS359	Aroclor-1248	49.8	J (all detects)	A
LDW20-SS377	Aroclor-1248	65.3	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XI. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XII. Overall Assessment of Data

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

Due to ICV %D, LCS %R, and RPD between two columns, data were qualified as estimated in ten samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4
Polychlorinated Biphenyls - Data Qualification Summary - SDG 20F0352

Sample	Compound	Flag	A or P	Reason
LDW20-SS251 LDW20-SS264 LDW20-SS409 LDW20-SS310 LDW20-SS318 LDW20-SS322 LDW20-SS359 LDW20-SS377 LDW20-SS379 LDW20-SS388	Aroclor-1260	J (all detects)	A	Initial calibration verification (%D)
LDW20-SS251 LDW20-SS264 LDW20-SS409 LDW20-SS310 LDW20-SS318 LDW20-SS322 LDW20-SS359 LDW20-SS377 LDW20-SS379 LDW20-SS388	Aroclor-1248 Aroclor-1254 Aroclor-1260	J (all detects) J (all detects) J (all detects)	P	Laboratory control samples (%R)
LDW20-SS251	Aroclor-1254	J (all detects)	A	Compound quantitation (RPD between two columns)
LDW20-SS409 LDW20-SS310 LDW20-SS359 LDW20-SS377	Aroclor-1248	J (all detects)	A	Compound quantitation (RPD between two columns)
LDW20-SS318	Aroclor-1248 Aroclor-1254	J (all detects) J (all detects)	A	Compound quantitation (RPD between two columns)

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 20F0352

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 20F0352

No Sample Data Qualified in this SDG

LDC #: 48785D3b

SDG #: 20F0352

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 08/19/20

Page: 1 of 1

Reviewer: SW

2nd Reviewer:

METHOD: GC Polychlorinated Biphenyls (EPA SW846 Method 8082A)

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	SW/A	Cooler temp. = 19.2°C, 12.0°C (Insufficient time to cool)
II.	Initial calibration/ICV	A/SW	ICAL ≤ 20%, ICV ≤ 20%.
III.	Continuing calibration	A	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes /IS	A/A	
VII.	Matrix spike/Matrix spike duplicates	A	
VIII.	Laboratory control samples	SW	LCS, SRM
IX.	Field duplicates	N	
X.	Compound quantitation/RL/LOQ/LODs	SW	
XI.	Target compound identification	N	
XII.	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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS251	20F0352-01	Sediment	06/18/20
2	LDW20-SS264	20F0352-02	Sediment	06/18/20
3	LDW20-SS409	20F0352-03	Sediment	06/18/20
4	LDW20-SS310	20F0352-04	Sediment	06/18/20
5	LDW20-SS318	20F0352-05	Sediment	06/18/20
6	LDW20-SS322	20F0352-06	Sediment	06/18/20
7	LDW20-SS359	20F0352-07	Sediment	06/18/20
8	LDW20-SS377	20F0352-08	Sediment	06/18/20
9	LDW20-SS379	20F0352-09	Sediment	06/18/20
10	LDW20-SS388	20F0352-10	Sediment	06/18/20
11	LDW20-SS409MS	20F0352-03MS	Sediment	06/18/20
12	LDW20-SS409MSD	20F0352-03MSD	Sediment	06/18/20
13				
14				

Notes:

	BI G00161-BLK1						

VALIDATION FINDINGS WORKSHEET

METHOD: Pesticide/PCBs (EPASW 846 Method 8081/8082)

A. alpha-BHC	K. Endrin	U. Toxaphene	EE. 2,4'-DDT	OO. trans–Heptachlor epoxide
B. beta-BHC	L. Endosulfan II	V. Aroclor-1016	FF. Hexachlorobenzene	PP. Mirex
C. delta-BHC	M. 4,4'-DDD	W. Aroclor-1221	GG. Chlordane	QQ cis-Chlordane
D. gamma-BHC	N. Endosulfan sulfate	X. Aroclor-1232	HH. Chlordane (Technical)	RR. trans-Chlordane
E. Heptachlor	O. 4,4'-DDT	Y. Aroclor-1242	II. Aroclor 1262	SS.
F. Aldrin	P. Methoxychlor	Z. Aroclor-1248	JJ. Aroclor 1268	TT.
G. Heptachlor epoxide	Q. Endrin ketone	AA. Aroclor-1254	KK. Oxychlordane	UU.
H. Endosulfan I	R. Endrin aldehyde	BB. Aroclor-1260	LL. trans-Nonachlor	VV
I. Dieldrin	S. alpha-Chlordane	CC. 2,4'-DDD	MM. cis-Nonachlor	WW.
J. 4,4'-DDE	T. gamma-Chlordane	DD. 2,4'-DDE	NN. cis–Heptachlor epoxide	XX.

Notes:_____

_____

_____

LDC #: 48785 D3b

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".
What type of initial calibration verification calculation was performed? ✓%D or ___%R
Y N N/A Was an initial calibration verification standard analyzed after each ICAL for each instrument?
Y N N/A Did the initial calibration verification standards meet the %D / %R validation criteria of ≤20.0% / 80-120%?

#	Date	Standard ID	Detector/ Column	Compound	%D (Limit ≤ 20.0)	Associated Samples	Qualifications
	07/02/20	SIG0056-5CV1	1C	BB	21.8	All (Det)	J / UJ / A (qual BB only)

LDC #: 48785 D3b

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

[✓ Y] N N/A Were laboratory control samples (LCS) and laboratory control sample duplicate (LCSD) analyzed for each matrix in this SDG?

Y [✓ N] N/A Were the LCS percent recoveries (%R) and relative percent differences (RPD) within the QC limits?

#	LCS/LCSD ID	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	BIG0061-BS1	BB	121 (58-120)	( )	( )	All (Det)	J dets/P
			( )	( )	( )		(qual Z, AA, BB)
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
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			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		

LDC #: 48785 D3b

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: / GC __ HPLC

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Level IV/D Only

~~Y~~ N N/A Were CRQLs adjusted for sample dilutions, dry weight factors, etc.?
~~Y~~ N N/A Did the reported results for detected target compounds agree within 10.0% of the recalculated results?
Y (N) N/A Did the percent difference of detected compounds between two columns./detectors ≤40%?
If no, please see findings bellow.

#	Compound Name	Sample ID	%RPD/%D Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	Aroclor 1254	1	48.6	J dets (A
	1248	3	57.4	
	1248	4	42.1	
	1248	5	49.9	
	1254	↓	42.5	
	1248	7	49.8	
	1248	8	65.3	↓

Comments: See sample calculation verification worksheet for recalculations

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 20, 2020

Parameters: Metals

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0352

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS251	20F0352-01	Sediment	06/18/20
LDW20-SS264	20F0352-02	Sediment	06/18/20
LDW20-SS409	20F0352-03	Sediment	06/18/20
LDW20-SS310	20F0352-04	Sediment	06/18/20
LDW20-SS318	20F0352-05	Sediment	06/18/20
LDW20-SS322	20F0352-06	Sediment	06/18/20
LDW20-SS359	20F0352-07	Sediment	06/18/20
LDW20-SS377	20F0352-08	Sediment	06/18/20
LDW20-SS379	20F0352-09	Sediment	06/18/20
LDW20-SS388	20F0352-10	Sediment	06/18/20
LDW20-SS251MS	20F0352-01MS	Sediment	06/18/20
LDW20-SS251MSD	20F0352-01MSD	Sediment	06/18/20
LDW20-SS251DUP	20F0352-01DUP	Sediment	06/18/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). 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 methods:

Arsenic, Cadmium, Chromium, Copper, Lead, Silver, and Zinc by Environmental Protection Agency (EPA) SW 846 Method 6020A
Mercury by EPA SW 846 Method 7471B

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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.

All technical holding time requirements were met.

II. ICPMS Tune

The mass calibration was within 0.1 AMU and the percent relative standard deviation (%RSD) was less than or equal to 5%.

III. Instrument Calibration

Initial and continuing calibrations were performed as required by the methods.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

IV. ICP Interference Check Sample Analysis

The frequency of interference check sample (ICS) analysis was met. All criteria were within QC limits.

V. Laboratory Blanks

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

Blank ID	Analyte	Maximum Concentration	Associated Samples
PB (prep blank)	Mercury	0.0224 mg/Kg	All samples in SDG 20F0352

Data qualification by the laboratory blanks was based on the maximum contaminant concentration in the laboratory blanks in the analysis of each analyte. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VIII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

IX. Serial Dilution

Serial dilution was not performed for this SDG.

X. Laboratory Control Samples

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

XI. Field Duplicates

No field duplicates were identified in this SDG.

XII. Internal Standards (ICP-MS)

Raw data were not reviewed for Stage 2B validation.

XIII. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

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

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4
Metals - Data Qualification Summary - SDG 20F0352

No Sample Data Qualified in this SDG

Duwamish AOC4
Metals - Laboratory Blank Data Qualification Summary - SDG 20F0352

No Sample Data Qualified in this SDG

Duwamish AOC4
Metals - Field Blank Data Qualification Summary - SDG 20F0352

No Sample Data Qualified in this SDG

LDC #: 48785D4a

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 8/19/20

SDG #: 20F0352

Page: 1 of 1

Laboratory: Analytical Resources, Inc.

Reviewer: C

2nd Reviewer: A

METHOD: Metals (EPA SW 846 Method 6020A/7471B)

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 rA	
II.	ICP/MS Tune	A	
III.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	SW	
VI.	Field Blanks	N	
VII.	Matrix Spike/Matrix Spike Duplicates	A	
VIII.	Duplicate sample analysis	A	
IX.	Serial Dilution	N	
X.	Laboratory control samples	A	LCS
XI.	Field Duplicates	N	
XII.	Internal Standard (ICP-MS)	N	not reviewed
XIII.	Sample Result Verification	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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS251	20F0352-01	Sediment	06/18/20
2	LDW20-SS264	20F0352-02	Sediment	06/18/20
3	LDW20-SS409	20F0352-03	Sediment	06/18/20
4	LDW20-SS310	20F0352-04	Sediment	06/18/20
5	LDW20-SS318	20F0352-05	Sediment	06/18/20
6	LDW20-SS322	20F0352-06	Sediment	06/18/20
7	LDW20-SS359	20F0352-07	Sediment	06/18/20
8	LDW20-SS377	20F0352-08	Sediment	06/18/20
9	LDW20-SS379	20F0352-09	Sediment	06/18/20
10	LDW20-SS388	20F0352-10	Sediment	06/18/20
11	LDW20-SS251MS	20F0352-01MS	Sediment	06/18/20
12	LDW20-SS251MSD	20F0352-01MSD	Sediment	06/18/20
13	LDW20-SS251DUP	20F0352-01DUP	Sediment	06/18/20
14				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1 to 10	As, Cd, Cr, Cu, Pb, Ag, Zn, Hg
QC: 11-13	As, Cd, Cr, Cu, Pb, Ag, Zn, Hg

Analysis Method

ICP	
ICP-MS	As, Cd, Cr, Cu, Pb, Ag, Zn
CVAA	Hg

VALIDATION FINDINGS WORKSHEET
Laboratory Blank Contamination (PB/ICB/CCB)

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)
Soil preparation factor applied (if applicable):

Sample Concentration, unless otherwise noted: mg/Kg Associated Samples: All

				Sample Identification									
Analyte	**PB (mg/Kg)**	**Maximum ICB/CCB (ug/L)**	**Action Level**	No Qual									
Hg	0.0224												

Comments: The listed analyte concentrtaion is the highest ICB or CCB detected in the analysis. The action level, when applicable, is established at 5X the highest ICB, CCB, or PB concentration.

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 20, 2020

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0352

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS251	20F0352-01	Sediment	06/18/20
LDW20-SS264	20F0352-02	Sediment	06/18/20
LDW20-SS409	20F0352-03	Sediment	06/18/20
LDW20-SS310	20F0352-04	Sediment	06/18/20
LDW20-SS318	20F0352-05	Sediment	06/18/20
LDW20-SS322	20F0352-06	Sediment	06/18/20
LDW20-SS359	20F0352-07	Sediment	06/18/20
LDW20-SS377	20F0352-08	Sediment	06/18/20
LDW20-SS379	20F0352-09	Sediment	06/18/20
LDW20-SS388	20F0352-10	Sediment	06/18/20
LDW20-SS379MS	20F0352-09MS	Sediment	06/18/20
LDW20-SS379DUP	20F0352-09DUP	Sediment	06/18/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). 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 methods:

Total Organic Carbon by Environmental Protection Agency (EPA) SW 846 Method 9060A
Total Solids by Standard Method 2540G

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration of each method were met.

III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met for each method when applicable.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits.

VII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

VIII. Laboratory Control Samples/Standard Reference Materials

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

Standard reference materials (SRM) were analyzed as required by the methods. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

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

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4
Wet Chemistry - Data Qualification Summary - SDG 20F0352

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 20F0352

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 20F0352

No Sample Data Qualified in this SDG

LDC #: 48785D6 **VALIDATION COMPLETENESS WORKSHEET** Date: 8/19/20
SDG #: 20F0352 Stage 2B Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer: G
2nd Reviewer: M

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM 2540G)

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	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	A	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	A	
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	A	LCS, SRM
IX.	Field duplicates	N	
X.	Sample result verification	N	
XI	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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS251	20F0352-01	Sediment	06/18/20
2	LDW20-SS264	20F0352-02	Sediment	06/18/20
3	LDW20-SS409	20F0352-03	Sediment	06/18/20
4	LDW20-SS310	20F0352-04	Sediment	06/18/20
5	LDW20-SS318	20F0352-05	Sediment	06/18/20
6	LDW20-SS322	20F0352-06	Sediment	06/18/20
7	LDW20-SS359	20F0352-07	Sediment	06/18/20
8	LDW20-SS377	20F0352-08	Sediment	06/18/20
9	LDW20-SS379	20F0352-09	Sediment	06/18/20
10	LDW20-SS388	20F0352-10	Sediment	06/18/20
11	LDW20-SS379MS	20F0352-09MS	Sediment	06/18/20
12	LDW20-SS379DUP	20F0352-09DUP	Sediment	06/18/20
13				
14				
15				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1 to 10	Total solids, TOC
QC: 11	TOC
12	TS, TOC

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 19, 2020

Parameters: Polychlorinated Dioxins/Dibenzofurans

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0352

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS379	20F0352-09	Sediment	06/18/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for High Resolution Superfund Methods Data Review (April 2016). 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 Dioxins/Dibenzofurans by Environmental Protection Agency (EPA) Method 1613B

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 19.2°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required frequency.

Retention time windows were established for all homologues. The chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomer was less than or equal to 25%.

The static resolving power was at least 10,000 (10% valley definition).

III. Initial Calibration and Initial Calibration Verification

A five point initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for unlabeled compounds and less than or equal to 35.0% for labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were within the QC limits for unlabeled compounds and labeled compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

All of the continuing calibration results were within the QC limits for unlabeled compounds and labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

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	Compound	Concentration	Associated Samples
BIF0803-BLK1	07/06/20	1,2,3,4,6,7,8-HpCDF 1,2,3,4,7,8,9-HpCDF 1,2,3,4,6,7,8-HpCDD OCDF OCDD	0.140 ng/Kg 0.0330 ng/Kg 0.535 ng/Kg 1.37 ng/Kg 6.33 ng/Kg	All samples in SDG 20F0352

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks.

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/Standard Reference Materials

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

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Labeled Compounds

All percent recoveries (%R) for labeled compounds used to quantitate target compounds were within QC limits.

XI. Compound Quantitation

All compound quantitations were within validation criteria with the following exceptions:

Sample	Compound	Flag	A or P
All samples in SDG 20F0352	All compounds reported as estimated maximum possible concentration (EMPC) and greater than the reporting limit.	J (all detects)	A
All samples in SDG 20F0352	All compounds reported as estimated maximum possible concentration (EMPC) and less than the reporting limit.	U (all non-detects)	A

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B 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 compounds reported as EMPC, data were qualified as estimated or not detected in one sample.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Data Qualification Summary - SDG 20F0352

Sample	Compound	Flag	A or P	Reason
LDW20-SS379	All compounds reported as estimated maximum possible concentration (EMPC) and greater than the reporting limit.	J (all detects)	A	Compound quantitation (EMPC)
LDW20-SS379	All compounds reported as estimated maximum possible concentration (EMPC) and less than the reporting limit.	U (all non-detects)	A	Compound quantitation (EMPC)

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG 20F0352

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Field Blank Data Qualification Summary - SDG 20F0352

No Sample Data Qualified in this SDG

LDC #: 48785D21 **VALIDATION COMPLETENESS WORKSHEET** Date: 08/19/20
SDG #: 20F0352 Stage 2B Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer: JVG
2nd Reviewer:

METHOD: HRGC/HRMS Polychlorinated Dioxins/Dibenzofurans (EPA Method 1613B)

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	SW/A	cooler temp = 19.2°C (insufficient time to cool)
II.	HRGC/HRMS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	ICAL ≤ 20/35%. ICV ≤ QC limits
IV.	Continuing calibration	A	CCV ≤ QC limits
V.	Laboratory Blanks	SW	
VI.	Field blanks	N	
VII.	Matrix spike/Matrix spike duplicates	N	
VIII.	Laboratory control samples	A	LCS, SRM
IX.	Field duplicates	N	
X.	Labeled Compounds	A	
XI.	Compound quantitation RL/LOQ/LODs	N	EMPC = J dets (>RL); U (<RL)
XII.	Target compound identification	N	
XIII.	System performance	N	
XIV.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS379	20F0352-09	Sediment	06/18/20
2				
3				
4				
5				
6				
7				
8				
9				
10				

Notes:

	BI F0803-BLK1						

VALIDATION FINDINGS WORKSHEET

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

A. 2,3,7,8-TCDD	F. 1,2,3,4,6,7,8-HpCDD	K. 1,2,3,4,7,8-HxCDF	P. 1,2,3,4,7,8,9-HpCDF	U. Total HpCDD
B. 1,2,3,7,8-PeCDD	G. OCDD	L. 1,2,3,6,7,8-HxCDF	Q. OCDF	V. Total TCDF
C. 1,2,3,4,7,8-HxCDD	H. 2,3,7,8-TCDF	M. 2,3,4,6,7,8-HxCDF	R. Total TCDD	W. Total PeCDF
D. 1,2,3,6,7,8-HxCDD	I. 1,2,3,7,8-PeCDF	N. 1,2,3,7,8,9-HxCDF	S. Total PeCDD	X. Total HxCDF
E. 1,2,3,7,8,9-HxCDD	J. 2,3,4,7,8-PeCDF	O. 1,2,3,4,6,7,8-HpCDF	T. Total HxCDD	Y. Total HpCDF

Notes:_____

_____

_____

LDC #: 48785 D21

VALIDATION FINDINGS WORKSHEET
Blanks

Reviewer: JVG
2nd Reviewer: a

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were all samples associated with a method blank?
Y N N/A Was a method blank performed for each matrix and whenever a sample extraction was performed?
Y N N/A Was the method blank contaminated?

Blank extraction date: 07/06/20 **Blank analysis date:** 07/09/20 **Associated samples:** All

Conc. units: ng/kg

Compound	Blank ID	Sample Identification								
	BIF0803-BLK1 (5X)									
O	0.140 *	0.70								
P	0.0330 *	0.165								
F	0.535 *	2.675								
Q	1.37	6.850								
G	6.33	31.65								

Blank extraction date: _____ **Blank analysis date:** _____

Conc. units: _____ Associated Samples: * EMPC

Compound	Blank ID	Sample Identification								

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
All contaminants within five times the method blank concentration were qualified as not detected, "U".

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 19, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0359

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS224	20F0359-01	Sediment	06/19/20
LDW20-SS232	20F0359-02	Sediment	06/19/20
LDW20-SS240	20F0359-03	Sediment	06/19/20
LDW20-SS244	20F0359-04	Sediment	06/19/20
LDW20-SS243	20F0359-05	Sediment	06/19/20
LDW20-SS269	20F0359-06	Sediment	06/19/20
LDW20-SS261	20F0359-07	Sediment	06/19/20
LDW20-SS255	20F0359-08	Sediment	06/19/20
LDW20-SS250	20F0359-09	Sediment	06/19/20
LDW20-SS245	20F0359-10	Sediment	06/19/20
LDW20-SS222	20F0359-11	Sediment	06/19/20
LDW20-SS223	20F0359-12	Sediment	06/19/20
LDW20-SS226	20F0359-13	Sediment	06/19/20
LDW20-SS230	20F0359-14	Sediment	06/19/20
LDW20-SS235	20F0359-15	Sediment	06/19/20
LDW20-SS238	20F0359-16	Sediment	06/19/20
LDW20-SS240MS	20F0359-03MS	Sediment	06/19/20
LDW20-SS240MSD	20F0359-03MSD	Sediment	06/19/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). 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:

Semivolatile Organic Compounds (SVOCs) by Environmental Protection Agency (EPA) SW 846 Method 8270E

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 8.8°C and 20.4°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For compounds where average relative response factors (RRFs) were utilized, the percent relative standard deviations (%RSD) were less than or equal to 20.0%.

In the case where the laboratory used a calibration curve to evaluate the compounds, all coefficients of determination (r^2) were greater than or equal to 0.990.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
07/13/20	Fluoranthene Pyrene	22.3 21.5	LDW20-SS269 LDW20-SS261 LDW20-SS255 LDW20-SS250 LDW20-SS245 LDW20-SS222 LDW20-SS223 LDW20-SS226 LDW20-SS230 LDW20-SS235 LDW20-SS238	J (all detects) J (all detects)	A

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples/Standard Reference Materials

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

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits with the following exceptions:

SRM ID	Compound	%R (Limits)	Associated Samples	Flag	A or P
BIG0068-SRM1	Naphthalene 2-Methylnaphthalene Acenaphthylene Acenaphthene	20.5 (41-159) 33.6 (51-149) 43.7 (57-142) 48.0 (59-141)	All samples in SDG 20F0359	J (all detects) UJ (all non-detects)	A

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

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

Due to continuing calibration %D and SRM %R, data were qualified as estimated in sixteen samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4
Semivolatiles - Data Qualification Summary - SDG 20F0359

Sample	Compound	Flag	A or P	Reason
LDW20-SS269 LDW20-SS261 LDW20-SS255 LDW20-SS250 LDW20-SS245 LDW20-SS222 LDW20-SS223 LDW20-SS226 LDW20-SS230 LDW20-SS235 LDW20-SS238	Fluoranthene Pyrene	J (all detects) J (all detects)	A	Continuing calibration (%D)
LDW20-SS224 LDW20-SS232 LDW20-SS240 LDW20-SS244 LDW20-SS243 LDW20-SS269 LDW20-SS261 LDW20-SS255 LDW20-SS250 LDW20-SS245 LDW20-SS222 LDW20-SS223 LDW20-SS226 LDW20-SS230 LDW20-SS235 LDW20-SS238	Naphthalene 2-Methylnaphthalene Acenaphthylene Acenaphthene	J (all detects) UJ (all non-detects)	A	Standard reference materials (%R)

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0359

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0359

No Sample Data Qualified in this SDG

LDC #: 48785E2a
SDG #: 20F0359
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 08/17/20
Page: 1 of 2
Reviewer: JG
2nd Reviewer:

METHOD: GC/MS Semivolatiles (EPA SW 846 Method 8270E)

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 (Insufficient time to cool)
I.	Sample receipt/Technical holding times	SW / A	Cooler temps = 8.8°C, 13.2°C, 20.4°C
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A / A	ICAL ≤ 20? r ICV ≤ 30?
IV.	Continuing calibration	SW	CCV ≤ 20?
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	SW	LCS, SRM
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS224	20F0359-01	Sediment	06/19/20
2	LDW20-SS232	20F0359-02	Sediment	06/19/20
3	LDW20-SS240	20F0359-03	Sediment	06/19/20
4	LDW20-SS244	20F0359-04	Sediment	06/19/20
5	LDW20-SS243	20F0359-05	Sediment	06/19/20
6	LDW20-SS269	20F0359-06	Sediment	06/19/20
7	LDW20-SS261	20F0359-07	Sediment	06/19/20
8	LDW20-SS255	20F0359-08	Sediment	06/19/20
9	LDW20-SS250	20F0359-09	Sediment	06/19/20
10	LDW20-SS245	20F0359-10	Sediment	06/19/20
11	LDW20-SS222	20F0359-11	Sediment	06/19/20
12	LDW20-SS223	20F0359-12	Sediment	06/19/20
13	LDW20-SS226	20F0359-13	Sediment	06/19/20
14	LDW20-SS230	20F0359-14	Sediment	06/19/20

LDC #: 48785E2a

SDG #: 20F0359

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 08/17/20

Page: 2 of 2

Reviewer: JM

2nd Reviewer:

METHOD: GC/MS Semivolatiles (EPA SW 846 Method 8270E)

	Client ID	Lab ID	Matrix	Date
15	LDW20-SS235	20F0359-15	Sediment	06/19/20
16	LDW20-SS238	20F0359-16	Sediment	06/19/20
17	LDW20-SS240MS	20F0359-03MS	Sediment	06/19/20
18	LDW20-SS240MSD	20F0359-03MSD	Sediment	06/19/20
19				
20				
21				

Notes:

-	BIG0068-BLK1						

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

A. Phenol	AA. 2-Chloronaphthalene	AAA. Butylbenzylphthalate	AAAA. Dibenzothiophene	A1. N-Nitrosodiethylamine
B. Bis (2-chloroethyl) ether	BB. 2-Nitroaniline	BBB. 3,3'-Dichlorobenzidine	BBBB. Benzo(a)fluoranthene	B1. N-Nitrosodi-n-butylamine
C. 2-Chlorophenol	CC. Dimethylphthalate	CCC. Benzo(a)anthracene	CCCC. Benzo(b)fluorene	C1. N-Nitrosomethylethylamine
D. 1,3-Dichlorobenzene	DD. Acenaphthylene	DDD. Chrysene	DDDD. cis/trans-Decalin	D1. N-Nitrosomorpholine
E. 1,4-Dichlorobenzene	EE. 2,6-Dinitrotoluene	EEE. Bis(2-ethylhexyl)phthalate	EEEE. Biphenyl	E1. N-Nitrosopyrrolidine
F. 1,2-Dichlorobenzene	FF. 3-Nitroaniline	FFF. Di-n-octylphthalate	FFFF. Retene	F1. Phenacetin
G. 2-Methylphenol	GG. Acenaphthene	GGG. Benzo(b)fluoranthene	GGGG. C30-Hopane	G1. 2-Acetylaminofluorene
H. 2,2'-Oxybis(1-chloropropane)	HH. 2,4-Dinitrophenol	HHH. Benzo(k)fluoranthene	HHHH. 1-Methylphenanthrene	H1. Pronamide
I. 4-Methylphenol	II. 4-Nitrophenol	III. Benzo(a)pyrene	IIII. 1,4-Dioxane	I1. Methyl methanesulfonate
J. N-Nitroso-di-n-propylamine	JJ. Dibenzofuran	JJJ. Indeno(1,2,3-cd)pyrene	JJJJ. Acetophenone	J1. Ethyl methanesulfonate
K. Hexachloroethane	KK. 2,4-Dinitrotoluene	KKK. Dibenz(a,h)anthracene	KKKK. Atrazine	K1. o,o',o''-Triethylphosphorothioate
L. Nitrobenzene	LL. Diethylphthalate	LLL. Benzo(g,h,i)perylene	LLLL. Benzaldehyde	L1. n-Phenylene diamine
M. Isophorone	MM. 4-Chlorophenyl-phenyl ether	MMM. Bis(2-Chloroisopropyl)ether	MMMM. Caprolactam	M1. 1,4-Naphthoquinone
N. 2-Nitrophenol	NN. Fluorene	NNN. Aniline	NNNN. 2,6-Dichlorophenol	N1. N-Nitro-o-toluidine
O. 2,4-Dimethylphenol	OO. 4-Nitroaniline	OOO. N-Nitrosodimethylamine	OOOO. 1,2-Diphenylhydrazine	O1. 1,3,5-Trinitrobenzene
P. Bis(2-chloroethoxy)methane	PP. 4,6-Dinitro-2-methylphenol	PPP. Benzoic Acid	PPPP. 3-Methylphenol	P1. Pentachlorobenzene
Q. 2,4-Dichlorophenol	QQ. N-Nitrosodiphenylamine	QQQ. Benzyl alcohol	QQQQ. 3&4-Methylphenol	Q1. 4-Aminobiphenyl
R. 1,2,4-Trichlorobenzene	RR. 4-Bromophenyl-phenylether	RRR. Pyridine	RRRR. 4-Dimethyldibenzothiophene (4MDT)	R1. 2-Naphthylamine
S. Naphthalene	SS. Hexachlorobenzene	SSS. Benzidine	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	S1. Triphenylene
T. 4-Chloroaniline	TT. Pentachlorophenol	TTT. 1-Methylnaphthalene	TTTT. 1-Methyldibenzothiophene (1MDT)	T1. Octachlorostyrene
U. Hexachlorobutadiene	UU. Phenanthrene	UUU.Benzo(b)thiophene	UUUU.. 2,3,4,6-Tetrachlorophenol	U1. Famphur
V. 4-Chloro-3-methylphenol	VV. Anthracene	VVV.Benzonaphthothiophene	VVVV. 1,2,4,5-Tetrachlorobenzene	V1. 1,4-phenylenediamine
W. 2-Methylnaphthalene	WW. Carbazole	WWW.Benzo(e)pyrene	WWWW.. 2-Picoline	W1. Methapyrilene
X. Hexachlorocyclopentadiene	XX. Di-n-butylphthalate	XXX. 2,6-Dimethylnaphthalene	XXXX. 3-Methylcholanthrene	X1. Pentachloroethane
Y. 2,4,6-Trichlorophenol	YY. Fluoranthene	YYY. 2,3,5-Trimethylnaphthalene	YYYY. a,a-Dimethylphenethylamine	Y1. 3,3'-Dimethylbenzidine
Z. 2,4,5-Trichlorophenol	ZZ. Pyrene	ZZZ. Perylene	ZZZZ. Hexachloropropene	Z1. o-Toluidine

LDC #: 48785 E2a

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD: GC/MS BNA (EPA SW 846 Method 8270C)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

(Y) N N/A Was a continuing calibration standard analyzed at least once every 12 hours of sample analysis for each instrument?

(Y) N N/A Were percent differences (%D) and relative response factors (RRF) within method criteria for all CCC's and SPCC's ?

Y (N) N/A Were all %D and RRFs within the validation criteria of ≤20 %D and ≥0.05 RRF ?

#	Date	Standard ID	Compound	Finding %D (Limit: <20.0%)	Finding RRF (Limit: >0.05)	Associated Samples	Qualifications
	07/13/20	NT1020071302	YY	22.3		6-16 (Det)	J/UJ/A
			ZZ	21.5			

LDC #: 48785E2a

VALIDATION FINDINGS WORKSHEET

Laboratory Control Samples (LCS) / SRM

Page: 1 of 1

Reviewer: JVG

2nd Reviewer:

METHOD: GC/MS BNA (EPA SW 846 Method 8270~~C~~E)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

[✓ Y] N N/A Was a LCS required?

[✓ Y] N N/A Were the LCS/LCSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#	LCS/LCSD ID	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	BIG0068-SRM1	S	20.5 (41-159)	( )	( )	All (ND + Det)	J/UJ/A
		W	33.6 (51-149)	( )	( )		
		DD	43.7 (57-142)	( )	( )		
		GG	48.0 (59-141)	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
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			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 20, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0359

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS224	20F0359-01	Sediment	06/19/20
LDW20-SS232	20F0359-02	Sediment	06/19/20
LDW20-SS240	20F0359-03	Sediment	06/19/20
LDW20-SS244	20F0359-04	Sediment	06/19/20
LDW20-SS243	20F0359-05	Sediment	06/19/20
LDW20-SS269	20F0359-06	Sediment	06/19/20
LDW20-SS261	20F0359-07	Sediment	06/19/20
LDW20-SS255	20F0359-08	Sediment	06/19/20
LDW20-SS250	20F0359-09	Sediment	06/19/20
LDW20-SS245	20F0359-10	Sediment	06/19/20
LDW20-SS222	20F0359-11	Sediment	06/19/20
LDW20-SS223	20F0359-12	Sediment	06/19/20
LDW20-SS226	20F0359-13	Sediment	06/19/20
LDW20-SS230	20F0359-14	Sediment	06/19/20
LDW20-SS235	20F0359-15	Sediment	06/19/20
LDW20-SS238	20F0359-16	Sediment	06/19/20
LDW20-SS240MS	20F0359-03MS	Sediment	06/19/20
LDW20-SS240MSD	20F0359-03MSD	Sediment	06/19/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). 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:

Semivolatile Organic Compounds (SVOCs) by Environmental Protection Agency (EPA) SW 846 Method 8270E in Selected Ion Monitoring (SIM) mode

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 8.8°C and 20.4°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For compounds where average relative response factors (RRFs) were utilized, percent relative standard deviations (%RSD) were less than or equal to 20.0%.

In the case where the laboratory used a calibration curve to evaluate the compounds, all coefficients of determination (r^2) were greater than or equal to 0.990.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all compounds with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
06/26/20 (SIF0395-SCV1)	N-Nitrosodiphenylamine	65.7	LDW20-SS224 LDW20-SS232 LDW20-SS240 LDW20-SS244 LDW20-SS243	J (all detects) UJ (all non-detects)	A
06/26/20 (SIF0393-SCV1)	N-Nitrosodiphenylamine	41.9	LDW20-SS269 LDW20-SS261 LDW20-SS255 LDW20-SS250 LDW20-SS245 LDW20-SS222 LDW20-SS223 LDW20-SS226 LDW20-SS230 LDW20-SS235 LDW20-SS238	J (all detects) UJ (all non-detects)	A

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
07/11/20	Benzoic acid	20.5	LDW20-SS224 LDW20-SS232	J (all detects) UJ (all non-detects)	A
	Pentachlorophenol	34.3	LDW20-SS240 LDW20-SS244 LDW20-SS243	J (all detects) UJ (all non-detects)	
07/13/20	Benzyl alcohol	28.5	LDW20-SS269 LDW20-SS261	J (all detects) UJ (all non-detects)	A
	Pentachlorophenol	37.1	LDW20-SS255 LDW20-SS250 LDW20-SS245 LDW20-SS222 LDW20-SS223 LDW20-SS226 LDW20-SS230 LDW20-SS235 LDW20-SS238	J (all detects) UJ (all non-detects)	

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples/Standard Reference Materials

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

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits with the following exceptions:

SRM ID	Compound	%R (Limits)	Associated Samples	Flag	A or P
BIG0068-SRM2	1,2-Dichlorobenzene	13.3 (17-184)	All samples in SDG 20F0359	UJ (all non-detects)	P

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

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

Due to ICV %D, continuing calibration %D, and SRM %R, data were qualified as estimated in sixteen samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4
Semivolatiles – Data Qualification Summary - SDG 20F0359

Sample	Compound	Flag	A or P	Reason
LDW20-SS224 LDW20-SS232 LDW20-SS240 LDW20-SS244 LDW20-SS243 LDW20-SS269 LDW20-SS261 LDW20-SS255 LDW20-SS250 LDW20-SS245 LDW20-SS222 LDW20-SS223 LDW20-SS226 LDW20-SS230 LDW20-SS235 LDW20-SS238	N-Nitrosodiphenylamine	J (all detects) UJ (all non-detects)	A	Initial calibration verification (%D)
LDW20-SS224 LDW20-SS232 LDW20-SS240 LDW20-SS244 LDW20-SS243	Benzoic acid Pentachlorophenol	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	A	Continuing calibration (%D)
LDW20-SS269 LDW20-SS261 LDW20-SS255 LDW20-SS250 LDW20-SS245 LDW20-SS222 LDW20-SS223 LDW20-SS226 LDW20-SS230 LDW20-SS235 LDW20-SS238	Benzyl alcohol Pentachlorophenol	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	A	Continuing calibration (%D)
LDW20-SS224 LDW20-SS232 LDW20-SS240 LDW20-SS244 LDW20-SS243 LDW20-SS269 LDW20-SS261 LDW20-SS255 LDW20-SS250 LDW20-SS245 LDW20-SS222 LDW20-SS223 LDW20-SS226 LDW20-SS230 LDW20-SS235 LDW20-SS238	1,2-Dichlorobenzene	UJ (all non-detects)	P	Standard reference materials (%R)

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0359

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0359

No Sample Data Qualified in this SDG

LDC #: 48785E2b
SDG #: 20F0359
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 08/17/20
Page: 1 of 2
Reviewer: SR
2nd Reviewer:

METHOD: GC/MS ~~Polynuclear Aromatic Hydrocarbons~~ SVOA (EPA SW 846 Method 8270E-SIM)

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	SW/A	Cooler temps = 8.8°C, 13.2°C, 20.4°C (Insufficient time to cool)
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/SW	ICAL ≤ 20% r ICV ≤ 30%
IV.	Continuing calibration	SW	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	SW	LCS, SRM
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS224	20F0359-01	Sediment	06/19/20
2	LDW20-SS232	20F0359-02	Sediment	06/19/20
3	LDW20-SS240	20F0359-03	Sediment	06/19/20
4	LDW20-SS244	20F0359-04	Sediment	06/19/20
5	LDW20-SS243	20F0359-05	Sediment	06/19/20
6	LDW20-SS269	20F0359-06	Sediment	06/19/20
7	LDW20-SS261	20F0359-07	Sediment	06/19/20
8	LDW20-SS255	20F0359-08	Sediment	06/19/20
9	LDW20-SS250	20F0359-09	Sediment	06/19/20
10	LDW20-SS245	20F0359-10	Sediment	06/19/20
11	LDW20-SS222	20F0359-11	Sediment	06/19/20
12	LDW20-SS223	20F0359-12	Sediment	06/19/20
13	LDW20-SS226	20F0359-13	Sediment	06/19/20
14	LDW20-SS230	20F0359-14	Sediment	06/19/20

LDC #: 48785E2b

SDG #: 20F0359

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 08/17/20

Reviewer: [illegible]

2nd Reviewer: [illegible]

METHOD: GC/MS Polynuclear Aromatic Hydrocarbons (EPA SW 846 Method 8270E-SIM)

	Client ID	Lab ID	Matrix	Date
15	LDW20-SS235	20F0359-15	Sediment	06/19/20
16	LDW20-SS238	20F0359-16	Sediment	06/19/20
17	LDW20-SS240MS	20F0359-03MS	Sediment	06/19/20
18	LDW20-SS240MSD	20F0359-03MSD	Sediment	06/19/20
19				
20				
21				

Notes:

	BIG0068-BLK2						

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

A. Phenol	AA. 2-Chloronaphthalene	AAA. Butylbenzylphthalate	AAAA. Dibenzothiophene	A1. N-Nitrosodiethylamine
B. Bis (2-chloroethyl) ether	BB. 2-Nitroaniline	BBB. 3,3'-Dichlorobenzidine	BBBB. Benzo(a)fluoranthene	B1. N-Nitrosodi-n-butylamine
C. 2-Chlorophenol	CC. Dimethylphthalate	CCC. Benzo(a)anthracene	CCCC. Benzo(b)fluorene	C1. N-Nitrosomethylethylamine
D. 1,3-Dichlorobenzene	DD. Acenaphthylene	DDD. Chrysene	DDDD. cis/trans-Decalin	D1. N-Nitrosomorpholine
E. 1,4-Dichlorobenzene	EE. 2,6-Dinitrotoluene	EEE. Bis(2-ethylhexyl)phthalate	EEEE. Biphenyl	E1. N-Nitrosopyrrolidine
F. 1,2-Dichlorobenzene	FF. 3-Nitroaniline	FFF. Di-n-octylphthalate	FFFF. Retene	F1. Phenacetin
G. 2-Methylphenol	GG. Acenaphthene	GGG. Benzo(b)fluoranthene	GGGG. C30-Hopane	G1. 2-Acetylaminofluorene
H. 2,2'-Oxybis(1-chloropropane)	HH. 2,4-Dinitrophenol	HHH. Benzo(k)fluoranthene	HHHH. 1-Methylphenanthrene	H1. Pronamide
I. 4-Methylphenol	II. 4-Nitrophenol	III. Benzo(a)pyrene	IIII. 1,4-Dioxane	I1. Methyl methanesulfonate
J. N-Nitroso-di-n-propylamine	JJ. Dibenzofuran	JJJ. Indeno(1,2,3-cd)pyrene	JJJJ. Acetophenone	J1. Ethyl methanesulfonate
K. Hexachloroethane	KK. 2,4-Dinitrotoluene	KKK. Dibenz(a,h)anthracene	KKKK. Atrazine	K1. o,o',o''-Triethylphosphorothioate
L. Nitrobenzene	LL. Diethylphthalate	LLL. Benzo(g,h,i)perylene	LLLL. Benzaldehyde	L1. n-Phenylene diamine
M. Isophorone	MM. 4-Chlorophenyl-phenyl ether	MMM. Bis(2-Chloroisopropyl)ether	MMMM. Caprolactam	M1. 1,4-Naphthoquinone
N. 2-Nitrophenol	NN. Fluorene	NNN. Aniline	NNNN. 2,6-Dichlorophenol	N1. N-Nitro-o-toluidine
O. 2,4-Dimethylphenol	OO. 4-Nitroaniline	OOO. N-Nitrosodimethylamine	OOOO. 1,2-Diphenylhydrazine	O1. 1,3,5-Trinitrobenzene
P. Bis(2-chloroethoxy)methane	PP. 4,6-Dinitro-2-methylphenol	PPP. Benzoic Acid	PPPP. 3-Methylphenol	P1. Pentachlorobenzene
Q. 2,4-Dichlorophenol	QQ. N-Nitrosodiphenylamine	QQQ. Benzyl alcohol	QQQQ. 3&4-Methylphenol	Q1. 4-Aminobiphenyl
R. 1,2,4-Trichlorobenzene	RR. 4-Bromophenyl-phenylether	RRR. Pyridine	RRRR. 4-Dimethyldibenzothiophene (4MDT)	R1. 2-Naphthylamine
S. Naphthalene	SS. Hexachlorobenzene	SSS. Benzidine	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	S1. Triphenylene
T. 4-Chloroaniline	TT. Pentachlorophenol	TTT. 1-Methylnaphthalene	TTTT. 1-Methyldibenzothiophene (1MDT)	T1. Octachlorostyrene
U. Hexachlorobutadiene	UU. Phenanthrene	UUU.Benzo(b)thiophene	UUUU.. 2,3,4,6-Tetrachlorophenol	U1. Famphur
V. 4-Chloro-3-methylphenol	VV. Anthracene	VVV.Benzonaphthothiophene	VVVV. 1,2,4,5-Tetrachlorobenzene	V1. 1,4-phenylenediamine
W. 2-Methylnaphthalene	WW. Carbazole	WWW.Benzo(e)pyrene	WWWW.. 2-Picoline	W1. Methapyrilene
X. Hexachlorocyclopentadiene	XX. Di-n-butylphthalate	XXX. 2,6-Dimethylnaphthalene	XXXX. 3-Methylcholanthrene	X1. Pentachloroethane
Y. 2,4,6-Trichlorophenol	YY. Fluoranthene	YYY. 2,3,5-Trimethylnaphthalene	YYYY. a,a-Dimethylphenethylamine	Y1. 3,3'-Dimethylbenzidine
Z. 2,4,5-Trichlorophenol	ZZ. Pyrene	ZZZ. Perylene	ZZZZ. Hexachloropropene	Z1. o-Toluidine

LDC #: 48785 E26

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

Reviewer: JVG
2nd Reviewer:

METHOD: GC/MS SVOA (EPA SW 846 Method 8270C)
Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Was an initial calibration verification standard analyzed after each ICAL for each instrument?
Y N N/A Were all %D within the validation criteria of ~~≤20~~/30% %D ?

#	Date	Standard ID	Compound	Finding %D (Limit: ~~≤20.0%~~ 30%)	Associated Samples	Qualifications
(14)	06/24/20	SIF0395-SCV1	QQ	65.7	1-5, 17, 18, MB (ND + Det)	J/UJ/A
(10)	06/26/20	SIF0393-SCV1	QQ	41.9	6-16 (ND + Det)	

LDC #: 48785 E26

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Reviewer: JVG
2nd Reviewer: [signature]

METHOD: GC/MS BNA (EPA SW 846 Method 8270C)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

X N N/A Was a continuing calibration standard analyzed at least once every 12 hours of sample analysis for each instrument?

Y N N/A Were percent differences (%D) and relative response factors (RRF) within method criteria for all CCC's and SPCC's ?

Y (N) N/A Were all %D and RRFs within the validation criteria of ≤20 %D and ≥0.05 RRF ?

#	Date	Standard ID	Compound	Finding %D (Limit: <20.0%)	Finding RRF (Limit: >0.05)	Associated Samples	Qualifications
	07/11/20	NT19200711035	PPP	20.5		1-5, 17, 18, MB (ND+Det)	J/UJ/A
			TT	34.3			
	07/13/20	NT10200713035	QQQ	28.5		6-16 (ND+Det)	J/UJ/A
			TT	37.1			

CONCAL.wpd

LDC #: 48785E26

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS) /SRM

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD: GC/MS BNA (EPA SW 846 Method 8270C)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

[✓ Y] N N/A Was a LCS required?
[✓ Y] N N/A Were the LCS/LCSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#	LCS/LCSD ID	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	BIG0068-SRM2	F	13.3 (17-184)	( )	( )	All (ND)	J/UJ/P
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
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			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 20, 2020

Parameters: Hexachlorobenzene

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0359

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS224	20F0359-01	Sediment	06/19/20
LDW20-SS232	20F0359-02	Sediment	06/19/20
LDW20-SS240	20F0359-03	Sediment	06/19/20
LDW20-SS244	20F0359-04	Sediment	06/19/20
LDW20-SS243	20F0359-05	Sediment	06/19/20
LDW20-SS269	20F0359-06	Sediment	06/19/20
LDW20-SS261	20F0359-07	Sediment	06/19/20
LDW20-SS255	20F0359-08	Sediment	06/19/20
LDW20-SS250	20F0359-09	Sediment	06/19/20
LDW20-SS245	20F0359-10	Sediment	06/19/20
LDW20-SS222	20F0359-11	Sediment	06/19/20
LDW20-SS223	20F0359-12	Sediment	06/19/20
LDW20-SS226	20F0359-13	Sediment	06/19/20
LDW20-SS230	20F0359-14	Sediment	06/19/20
LDW20-SS235	20F0359-15	Sediment	06/19/20
LDW20-SS238	20F0359-16	Sediment	06/19/20
LDW20-SS240MS	20F0359-03MS	Sediment	06/19/20
LDW20-SS240MSD	20F0359-03MSD	Sediment	06/19/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). 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:

Hexachlorobenzene by Environmental Protection Agency (EPA) SW 846 Method 8081B

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 8.8°C and 20.4°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC Instrument Performance Check

Instrument performance was checked at 12 hour intervals.

The individual 4,4'-DDT and Endrin breakdowns (%BD) were less than or equal to 15.0%.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0%.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0%.

IV. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0%.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

All internal standard areas and retention times were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

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

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4
Hexachlorobenzene - Data Qualification Summary - SDG 20F0359

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Laboratory Blank Data Qualification Summary - SDG 20F0359

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Field Blank Data Qualification Summary - SDG 20F0359

No Sample Data Qualified in this SDG

LDC #: 48785E3a
SDG #: 20F0359
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 08/17/20
Page: 1 of 7
Reviewer: JH
2nd Reviewer:

METHOD: GC Hexachlorobenzene (EPA SW846 Method 8081B)

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	SW / A	cooler temps = 8.8°C, 13.2°C, 20.4°C (Insufficient time to cool)
II.	GC Instrument Performance Check	N	
III.	Initial calibration/ICV	A / A	ICAL ≤ 20% ICV ≤ 20%
IV.	Continuing calibration	A	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes / Int Stnd	A / A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	A	LCS/D
X.	Field duplicates	N	
XI.	Compound quantitation/RL/LOQ/LODs	N	
XII.	Target compound 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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS224	20F0359-01	Sediment	06/19/20
2	LDW20-SS232	20F0359-02	Sediment	06/19/20
3	LDW20-SS240	20F0359-03	Sediment	06/19/20
4	LDW20-SS244	20F0359-04	Sediment	06/19/20
5	LDW20-SS243	20F0359-05	Sediment	06/19/20
6	LDW20-SS269	20F0359-06	Sediment	06/19/20
7	LDW20-SS261	20F0359-07	Sediment	06/19/20
8	LDW20-SS255	20F0359-08	Sediment	06/19/20
9	LDW20-SS250	20F0359-09	Sediment	06/19/20
10	LDW20-SS245	20F0359-10	Sediment	06/19/20
11	LDW20-SS222	20F0359-11	Sediment	06/19/20
12	LDW20-SS223	20F0359-12	Sediment	06/19/20
13	LDW20-SS226	20F0359-13	Sediment	06/19/20
14	LDW20-SS230	20F0359-14	Sediment	06/19/20
15	LDW20-SS235	20F0359-15	Sediment	06/19/20

LDC #: 48785E3a **VALIDATION COMPLETENESS WORKSHEET** Date: 08/17/20
SDG #: 20F0359 Stage 2B Page: 2 of 2
Laboratory: Analytical Resources, Inc. Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: GC Hexachlorobenzene (EPA SW846 Method 8081B)

	Client ID	Lab ID	Matrix	Date
16	LDW20-SS238	20F0359-16	Sediment	06/19/20
17	LDW20-SS240MS	20F0359-03MS	Sediment	06/19/20
18	LDW20-SS240MSD	20F0359-03MSD	Sediment	06/19/20
19				
20				
21				

Notes:

—	BIG0069-BLK1						

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 19, 2020

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0359

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS224	20F0359-01	Sediment	06/19/20
LDW20-SS232	20F0359-02	Sediment	06/19/20
LDW20-SS240	20F0359-03	Sediment	06/19/20
LDW20-SS244	20F0359-04	Sediment	06/19/20
LDW20-SS243	20F0359-05	Sediment	06/19/20
LDW20-SS269	20F0359-06	Sediment	06/19/20
LDW20-SS261	20F0359-07	Sediment	06/19/20
LDW20-SS255	20F0359-08	Sediment	06/19/20
LDW20-SS250	20F0359-09	Sediment	06/19/20
LDW20-SS245	20F0359-10	Sediment	06/19/20
LDW20-SS222	20F0359-11	Sediment	06/19/20
LDW20-SS223	20F0359-12	Sediment	06/19/20
LDW20-SS226	20F0359-13	Sediment	06/19/20
LDW20-SS230	20F0359-14	Sediment	06/19/20
LDW20-SS235	20F0359-15	Sediment	06/19/20
LDW20-SS238	20F0359-16	Sediment	06/19/20
LDW20-SS240MS	20F0359-03MS	Sediment	06/19/20
LDW20-SS240MSD	20F0359-03MSD	Sediment	06/19/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). 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) by Environmental Protection Agency (EPA) SW 846 Method 8082A

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 8.8°C and 20.4°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Standard	Column	Compound	%D	Associated Samples	Flag	A or P
07/02/20	SIG0056-SCV1	1C	Aroclor-1260	21.8	All samples in SDG 20F0359	J (all detects)	A

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

All internal standard areas and retention times were within QC limits.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VIII. Laboratory Control Samples/Standard Reference Materials

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

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Compound Quantitation

The sample results for detected compounds from the two columns were within 40% relative percent difference (RPD) with the following exceptions:

Sample	Compound	RPD	Flag	A or P
LDW20-SS224	Aroclor-1248 Aroclor-1260	44.2 42.7	J (all detects) J (all detects)	A
LDW20-SS240	Aroclor-1254	48.9	J (all detects)	A
LDW20-SS244	Aroclor-1254 Aroclor-1260	41.1 59.2	J (all detects) J (all detects)	A
LDW20-SS243	Aroclor-1254 Aroclor-1260	41.2 40.5	J (all detects) J (all detects)	A
LDW20-SS269	Aroclor-1248 Aroclor-1260	42.4 40.7	J (all detects) J (all detects)	A
LDW20-SS255	Aroclor-1254	49.2	J (all detects)	A
LDW20-SS250	Aroclor-1248 Aroclor-1254	42 44.8	J (all detects) J (all detects)	A
LDW20-SS222	Aroclor-1254	43	J (all detects)	A
LDW20-SS226	Aroclor-1254	44.6	J (all detects)	A

Sample	Compound	RPD	Flag	A or P
LDW20-SS230	Aroclor-1248 Aroclor-1254	42.1 54.8	J (all detects) J (all detects)	A
LDW20-SS235	Aroclor-1254	40.8	J (all detects)	A
LDW20-SS238	Aroclor-1254	51.5	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XI. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XII. Overall Assessment of Data

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

Due to ICV %D and RPD between two columns, data were qualified as estimated in sixteen samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4
Polychlorinated Biphenyls - Data Qualification Summary - SDG 20F0359

Sample	Compound	Flag	A or P	Reason
LDW20-SS224 LDW20-SS232 LDW20-SS240 LDW20-SS244 LDW20-SS243 LDW20-SS269 LDW20-SS261 LDW20-SS255 LDW20-SS250 LDW20-SS245 LDW20-SS222 LDW20-SS223 LDW20-SS226 LDW20-SS230 LDW20-SS235 LDW20-SS238	Aroclor-1260	J (all detects)	A	Initial calibration verification (%D)
LDW20-SS224 LDW20-SS269	Aroclor-1248 Aroclor-1260	J (all detects) J (all detects)	A	Compound quantitation (RPD between two columns)
LDW20-SS240 LDW20-SS255 LDW20-SS222 LDW20-SS226 LDW20-SS235 LDW20-SS238	Aroclor-1254	J (all detects)	A	Compound quantitation (RPD between two columns)
LDW20-SS244 LDW20-SS243	Aroclor-1254 Aroclor-1260	J (all detects) J (all detects)	A	Compound quantitation (RPD between two columns)
LDW20-SS250 LDW20-SS230	Aroclor-1248 Aroclor-1254	J (all detects) J (all detects)	A	Compound quantitation (RPD between two columns)

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 20F0359

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 20F0359

No Sample Data Qualified in this SDG

LDC #: 48785E3b

SDG #: 20F0359

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 08/17/20

Page: 1 of 7

Reviewer: JV

2nd Reviewer:

METHOD: GC Polychlorinated Biphenyls (EPA SW846 Method 8082A)

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	SW / A	Cooler temps = 8.8°C, 13.2°C, 20.4°C (Insufficient time to cool)
II.	Initial calibration/ICV	A / SW	ICAL ≤ 20%, ICV ≤ 20%
III.	Continuing calibration	A	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes	A	
VII.	Matrix spike/Matrix spike duplicates	A	
VIII.	Laboratory control samples	A	LCS, SRM
IX.	Field duplicates	N	
X.	Compound quantitation/RL/LOQ/LODs	SW	
XI.	Target compound identification	N	
XII	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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS224	20F0359-01	Sediment	06/19/20
2	LDW20-SS232	20F0359-02	Sediment	06/19/20
3	LDW20-SS240	20F0359-03	Sediment	06/19/20
4	LDW20-SS244	20F0359-04	Sediment	06/19/20
5	LDW20-SS243	20F0359-05	Sediment	06/19/20
6	LDW20-SS269	20F0359-06	Sediment	06/19/20
7	LDW20-SS261	20F0359-07	Sediment	06/19/20
8	LDW20-SS255	20F0359-08	Sediment	06/19/20
9	LDW20-SS250	20F0359-09	Sediment	06/19/20
10	LDW20-SS245	20F0359-10	Sediment	06/19/20
11	LDW20-SS222	20F0359-11	Sediment	06/19/20
12	LDW20-SS223	20F0359-12	Sediment	06/19/20
13	LDW20-SS226	20F0359-13	Sediment	06/19/20
14	LDW20-SS230	20F0359-14	Sediment	06/19/20
15	LDW20-SS235	20F0359-15	Sediment	06/19/20
16	LDW20-SS238	20F0359-16	Sediment	06/19/20
17	LDW20-SS240MS	20F0359-03MS	Sediment	06/19/20

LDC #: 48785E3b

SDG #: 20F0359

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 08/17/20

Reviewer: JM

2nd Reviewer: [illegible]

METHOD: GC Polychlorinated Biphenyls (EPA SW846 Method 8082A)

	Client ID	Lab ID	Matrix	Date
18	LDW20-SS240MSD	20F0359-03MSD	Sediment	06/19/20
19				
20				
21				

Notes:

	BIG0070-BLK1						

VALIDATION FINDINGS WORKSHEET

METHOD: Pesticide/PCBs (EPASW 846 Method 8081/8082)

A. alpha-BHC	K. Endrin	U. Toxaphene	EE. 2,4'-DDT	OO. trans–Heptachlor epoxide
B. beta-BHC	L. Endosulfan II	V. Aroclor-1016	FF. Hexachlorobenzene	PP. Mirex
C. delta-BHC	M. 4,4'-DDD	W. Aroclor-1221	GG. Chlordane	QQ cis-Chlordane
D. gamma-BHC	N. Endosulfan sulfate	X. Aroclor-1232	HH. Chlordane (Technical)	RR. trans-Chlordane
E. Heptachlor	O. 4,4'-DDT	Y. Aroclor-1242	II. Aroclor 1262	SS.
F. Aldrin	P. Methoxychlor	Z. Aroclor-1248	JJ. Aroclor 1268	TT.
G. Heptachlor epoxide	Q. Endrin ketone	AA. Aroclor-1254	KK. Oxychlordane	UU.
H. Endosulfan I	R. Endrin aldehyde	BB. Aroclor-1260	LL. trans-Nonachlor	VV
I. Dieldrin	S. alpha-Chlordane	CC. 2,4'-DDD	MM. cis-Nonachlor	WW.
J. 4,4'-DDE	T. gamma-Chlordane	DD. 2,4'-DDE	NN. cis–Heptachlor epoxide	XX.

Notes:_____

_____

_____

LDC #: 48785 E36

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".
What type of initial calibration verification calculation was performed? /%D or ___%R
(Y) N N/A Was an initial calibration verification standard analyzed after each ICAL for each instrument?
Y (N) N/A Did the initial calibration verification standards meet the %D / %R validation criteria of ≤20.0% / 80-120%?

#	Date	Standard ID	Detector/ Column	Compound	%D (Limit ≤ 20.0)	Associated Samples	Qualifications
	07/02/20	SIG0056-SCV1	1C	BB	21.8	All (Det)	J/UJ/A (qual BB only)

ICV-8081_2.wpd

LDC #: 48785 E35

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Reviewer: JVG
2nd Reviewer:

METHOD: ✓ GC __ HPLC

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Level IV/D Only

Y N N/A Were CRQLs adjusted for sample dilutions, dry weight factors, etc.?
Y N N/A Did the reported results for detected target compounds agree within 10.0% of the recalculated results?
Y N N/A Did the percent difference of detected compounds between two columns./detectors ≤40%?
If no, please see findings bellow.

#	Compound Name	Sample ID	%RPD/%D Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	Aroclor 1248	1	44.2	J dets/A
	1260	↓	42.7	↓
	1254	3	48.9	
	1254	4	41.1	
	1260	↓	59.2	
	1254	5	41.2	
	1260	↓	40.5	
	1248	6	42.4	
	1260	↓	40.7	
	1254	8	49.2	
	1248	9	42	
	1254	↓	44.8	↓

Comments: See sample calculation verification worksheet for recalculations

LDC #: 48785 E36

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Reviewer: JVG
2nd Reviewer:

METHOD: ✓ GC __ HPLC

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Level IV/D Only

Y N N/A Were CRQLs adjusted for sample dilutions, dry weight factors, etc.?
Y N N/A Did the reported results for detected target compounds agree within 10.0% of the recalculated results?
Y (N) N/A Did the percent difference of detected compounds between two columns./detectors ≤40%?
If no, please see findings bellow.

#	Compound Name	Sample ID	%RPD/%D Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	Aroclor 1254	11	43	J dets /A
	1254	13	44.6	
	1248	14	42.1	
	1254	↓	54.8	
	1254	15	40.8	
	1254	16	51.5	↓

Comments: See sample calculation verification worksheet for recalculations

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 20, 2020

Parameters: Metals

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0359

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS224	20F0359-01	Sediment	06/19/20
LDW20-SS232	20F0359-02	Sediment	06/19/20
LDW20-SS240	20F0359-03	Sediment	06/19/20
LDW20-SS244	20F0359-04	Sediment	06/19/20
LDW20-SS243	20F0359-05	Sediment	06/19/20
LDW20-SS269	20F0359-06	Sediment	06/19/20
LDW20-SS261	20F0359-07	Sediment	06/19/20
LDW20-SS255	20F0359-08	Sediment	06/19/20
LDW20-SS250	20F0359-09	Sediment	06/19/20
LDW20-SS245	20F0359-10	Sediment	06/19/20
LDW20-SS222	20F0359-11	Sediment	06/19/20
LDW20-SS223	20F0359-12	Sediment	06/19/20
LDW20-SS226	20F0359-13	Sediment	06/19/20
LDW20-SS230	20F0359-14	Sediment	06/19/20
LDW20-SS235	20F0359-15	Sediment	06/19/20
LDW20-SS238	20F0359-16	Sediment	06/19/20
LDW20-SS224MS	20F0359-01MS	Sediment	06/19/20
LDW20-SS224MSD	20F0359-01MSD	Sediment	06/19/20
LDW20-SS224DUP	20F0359-01DUP	Sediment	06/19/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). 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 methods:

Arsenic, Cadmium, Chromium, Copper, Lead, Silver, and Zinc by Environmental Protection Agency (EPA) SW 846 Method 6020A
Mercury by EPA SW 846 Method 7471B

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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.

All technical holding time requirements were met.

II. ICPMS Tune

The mass calibration was within 0.1 AMU and the percent relative standard deviation (%RSD) was less than or equal to 5%.

III. Instrument Calibration

Initial and continuing calibrations were performed as required by the methods.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

IV. ICP Interference Check Sample Analysis

The frequency of interference check sample (ICS) analysis was met. All criteria were within QC limits.

V. Laboratory Blanks

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

Blank ID	Analyte	Maximum Concentration	Associated Samples
ICB/CCB	Silver	0.022 ug/L	LDW20-SS224 LDW20-SS244 LDW20-SS243 LDW20-SS269 LDW20-SS261 LDW20-SS255 LDW20-SS250 LDW20-SS245 LDW20-SS222 LDW20-SS223 LDW20-SS226 LDW20-SS230 LDW20-SS235 LDW20-SS238 LDW20-SS224DUP
PB (prep blank)	Zinc	1.1 mg/Kg	All samples in SDG 20F0359

Data qualification by the laboratory blanks was based on the maximum contaminant concentration in the laboratory blanks in the analysis of each analyte. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Analyte	Reported Concentration	Modified Final Concentration
LDW20-SS224	Silver	0.19 mg/Kg	0.19U mg/Kg
LDW20-SS244	Silver	0.14 mg/Kg	0.14U mg/Kg
LDW20-SS243	Silver	0.24 mg/Kg	0.24U mg/Kg
LDW20-SS269	Silver	0.19 mg/Kg	0.19U mg/Kg
LDW20-SS261	Silver	0.15 mg/Kg	0.15U mg/Kg
LDW20-SS255	Silver	0.15 mg/Kg	0.15U mg/Kg
LDW20-SS250	Silver	0.19 mg/Kg	0.19U mg/Kg
LDW20-SS245	Silver	0.19 mg/Kg	0.19U mg/Kg
LDW20-SS222	Silver	0.2 mg/Kg	0.2U mg/Kg
LDW20-SS223	Silver	0.18 mg/Kg	0.18U mg/Kg
LDW20-SS226	Silver	0.18 mg/Kg	0.18U mg/Kg
LDW20-SS230	Silver	0.16 mg/Kg	0.16U mg/Kg
LDW20-SS235	Silver	0.16 mg/Kg	0.16U mg/Kg
LDW20-SS238	Silver	0.16 mg/Kg	0.16U mg/Kg
LDW20-SS224DUP	Silver	0.15 mg/Kg	0.15U mg/Kg

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VIII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

IX. Serial Dilution

Serial dilution was not performed for this SDG.

X. Laboratory Control Samples

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

XI. Field Duplicates

No field duplicates were identified in this SDG.

XII. Internal Standards (ICP-MS)

Raw data were not reviewed for Stage 2B validation.

XIII. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

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

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

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4
Metals - Data Qualification Summary - SDG 20F0359

No Sample Data Qualified in this SDG

Duwamish AOC4
Metals - Laboratory Blank Data Qualification Summary - SDG 20F0359

Sample	Analyte	Modified Final Concentration	A or P
LDW20-SS224	Silver	0.19U mg/Kg	A
LDW20-SS244	Silver	0.14U mg/Kg	A
LDW20-SS243	Silver	0.24U mg/Kg	A
LDW20-SS269	Silver	0.19U mg/Kg	A
LDW20-SS261	Silver	0.15U mg/Kg	A
LDW20-SS255	Silver	0.15U mg/Kg	A
LDW20-SS250	Silver	0.19U mg/Kg	A
LDW20-SS245	Silver	0.19U mg/Kg	A
LDW20-SS222	Silver	0.2U mg/Kg	A
LDW20-SS223	Silver	0.18U mg/Kg	A
LDW20-SS226	Silver	0.18U mg/Kg	A
LDW20-SS230	Silver	0.16U mg/Kg	A
LDW20-SS235	Silver	0.16U mg/Kg	A
LDW20-SS238	Silver	0.16U mg/Kg	A
LDW20-SS224DUP	Silver	0.15U mg/Kg	A

Duwamish AOC4
Metals - Field Blank Data Qualification Summary - SDG 20F0359

No Sample Data Qualified in this SDG

LDC #: 48785E4a **VALIDATION COMPLETENESS WORKSHEET** Date: 8/19/20
SDG #: 20F0359 Stage 2B Page: 1 of 2
Laboratory: Analytical Resources, Inc. Reviewer: a
2nd Reviewer: A

METHOD: Metals (EPA SW 846 Method 6020A/7471B)

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	
II.	ICP/MS Tune	A	
III.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	SW	
VI.	Field Blanks	N	
VII.	Matrix Spike/Matrix Spike Duplicates	A	
VIII.	Duplicate sample analysis	A	
IX.	Serial Dilution	N	
X.	Laboratory control samples	A	LCS
XI.	Field Duplicates	N	
XII.	Internal Standard (ICP-MS)	N	not reviewed
XIII.	Sample Result Verification	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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS224	20F0359-01	Sediment	06/19/20
2	LDW20-SS232	20F0359-02	Sediment	06/19/20
3	LDW20-SS240	20F0359-03	Sediment	06/19/20
4	LDW20-SS244	20F0359-04	Sediment	06/19/20
5	LDW20-SS243	20F0359-05	Sediment	06/19/20
6	LDW20-SS269	20F0359-06	Sediment	06/19/20
7	LDW20-SS261	20F0359-07	Sediment	06/19/20
8	LDW20-SS255	20F0359-08	Sediment	06/19/20
9	LDW20-SS250	20F0359-09	Sediment	06/19/20
10	LDW20-SS245	20F0359-10	Sediment	06/19/20
11	LDW20-SS222	20F0359-11	Sediment	06/19/20
12	LDW20-SS223	20F0359-12	Sediment	06/19/20
13	LDW20-SS226	20F0359-13	Sediment	06/19/20
14	LDW20-SS230	20F0359-14	Sediment	06/19/20
15	LDW20-SS235	20F0359-15	Sediment	06/19/20

LDC #: 48785E4a **VALIDATION COMPLETENESS WORKSHEET** Date: 8/9/20
SDG #: 20F0359 Stage 2B Page: 2 of 2
Laboratory: Analytical Resources, Inc. Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: Metals (EPA SW 846 Method 6020A/7471B)

	Client ID	Lab ID	Matrix	Date
16	LDW20-SS238	20F0359-16	Sediment	06/19/20
17	LDW20-SS224MS	20F0359-01MS	Sediment	06/19/20
18	LDW20-SS224MSD	20F0359-01MSD	Sediment	06/19/20
19	LDW20-SS224DUP	20F0359-01DUP	Sediment	06/19/20
20				
21				
22				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1 to 16	As, Cd, Cr, Cu, Pb, Ag, Zn, Hg
QC: 17-19	As, Cd, Cr, Cu, Pb, Ag, Zn

Analysis Method

ICP	
ICP-MS	As, Cd, Cr, Cu, Pb, Ag, Zn
CVAA	Hg

VALIDATION FINDINGS WORKSHEET
Laboratory Blank Contamination (PB/ICB/CCB)

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)
Soil preparation factor applied (if applicable):

Sample Concentration, unless otherwise noted: mg/Kg Associated Samples: 1, 4-16, 19

				Sample Identification													
Analyte	**PB (mg/Kg)**	**Maximum ICB/CCB (ug/L)**	**Action Level**	1	4	5	6	7	8	9	10	11	12	13	14	15	16
Ag		0.022		0.19	0.14	0.24	0.19	0.15	0.15	0.19	0.19	0.2	0.18	0.18	0.16	0.16	0.16

19
0.15

Sample Concentration, unless otherwise noted: mg/Kg Associated Samples: All

				Sample Identification													
Analyte	**PB (mg/Kg)**	**Maximum ICB/CCB (ug/L)**	**Action Level**	No quals													
Zn	1.1																

Comments: The listed analyte concentrtaion is the highest ICB or CCB detected in the analysis. The action level, when applicable, is established at 5X the highest ICB, CCB, or PB concentration.

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 20, 2020

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0359

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS224	20F0359-01	Sediment	06/19/20
LDW20-SS232	20F0359-02	Sediment	06/19/20
LDW20-SS240	20F0359-03	Sediment	06/19/20
LDW20-SS244	20F0359-04	Sediment	06/19/20
LDW20-SS243	20F0359-05	Sediment	06/19/20
LDW20-SS269	20F0359-06	Sediment	06/19/20
LDW20-SS261	20F0359-07	Sediment	06/19/20
LDW20-SS255	20F0359-08	Sediment	06/19/20
LDW20-SS250	20F0359-09	Sediment	06/19/20
LDW20-SS245	20F0359-10	Sediment	06/19/20
LDW20-SS222	20F0359-11	Sediment	06/19/20
LDW20-SS223	20F0359-12	Sediment	06/19/20
LDW20-SS226	20F0359-13	Sediment	06/19/20
LDW20-SS230	20F0359-14	Sediment	06/19/20
LDW20-SS235	20F0359-15	Sediment	06/19/20
LDW20-SS238	20F0359-16	Sediment	06/19/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). 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 methods:

Total Organic Carbon by Environmental Protection Agency (EPA) SW 846 Method 9060A
Total Solids by Standard Method 2540G

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration of each method were met.

III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met for each method when applicable.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. 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.

VII. Duplicate Sample Analysis

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

VIII. Laboratory Control Samples/Standard Reference Materials

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

Standard reference materials (SRM) were analyzed as required by the methods. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

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

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4
Wet Chemistry - Data Qualification Summary - SDG 20F0359

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 20F0359

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 20F0359

No Sample Data Qualified in this SDG

LDC #: 48785E6 **VALIDATION COMPLETENESS WORKSHEET** Date: 8/19/20
SDG #: 20F0359 Stage 2B Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer: GA
2nd Reviewer: AC

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM 2540G)

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	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	A	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	
VII.	Duplicate sample analysis	N	
VIII.	Laboratory control samples	A	LCS, SRM
IX.	Field duplicates	N	
X.	Sample result verification	N	
XI	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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS224	20F0359-01	Sediment	06/19/20
2	LDW20-SS232	20F0359-02	Sediment	06/19/20
3	LDW20-SS240	20F0359-03	Sediment	06/19/20
4	LDW20-SS244	20F0359-04	Sediment	06/19/20
5	LDW20-SS243	20F0359-05	Sediment	06/19/20
6	LDW20-SS269	20F0359-06	Sediment	06/19/20
7	LDW20-SS261	20F0359-07	Sediment	06/19/20
8	LDW20-SS255	20F0359-08	Sediment	06/19/20
9	LDW20-SS250	20F0359-09	Sediment	06/19/20
10	LDW20-SS245	20F0359-10	Sediment	06/19/20
11	LDW20-SS222	20F0359-11	Sediment	06/19/20
12	LDW20-SS223	20F0359-12	Sediment	06/19/20
13	LDW20-SS226	20F0359-13	Sediment	06/19/20
14	LDW20-SS230	20F0359-14	Sediment	06/19/20
15	LDW20-SS235	20F0359-15	Sediment	06/19/20
16	LDW20-SS238	20F0359-16	Sediment	06/19/20
17				

LDC Report# 48785E21

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 19, 2020

Parameters: Polychlorinated Dioxins/Dibenzofurans

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0359

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS244	20F0359-04	Sediment	06/19/20
LDW20-SS243	20F0359-05	Sediment	06/19/20
LDW20-SS244DUP	20F0359-04DUP	Sediment	06/19/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for High Resolution Superfund Methods Data Review (April 2016). 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 Dioxins/Dibenzofurans by Environmental Protection Agency (EPA) Method 1613B

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 8.8°C and 13.2°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required frequency.

Retention time windows were established for all homologues. The chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomer was less than or equal to 25%.

The static resolving power was at least 10,000 (10% valley definition).

III. Initial Calibration and Initial Calibration Verification

A five point initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for unlabeled compounds and less than or equal to 35.0% for labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were within the QC limits for unlabeled compounds and labeled compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

All of the continuing calibration results were within the QC limits for unlabeled compounds and labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

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	Compound	Concentration	Associated Samples
BIG0062-BLK1	07/09/20	1,2,3,4,6,7,8-HpCDF 1,2,3,4,6,7,8-HpCDD OCDF OCDD	0.0645 ng/Kg 0.319 ng/Kg 0.727 ng/Kg 2.68 ng/Kg	All samples in SDG 20F0359

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates/Duplicate Sample Analysis

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.

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits with the following exceptions:

DUP ID (Associated Samples)	Compound	RPD (Limits)	Flag	A or P
LDW20-SS244DUP (LDW20-SS244)	1,2,3,4,6,7,8-HpCDF OCDF	105 (≤25) 29.5 (≤25)	J (all detects) J (all detects)	A

VIII. Laboratory Control Samples/Standard Reference Materials

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

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Labeled Compounds

All percent recoveries (%R) for labeled compounds used to quantitate target compounds were within QC limits.

XI. Compound Quantitation

All compound quantitations were within validation criteria with the following exceptions:

Sample	Compound	Flag	A or P
All samples in SDG 20F0359	All compounds reported as estimated maximum possible concentration (EMPC) and greater than the reporting limit.	J (all detects)	A
All samples in SDG 20F0359	All compounds reported as estimated maximum possible concentration (EMPC) and less than the reporting limit.	U (all non-detects)	A
All samples in SDG 20F0359	All compounds flagged "X" due to chlorinated diphenyl ether (CDPE) interference.	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B 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 DUP RPD, compounds reported as EMPC, and CDPE interference, data were qualified as estimated or not detected in two samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Data Qualification Summary - SDG 20F0359

Sample	Compound	Flag	A or P	Reason
LDW20-SS244	1,2,3,4,6,7,8-HpCDF OCDF	J (all detects) J (all detects)	A	Duplicate sample analysis (RPD)
LDW20-SS244 LDW20-SS243	All compounds reported as estimated maximum possible concentration (EMPC) and greater than the reporting limit.	J (all detects)	A	Compound quantitation (EMPC)
LDW20-SS244 LDW20-SS243	All compounds reported as estimated maximum possible concentration (EMPC) and less than the reporting limit.	U (all non-detects)	A	Compound quantitation (EMPC)
LDW20-SS244 LDW20-SS243	All compounds flagged "X" due to chlorinated diphenyl ether (CDPE) interference.	J (all detects)	A	Compound quantitation

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG 20F0359

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Field Blank Data Qualification Summary - SDG 20F0359

No Sample Data Qualified in this SDG

LDC #: 48785E21 **VALIDATION COMPLETENESS WORKSHEET** Date: 08/17/20
SDG #: 20F0359 Stage 2B Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer: SW
2nd Reviewer:

METHOD: HRGC/HRMS Polychlorinated Dioxins/Dibenzofurans (EPA Method 1613B)

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	SW/A	Cooler temps = 8.8°C, 13.2°C (Insufficient time to cool)
II.	HRGC/HRMS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	ICAL ≤ 20/35 %. ICV ≤ QC limits
IV.	Continuing calibration	A	CCV ≤ QC limits
V.	Laboratory Blanks	SW	
VI.	Field blanks	N	
VII.	Matrix spike/Matrix spike duplicates (LD)	N/SW	
VIII.	Laboratory control samples	A	LCS, SRM
IX.	Field duplicates	N	
X.	Labeled Compounds	A	
XI.	Compound quantitation RL/LOQ/LODs	SW	EMPC = J dots (>RL); U (<RL)
XII.	Target compound 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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS244	20F0359-04	Sediment	06/19/20
2	LDW20-SS243	20F0359-05	Sediment	06/19/20
3	LDW20-SS244DUP	20F0359-04DUP	Sediment	06/19/20
4				
5				
6				
7				
8				
9				
10				

Notes:

4	BIG0062-BLK1						

VALIDATION FINDINGS WORKSHEET

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

A. 2,3,7,8-TCDD	F. 1,2,3,4,6,7,8-HpCDD	K. 1,2,3,4,7,8-HxCDF	P. 1,2,3,4,7,8,9-HpCDF	U. Total HpCDD
B. 1,2,3,7,8-PeCDD	G. OCDD	L. 1,2,3,6,7,8-HxCDF	Q. OCDF	V. Total TCDF
C. 1,2,3,4,7,8-HxCDD	H. 2,3,7,8-TCDF	M. 2,3,4,6,7,8-HxCDF	R. Total TCDD	W. Total PeCDF
D. 1,2,3,6,7,8-HxCDD	I. 1,2,3,7,8-PeCDF	N. 1,2,3,7,8,9-HxCDF	S. Total PeCDD	X. Total HxCDF
E. 1,2,3,7,8,9-HxCDD	J. 2,3,4,7,8-PeCDF	O. 1,2,3,4,6,7,8-HpCDF	T. Total HxCDD	Y. Total HpCDF

Notes:_____

LDC #: 48785 E21

VALIDATION FINDINGS WORKSHEET
Blanks

Reviewer: JVG
2nd Reviewer:

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were all samples associated with a method blank?
Y N N/A Was a method blank performed for each matrix and whenever a sample extraction was performed?
Y N N/A Was the method blank contaminated?

Blank extraction date: 07/09/20 **Blank analysis date:** 07/13/20 **Associated samples:** All (75X)

Conc. units: ng/kg

Compound	Blank ID	Sample Identification								
	BIG0062-BLK1 (5X)									
O	0.0645	0.3225								
F	0.319	1.595								
Q	0.727	3.635								
G	2.68	13.4								

Blank extraction date: _____ **Blank analysis date:** _____

Conc. units: _____ Associated Samples: _____

Compound	Blank ID	Sample Identification								

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
All contaminants within five times the method blank concentration were qualified as not detected, "U".

LDC #: 48785 E21

VALIDATION FINDINGS WORKSHEET
Duplicate Analysis

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

[✓ Y] N N/A Was a duplicate sample analyzed for each matrix in this SDG?

Y [✓ N] N/A Were all duplicate sample relative percent differences (RPD) ≤ 25 ?

#	Duplicate ID	Compound	RPD (Limits)	Associated Samples	Qualifications
	3	O	105 (≤ 25)	1 (Det)	J dets/A
		Q	29.5 (≤ ↓)	↓ ↓	↓
			(≤)		
			(≤)		
			(≤)		
			(≤)		
			(≤)		
			(≤)		
			(≤)		
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			(≤)		
			(≤)		

Comments:

LDC #: 48782

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported RLs

Reviewer: [illegible]
2nd Reviewer: _____

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B/SGS AXYS Method MLA-017)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were the correct labeled compound, quantitation ions and relative response factors (RRF) used to quantitate the compound?
Y N N/A Compound quantitation and RLs were adjusted to reflect all sample dilutions and dry weight factors (if necessary).

#	Date	Sample ID	Finding	Associated Samples	Qualifications
		All	All results flagged as EMPC		Jdets/A
		All	All results flagged "X" by the lab due to chlorinated		Jdets/A
			diphenyl ether (CDPE) interference		

Comments: See sample calculation verification worksheet for recalculations

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 19, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0392

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS411	20F0392-13	Sediment	06/22/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). 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:

Semivolatile Organic Compounds (SVOCs) by Environmental Protection Agency (EPA) SW 846 Method 8270E

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 15.0°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
07/13/20	Fluoranthene Pyrene	22.3 21.5	LDW20-SS411	J (all detects) J (all detects)	A

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. 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.

IX. Laboratory Control Samples/Standard Reference Materials

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

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits with the following exceptions:

SRM ID	Compound	%R (Limits)	Associated Samples	Flag	A or P
BIG0068-SRM1	Naphthalene 2-Methylnaphthalene Acenaphthylene Acenaphthene	20.5 (41-159) 33.6 (51-149) 43.7 (57-142) 48.0 (59-141)	All samples in SDG 20F0392	UJ (all non-detects) UJ (all non-detects) UJ (all non-detects) UJ (all non-detects)	P

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

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

Due to continuing calibration %D and SRM %R, data were qualified as estimated in one sample.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4
Semivolatiles - Data Qualification Summary - SDG 20F0392

Sample	Compound	Flag	A or P	Reason
LDW20-SS411	Fluoranthene Pyrene	J (all detects) J (all detects)	A	Continuing calibration (%D)
LDW20-SS411	Naphthalene 2-Methylnaphthalene Acenaphthylene Acenaphthene	UJ (all non-detects) UJ (all non-detects) UJ (all non-detects) UJ (all non-detects)	P	Standard reference materials (%R)

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0392

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0392

No Sample Data Qualified in this SDG

LDC #: 48785F2a
SDG #: 20F0392
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 08/17/20
Page: 1 of 1
Reviewer: DK
2nd Reviewer:

METHOD: GC/MS Semivolatiles (EPA SW 846 Method 8270E)

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	SW / A	Cooler temp. = 15.0°C (Insufficient time to cool)
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A / A	ICAL ≤ 20%, ICV ≤ 30%
IV.	Continuing calibration	SW	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	N	
IX.	Laboratory control samples	SW	LCS, SRM
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS411	20F0392-13	Sediment	06/22/20
2				
3				
4				
5				
6				
7				
8				
9				

Notes:

—	BIG0068-BLK1						

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

A. Phenol	AA. 2-Chloronaphthalene	AAA. Butylbenzylphthalate	AAAA. Dibenzothiophene	A1. N-Nitrosodiethylamine
B. Bis (2-chloroethyl) ether	BB. 2-Nitroaniline	BBB. 3,3'-Dichlorobenzidine	BBBB. Benzo(a)fluoranthene	B1. N-Nitrosodi-n-butylamine
C. 2-Chlorophenol	CC. Dimethylphthalate	CCC. Benzo(a)anthracene	CCCC. Benzo(b)fluorene	C1. N-Nitrosomethylethylamine
D. 1,3-Dichlorobenzene	DD. Acenaphthylene	DDD. Chrysene	DDDD. cis/trans-Decalin	D1. N-Nitrosomorpholine
E. 1,4-Dichlorobenzene	EE. 2,6-Dinitrotoluene	EEE. Bis(2-ethylhexyl)phthalate	EEEE. Biphenyl	E1. N-Nitrosopyrrolidine
F. 1,2-Dichlorobenzene	FF. 3-Nitroaniline	FFF. Di-n-octylphthalate	FFFF. Retene	F1. Phenacetin
G. 2-Methylphenol	GG. Acenaphthene	GGG. Benzo(b)fluoranthene	GGGG. C30-Hopane	G1. 2-Acetylaminofluorene
H. 2,2'-Oxybis(1-chloropropane)	HH. 2,4-Dinitrophenol	HHH. Benzo(k)fluoranthene	HHHH. 1-Methylphenanthrene	H1. Pronamide
I. 4-Methylphenol	II. 4-Nitrophenol	III. Benzo(a)pyrene	IIII. 1,4-Dioxane	I1. Methyl methanesulfonate
J. N-Nitroso-di-n-propylamine	JJ. Dibenzofuran	JJJ. Indeno(1,2,3-cd)pyrene	JJJJ. Acetophenone	J1. Ethyl methanesulfonate
K. Hexachloroethane	KK. 2,4-Dinitrotoluene	KKK. Dibenz(a,h)anthracene	KKKK. Atrazine	K1. o,o',o''-Triethylphosphorothioate
L. Nitrobenzene	LL. Diethylphthalate	LLL. Benzo(g,h,i)perylene	LLLL. Benzaldehyde	L1. n-Phenylene diamine
M. Isophorone	MM. 4-Chlorophenyl-phenyl ether	MMM. Bis(2-Chloroisopropyl)ether	MMMM. Caprolactam	M1. 1,4-Naphthoquinone
N. 2-Nitrophenol	NN. Fluorene	NNN. Aniline	NNNN. 2,6-Dichlorophenol	N1. N-Nitro-o-toluidine
O. 2,4-Dimethylphenol	OO. 4-Nitroaniline	OOO. N-Nitrosodimethylamine	OOOO. 1,2-Diphenylhydrazine	O1. 1,3,5-Trinitrobenzene
P. Bis(2-chloroethoxy)methane	PP. 4,6-Dinitro-2-methylphenol	PPP. Benzoic Acid	PPPP. 3-Methylphenol	P1. Pentachlorobenzene
Q. 2,4-Dichlorophenol	QQ. N-Nitrosodiphenylamine	QQQ. Benzyl alcohol	QQQQ. 3&4-Methylphenol	Q1. 4-Aminobiphenyl
R. 1,2,4-Trichlorobenzene	RR. 4-Bromophenyl-phenylether	RRR. Pyridine	RRRR. 4-Dimethyldibenzothiophene (4MDT)	R1. 2-Naphthylamine
S. Naphthalene	SS. Hexachlorobenzene	SSS. Benzidine	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	S1. Triphenylene
T. 4-Chloroaniline	TT. Pentachlorophenol	TTT. 1-Methylnaphthalene	TTTT. 1-Methyldibenzothiophene (1MDT)	T1. Octachlorostyrene
U. Hexachlorobutadiene	UU. Phenanthrene	UUU.Benzo(b)thiophene	UUUU.. 2,3,4,6-Tetrachlorophenol	U1. Famphur
V. 4-Chloro-3-methylphenol	VV. Anthracene	VVV.Benzonaphthothiophene	VVVV. 1,2,4,5-Tetrachlorobenzene	V1. 1,4-phenylenediamine
W. 2-Methylnaphthalene	WW. Carbazole	WWW.Benzo(e)pyrene	WWWW.. 2-Picoline	W1. Methapyrilene
X. Hexachlorocyclopentadiene	XX. Di-n-butylphthalate	XXX. 2,6-Dimethylnaphthalene	XXXX. 3-Methylcholanthrene	X1. Pentachloroethane
Y. 2,4,6-Trichlorophenol	YY. Fluoranthene	YYY. 2,3,5-Trimethylnaphthalene	YYYY. a,a-Dimethylphenethylamine	Y1. 3,3'-Dimethylbenzidine
Z. 2,4,5-Trichlorophenol	ZZ. Pyrene	ZZZ. Perylene	ZZZZ. Hexachloropropene	Z1. o-Toluidine

LDC #: 48785 F2a

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: [signature]

METHOD: GC/MS BNA (EPA SW 846 Method 8270C)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

(Y) N N/A Was a continuing calibration standard analyzed at least once every 12 hours of sample analysis for each instrument?

(Y) N N/A Were percent differences (%D) and relative response factors (RRF) within method criteria for all CCC's and SPCC's ?

Y (N) N/A Were all %D and RRFs within the validation criteria of ≤20 %D and ≥0.05 RRF ?

#	Date	Standard ID	Compound	Finding %D (Limit: <20.0%)	Finding RRF (Limit: >0.05)	Associated Samples	Qualifications
	07/13/20	NT102007302	YY	22.3		1 (Det)	J/UJ/A
			ZZ	21.5		↓ ↓	↓

LDC #: 48785F2a

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS)

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD: GC/MS BNA (EPA SW 846 Method 8270~~C~~E)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

[✓ Y] N N/A Was a LCS required?
Y [✓ N] N/A Were the LCS/LCSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#	LCS/LCSD ID	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	BIG0068-SRM1	S	20.5 (41-159)	( )	( )	All (ND)	J/UJ/P
		W	33.6 (51-159)	( )	( )		
		DD	43.7 (57-142)	( )	( )		
		GG	48.0 (59-141)	( )	( )	↓ ↓	↓
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
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			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 20, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0392

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS411	20F0392-13	Sediment	06/22/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). 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:

Semivolatile Organic Compounds (SVOCs) by Environmental Protection Agency (EPA) SW 846 Method 8270E in Selected Ion Monitoring (SIM) mode

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 8.8°C and 20.4°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For compounds where average relative response factors (RRFs) were utilized, percent relative standard deviations (%RSD) were less than or equal to 20.0%.

In the case where the laboratory used a calibration curve to evaluate the compounds, all coefficients of determination (r^2) were greater than or equal to 0.990.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all compounds with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
06/26/20	N-Nitrosodiphenylamine	41.9	LDW20-SS411	UJ (all non-detects)	A

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
07/13/20	Benzyl alcohol	28.5	LDW20-SS411	J (all detects) UJ (all non-detects)	A
	Pentachlorophenol	37.1		J (all detects) UJ (all non-detects)	

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. 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.

IX. Laboratory Control Samples/Standard Reference Materials

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

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits with the following exceptions:

SRM ID	Compound	%R (Limits)	Associated Samples	Flag	A or P
BIG0068-SRM2	1,2-Dichlorobenzene	13.3 (17-184)	All samples in SDG 20F0392	UJ (all non-detects)	P

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

All compound quantitations met validation criteria with the following exceptions:

Sample	Compound	Finding	Criteria	Flag	A or P
LDW20-SS411	Benzoic acid	Sample result exceeded calibration range.	Reported result should be within calibration range.	J (all detects)	P

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

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

Due to ICV %D, continuing calibration %D, SRM %R, and results exceeding calibration, data were qualified as estimated in one sample.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4
Semivolatiles – Data Qualification Summary - SDG 20F0392

Sample	Compound	Flag	A or P	Reason
LDW20-SS411	N-Nitrosodiphenylamine	UJ (all non-detects)	A	Initial calibration verification (%D)
LDW20-SS411	Benzyl alcohol Pentachlorophenol	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	A	Continuing calibration (%D)
LDW20-SS411	1,2-Dichlorobenzene	UJ (all non-detects)	P	Standard reference materials (%R)
LDW20-SS411	Benzoic acid	J (all detects)	P	Compound quantitation (exceeded range)

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0392

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0392

No Sample Data Qualified in this SDG

LDC #: 48785F2b

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 08/17/20

SDG #: 20F0392

Page: 1 of 1

Laboratory: Analytical Resources, Inc.

Reviewer: JW

2nd Reviewer:

METHOD: GC/MS ~~Polynuclear Aromatic Hydrocarbon~~ SVOA s (EPA SW 846 Method 8270E-SIM)

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	SW A	cooler temp. = 15.0°C (Insufficient time to cool)
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A / SW	ICAL ≤ 20% r ICV ≤ 20%
IV.	Continuing calibration	SW	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	N	
IX.	Laboratory control samples	SW	LCS, SRM
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	SW	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS411	20F0392-13	Sediment	06/22/20
2				
3				
4				
5				
6				
7				
8				
9				

Notes:

	BIG0068-BLK2						

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

A. Phenol	AA. 2-Chloronaphthalene	AAA. Butylbenzylphthalate	AAAA. Dibenzothiophene	A1. N-Nitrosodiethylamine
B. Bis (2-chloroethyl) ether	BB. 2-Nitroaniline	BBB. 3,3'-Dichlorobenzidine	BBBB. Benzo(a)fluoranthene	B1. N-Nitrosodi-n-butylamine
C. 2-Chlorophenol	CC. Dimethylphthalate	CCC. Benzo(a)anthracene	CCCC. Benzo(b)fluorene	C1. N-Nitrosomethylethylamine
D. 1,3-Dichlorobenzene	DD. Acenaphthylene	DDD. Chrysene	DDDD. cis/trans-Decalin	D1. N-Nitrosomorpholine
E. 1,4-Dichlorobenzene	EE. 2,6-Dinitrotoluene	EEE. Bis(2-ethylhexyl)phthalate	EEEE. Biphenyl	E1. N-Nitrosopyrrolidine
F. 1,2-Dichlorobenzene	FF. 3-Nitroaniline	FFF. Di-n-octylphthalate	FFFF. Retene	F1. Phenacetin
G. 2-Methylphenol	GG. Acenaphthene	GGG. Benzo(b)fluoranthene	GGGG. C30-Hopane	G1. 2-Acetylaminofluorene
H. 2,2'-Oxybis(1-chloropropane)	HH. 2,4-Dinitrophenol	HHH. Benzo(k)fluoranthene	HHHH. 1-Methylphenanthrene	H1. Pronamide
I. 4-Methylphenol	II. 4-Nitrophenol	III. Benzo(a)pyrene	IIII. 1,4-Dioxane	I1. Methyl methanesulfonate
J. N-Nitroso-di-n-propylamine	JJ. Dibenzofuran	JJJ. Indeno(1,2,3-cd)pyrene	JJJJ. Acetophenone	J1. Ethyl methanesulfonate
K. Hexachloroethane	KK. 2,4-Dinitrotoluene	KKK. Dibenz(a,h)anthracene	KKKK. Atrazine	K1. o,o',o''-Triethylphosphorothioate
L. Nitrobenzene	LL. Diethylphthalate	LLL. Benzo(g,h,i)perylene	LLLL. Benzaldehyde	L1. n-Phenylene diamine
M. Isophorone	MM. 4-Chlorophenyl-phenyl ether	MMM. Bis(2-Chloroisopropyl)ether	MMMM. Caprolactam	M1. 1,4-Naphthoquinone
N. 2-Nitrophenol	NN. Fluorene	NNN. Aniline	NNNN. 2,6-Dichlorophenol	N1. N-Nitro-o-toluidine
O. 2,4-Dimethylphenol	OO. 4-Nitroaniline	OOO. N-Nitrosodimethylamine	OOOO. 1,2-Diphenylhydrazine	O1. 1,3,5-Trinitrobenzene
P. Bis(2-chloroethoxy)methane	PP. 4,6-Dinitro-2-methylphenol	PPP. Benzoic Acid	PPPP. 3-Methylphenol	P1. Pentachlorobenzene
Q. 2,4-Dichlorophenol	QQ. N-Nitrosodiphenylamine	QQQ. Benzyl alcohol	QQQQ. 3&4-Methylphenol	Q1. 4-Aminobiphenyl
R. 1,2,4-Trichlorobenzene	RR. 4-Bromophenyl-phenylether	RRR. Pyridine	RRRR. 4-Dimethyldibenzothiophene (4MDT)	R1. 2-Naphthylamine
S. Naphthalene	SS. Hexachlorobenzene	SSS. Benzidine	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	S1. Triphenylene
T. 4-Chloroaniline	TT. Pentachlorophenol	TTT. 1-Methylnaphthalene	TTTT. 1-Methyldibenzothiophene (1MDT)	T1. Octachlorostyrene
U. Hexachlorobutadiene	UU. Phenanthrene	UUU.Benzo(b)thiophene	UUUU.. 2,3,4,6-Tetrachlorophenol	U1. Famphur
V. 4-Chloro-3-methylphenol	VV. Anthracene	VVV.Benzonaphthothiophene	VVVV. 1,2,4,5-Tetrachlorobenzene	V1. 1,4-phenylenediamine
W. 2-Methylnaphthalene	WW. Carbazole	WWW.Benzo(e)pyrene	WWWW.. 2-Picoline	W1. Methapyrilene
X. Hexachlorocyclopentadiene	XX. Di-n-butylphthalate	XXX. 2,6-Dimethylnaphthalene	XXXX. 3-Methylcholanthrene	X1. Pentachloroethane
Y. 2,4,6-Trichlorophenol	YY. Fluoranthene	YYY. 2,3,5-Trimethylnaphthalene	YYYY. a,a-Dimethylphenethylamine	Y1. 3,3'-Dimethylbenzidine
Z. 2,4,5-Trichlorophenol	ZZ. Pyrene	ZZZ. Perylene	ZZZZ. Hexachloropropene	Z1. o-Toluidine

LDC #: 48785F26

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

Reviewer: JVG
2nd Reviewer:

METHOD: GC/MS SVOA (EPA SW 846 Method 8270C (E-SIM))
Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Was an initial calibration verification standard analyzed after each ICAL for each instrument?
Y N N/A Were all %D within the validation criteria of ~~≤20~~/30% %D ?

#	Date	Standard ID	Compound	Finding %D (Limit: ~~<20.0%~~ (30%))	Associated Samples	Qualifications
(14)	06/26/20	SIF0395-SCV1	QQ	65.7	MB	NQ (QC only)
(16)	06/26/20	SIF0393-SCV1	QQ	41.9	1 (ND)	J/UJ/A

LDC #: 48785 F2b

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD: GC/MS BNA (EPA SW 846 Method 8270C (E-Sim))

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

~~X~~ N N/A Was a continuing calibration standard analyzed at least once every 12 hours of sample analysis for each instrument?

~~Y~~ N N/A Were percent differences (%D) and relative response factors (RRF) within method criteria for all CCC's and SPCC's ?

Y (N) N/A Were all %D and RRFs within the validation criteria of ≤20 %D and ≥0.05 RRF ?

#	Date	Standard ID	Compound	Finding %D (Limit: <20.0%)	Finding RRF (Limit: >0.05)	Associated Samples	Qualifications
	07/11/20	NT14 20071103S	PPP	20.5		MB	NQ (QC only)
			TT	34.3		↓	
	07/13/20	NT10 20071305	QQQ	28.5		1 (ND + Det)	J/UJ/A
			TT	37.1		↓ ↓	↓

CONCAL.wpd

LDC #: 48785F2b

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS) /SRM

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: ________

METHOD: GC/MS BNA (EPA SW 846 Method 8270C)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

[✓ Y] N N/A Was a LCS required?

[✓ Y] N N/A Were the LCS/LCSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#	LCS/LCSD ID	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	BIG0068-SRM2	F	13.3 (17-184)	( )	( )	All (ND)	J/UJ/P
			( )	( )	( )		
			( )	( )	( )		
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LDC #: 48785 F26

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported RLs

Reviewer: JVG
2nd Reviewer: _____

METHOD: GC/MS PAH (EPA SW 846 Method 8270C-SIM)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

(Y) N N/A Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?

Y (N) N/A Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?

#	Date	Sample ID	Compound	Finding	Qualifications
		1	PPP	> cal range	J dets / P

Comments: See sample calculation verification worksheet for recalculations

Note: Analyst did not rerun extract, as the Benzoic acid was in range in the Full scan, not realizing compound is reported in the SIM analysis.

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 20, 2020

Parameters: Hexachlorobenzene

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0392

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS411	20F0392-13	Sediment	06/22/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). 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:

Hexachlorobenzene by Environmental Protection Agency (EPA) SW 846 Method 8081B

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 15.0°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC Instrument Performance Check

Instrument performance was checked at 12 hour intervals.

The individual 4,4'-DDT and Endrin breakdowns (%BD) were less than or equal to 15.0%.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0%.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0%.

IV. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0%.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

All internal standard areas and retention times were within QC limits.

VIII. 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.

IX. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

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

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4
Hexachlorobenzene - Data Qualification Summary - SDG 20F0392

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Laboratory Blank Data Qualification Summary - SDG 20F0392

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Field Blank Data Qualification Summary - SDG 20F0392

No Sample Data Qualified in this SDG

LDC #: 48785F3a
SDG #: 20F0392
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 08/17/20
Page: 1 of 1
Reviewer: SW
2nd Reviewer:

METHOD: GC Hexachlorobenzene (EPA SW846 Method 8081B)

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	SW/A	Cooler temp = 15.0°C (Insufficient time to cool)
II.	GC Instrument Performance Check	N	
III.	Initial calibration/ICV	A/A	ICAL ≤ 20% ICV ≤ 20%
IV.	Continuing calibration	A	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes / Not Spkd	A/A	
VIII.	Matrix spike/Matrix spike duplicates	N	
IX.	Laboratory control samples	A	LCS/D
X.	Field duplicates	N	
XI.	Compound quantitation/RL/LOQ/LODs	N	
XII.	Target compound 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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS411	20F0392-13	Sediment	06/22/20
2				
3				
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11				

Notes:

	BIG0069-BLK1						

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 19, 2020

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0392

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT301	20F0392-01	Sediment	06/22/20
LDW20-IT302	20F0392-02	Sediment	06/22/20
LDW20-IT302RE	20F0392-02RE	Sediment	06/22/20
LDW20-IT306	20F0392-03	Sediment	06/22/20
LDW20-IT306RE	20F0392-03RE	Sediment	06/22/20
LDW20-IT309	20F0392-04	Sediment	06/22/20
LDW20-IT309RE	20F0392-04RE	Sediment	06/22/20
LDW20-IT312	20F0392-05	Sediment	06/22/20
LDW20-IT312RE	20F0392-05RE	Sediment	06/22/20
LDW20-IT316	20F0392-06	Sediment	06/22/20
LDW20-IT320	20F0392-07	Sediment	06/22/20
LDW20-IT323	20F0392-08	Sediment	06/22/20
LDW20-IT308	20F0392-09	Sediment	06/22/20
LDW20-IT401	20F0392-10	Sediment	06/22/20
LDW20-IT406	20F0392-11	Sediment	06/22/20
LDW20-IT406RE	20F0392-11RE	Sediment	06/22/20
LDW20-IT411	20F0392-12	Sediment	06/22/20
LDW20-SS411	20F0392-13	Sediment	06/22/20
LDW20-SS411RE	20F0392-13RE	Sediment	06/22/20
LDW20-IT301MS	20F0392-01MS	Sediment	06/22/20
LDW20-IT301MSD	20F0392-01MSD	Sediment	06/22/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). 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) by Environmental Protection Agency (EPA) SW 846 Method 8082A

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 10.9°C and 20.3°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Standard	Column	Compound	%D	Associated Samples	Flag	A or P
07/02/20	SIG0056-SCV1	1C	Aroclor-1260	21.8	All samples in SDG 20F0392	J (all detects)	A

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

All internal standard areas and retention times were within QC limits with the following exceptions:

Sample	Column	Internal Standards	%R (Limits)	Affected Compound	Flag	A or P
LDW20-IT406	1C	Hexabromobiphenyl	49 (50-200)	Aroclor-1260	J (all detects)	A
LDW20-SS411	1C	Hexabromobiphenyl	31 (50-200)	Aroclor-1260	J (all detects)	A

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VIII. Laboratory Control Samples/Standard Reference Materials

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

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XI. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XII. Overall Assessment of Data

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

In the case where more than one result was reported for an individual sample, the least technically acceptable results were deemed not reportable as follows:

Sample	Compound	Reason	Flag	A or P
LDW20-IT302	Aroclor-1254	Results exceeded calibration range.	Not reportable	-

Sample	Compound	Reason	Flag	A or P
LDW20-IT302RE	All compounds except Aroclor-1254	Results from undiluted analyses were more usable.	Not reportable	-
LDW20-IT306 LDW20-IT309 LDW20-IT312	Aroclor-1248 Aroclor-1254	Results exceeded calibration range.	Not reportable	-
LDW20-IT306RE LDW20-IT309RE LDW20-IT312RE	All compounds except Aroclor-1248 Aroclor-1254	Results from undiluted analyses were more usable.	Not reportable	-
LDW20-IT406 LDW20-SS411	Aroclor-1260	Internal standard failure.	Not reportable	-
LDW20-IT406RE LDW20-SS411RE	All compounds except Aroclor-1260	Professional judgement.	Not reportable	-

Due to ICV %D, data were qualified as estimated in thirteen samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4
Polychlorinated Biphenyls - Data Qualification Summary - SDG 20F0392

Sample	Compound	Flag	A or P	Reason
LDW20-IT301 LDW20-IT302 LDW20-IT306 LDW20-IT309 LDW20-IT312 LDW20-IT316 LDW20-IT320 LDW20-IT323 LDW20-IT308 LDW20-IT401 LDW20-IT406RE LDW20-IT411 LDW20-SS411RE	Aroclor-1260	J (all detects)	A	Initial calibration verification (%D)
LDW20-IT302	Aroclor-1254	Not reportable	-	Overall assessment of data
LDW20-IT302RE	All compounds except Aroclor-1254	Not reportable	-	Overall assessment of data
LDW20-IT306 LDW20-IT309 LDW20-IT312	Aroclor-1248 Aroclor-1254	Not reportable	-	Overall assessment of data
LDW20-IT306RE LDW20-IT309RE LDW20-IT312RE	All compounds except Aroclor-1248 Aroclor-1254	Not reportable	-	Overall assessment of data
LDW20-IT406 LDW20-SS411	Aroclor-1260	Not reportable	-	Overall assessment of data
LDW20-IT406RE LDW20-SS411RE	All compounds except Aroclor-1260	Not reportable	-	Overall assessment of data

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 20F0392

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 20F0392

No Sample Data Qualified in this SDG

LDC #: 48785F3b
SDG #: 20F0392
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 08/17/20
Page: 1 of 1
Reviewer: DM
2nd Reviewer: Q

METHOD: GC Polychlorinated Biphenyls (EPA SW846 Method 8082A)

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 (Insufficient time to cool)
I.	Sample receipt/Technical holding times	SW/A	cooler temps. = 12.7°C, 20.3°C, 10.9°C, 15.0°C
II.	Initial calibration/ICV	A/SW	ICAL ≤ 20%, ICV ≤ 20%
III.	Continuing calibration	A	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes /IS	A/~~SW~~A	
VII.	Matrix spike/Matrix spike duplicates	A	
VIII.	Laboratory control samples	A	LCS, SRM
IX.	Field duplicates	N	
X.	Compound quantitation/RL/LOQ/LODs	N	
XI.	Target compound identification	N	
XII.	Overall assessment of data	SW	

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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-IT301	20F0392-01	Sediment	06/22/20
2	LDW20-IT302	20F0392-02	Sediment	06/22/20
3	LDW20-IT302RE	20F0392-02RE	Sediment	06/22/20
4	LDW20-IT306	20F0392-03	Sediment	06/22/20
5	LDW20-IT306RE	20F0392-03RE	Sediment	06/22/20
6	LDW20-IT309	20F0392-04	Sediment	06/22/20
7	LDW20-IT309RE	20F0392-04RE	Sediment	06/22/20
8	LDW20-IT312	20F0392-05	Sediment	06/22/20
9	LDW20-IT312RE	20F0392-05RE	Sediment	06/22/20
10	LDW20-IT316	20F0392-06	Sediment	06/22/20
11	LDW20-IT320	20F0392-07	Sediment	06/22/20
12	LDW20-IT323	20F0392-08	Sediment	06/22/20
13	LDW20-IT308	20F0392-09	Sediment	06/22/20
14	LDW20-IT401	20F0392-10	Sediment	06/22/20
15	LDW20-IT406	20F0392-11	Sediment	06/22/20
16	LDW20-IT406RE	20F0392-11RE	Sediment	06/22/20
17	LDW20-IT411	20F0392-12	Sediment	06/22/20

LDC #: 48785F3b
SDG #: 20F0392
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 8/17/20
Page: 2 of 2
Reviewer: JG
2nd Reviewer: CT

METHOD: GC Polychlorinated Biphenyls (EPA SW846 Method 8082A)

	Client ID	Lab ID	Matrix	Date
18	LDW20-SS411	20F0392-13	Sediment	06/22/20
19	LDW20-SS411RE	20F0392-13RE	Sediment	06/22/20
20	LDW20-IT301MS	20F0392-01MS	Sediment	06/22/20
21	LDW20-IT301MSD	20F0392-01MSD	Sediment	06/22/20
22				
23				
24				

Notes:

	BIG073-BLK1						

VALIDATION FINDINGS WORKSHEET

METHOD: Pesticide/PCBs (EPASW 846 Method 8081/8082)

A. alpha-BHC	K. Endrin	U. Toxaphene	EE. 2,4'-DDT	OO. trans–Heptachlor epoxide
B. beta-BHC	L. Endosulfan II	V. Aroclor-1016	FF. Hexachlorobenzene	PP. Mirex
C. delta-BHC	M. 4,4'-DDD	W. Aroclor-1221	GG. Chlordane	QQ cis-Chlordane
D. gamma-BHC	N. Endosulfan sulfate	X. Aroclor-1232	HH. Chlordane (Technical)	RR. trans-Chlordane
E. Heptachlor	O. 4,4'-DDT	Y. Aroclor-1242	II. Aroclor 1262	SS.
F. Aldrin	P. Methoxychlor	Z. Aroclor-1248	JJ. Aroclor 1268	TT.
G. Heptachlor epoxide	Q. Endrin ketone	AA. Aroclor-1254	KK. Oxychlordane	UU.
H. Endosulfan I	R. Endrin aldehyde	BB. Aroclor-1260	LL. trans-Nonachlor	VV
I. Dieldrin	S. alpha-Chlordane	CC. 2,4'-DDD	MM. cis-Nonachlor	WW.
J. 4,4'-DDE	T. gamma-Chlordane	DD. 2,4'-DDE	NN. cis–Heptachlor epoxide	XX.

Notes:_____

_____

_____

LDC #: 48785F36

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

Reviewer: JVG
2nd Reviewer:

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".
What type of initial calibration verification calculation was performed? %D or %R
(Y) N N/A Was an initial calibration verification standard analyzed after each ICAL for each instrument?
Y (N) N/A Did the initial calibration verification standards meet the %D / %R validation criteria of ≤20.0% / 80-120%?

#	Date	Standard ID	Detector/ (Column)	Compound	%D (Limit ≤ 20.0)	Associated Samples	Qualifications
	07/02/20	SIG0056-SCV1	1C	BB	21.8	All	J/UJ/A (qual BB only)

LDC #: 48785 F3b

VALIDATION FINDINGS WORKSHEET
Internal Standards

Page: 1 of 1
Reviewer: SV6
2nd Reviewer:

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were all internal standard area counts within -50 to +100 of the associated calibration standard?

Y N N/A Were the retention times of the internal standards within +/- 30 seconds of the retention times of the associated calibration standard?

#	Date	Sample ID	Internal Standard	%R ~~Area~~ (Limits)	RT (Limits)	Qualifications
	(Not reported) 14 x (Pct)		HBB (1C)	49 (50-200)		J/UJ/R (qual BB only)
		15	HBB (1C)	49		J/UJ/A
		18	HBB (1C)	31		R
			~~HBB (2C)~~	~~42~~ R		~~R~~

BNB = 1-Bromo-2-nitrobenzene
HBB = Hexabromobiphenyl

LDC #: 48785 F36

VALIDATION FINDINGS WORKSHEET
Overall Assessment of Data

Reviewer: JVG
2nd Reviewer: _____

METHOD: GC Pesticides/PCBs (EPA SW846 Method 8081/8082)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

All available information pertaining to the data were reviewed using professional judgement to compliment the determination of the overall quality of the data.

(Y) N N/A Was the overall quality and usability of the data acceptable?

#	Compound Name	Finding	Associated sample	Qualifications
	AA	> cal range	2	NR / A
	All except AA	dil	3	
	Z, AA	> cal range	4, 6, 8	
	All except Z, AA	dil	5, 7, 9	
	BB	IS failure	15, 18	
	All except BB	Prof. judgment	16, 19	

Comments: _____

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 20, 2020

Parameters: Metals

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0392

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT301	20F0392-01	Sediment	06/22/20
LDW20-IT302	20F0392-02	Sediment	06/22/20
LDW20-IT306	20F0392-03	Sediment	06/22/20
LDW20-IT309	20F0392-04	Sediment	06/22/20
LDW20-IT312	20F0392-05	Sediment	06/22/20
LDW20-IT316	20F0392-06	Sediment	06/22/20
LDW20-IT320	20F0392-07	Sediment	06/22/20
LDW20-IT323	20F0392-08	Sediment	06/22/20
LDW20-IT308	20F0392-09	Sediment	06/22/20
LDW20-IT401	20F0392-10	Sediment	06/22/20
LDW20-IT406	20F0392-11	Sediment	06/22/20
LDW20-IT411	20F0392-12	Sediment	06/22/20
LDW20-SS411	20F0392-13	Sediment	06/22/20
LDW20-IT411MS	20F0392-12MS	Sediment	06/22/20
LDW20-IT411MSD	20F0392-12MSD	Sediment	06/22/20
LDW20-IT411DUP	20F0392-12DUP	Sediment	06/22/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). 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 methods:

Arsenic, Cadmium, Chromium, Copper, Lead, Silver, and Zinc by Environmental Protection Agency (EPA) SW 846 Method 6020A
Mercury by EPA SW 846 Method 7471B

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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.

All technical holding time requirements were met.

II. ICPMS Tune

The mass calibration was within 0.1 AMU and the percent relative standard deviation (%RSD) was less than or equal to 5%.

III. Instrument Calibration

Initial and continuing calibrations were performed as required by the methods.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

IV. ICP Interference Check Sample Analysis

The frequency of interference check sample (ICS) analysis was met. All criteria were within QC limits.

V. Laboratory Blanks

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

Blank ID	Analyte	Maximum Concentration	Associated Samples
ICB/CCB	Chromium	0.27 mg/Kg	LDW20-SS411 LDW20-IT411DUP

Data qualification by the laboratory blanks was based on the maximum contaminant concentration in the laboratory blanks in the analysis of each analyte. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW20-IT411MS/MSD (LDW20-SS411 LDW20-IT411DUP)	Lead	0.148 (75-125)	26.8 (75-125)	J (all detects)	A

For LDW20-IT411MS/MSD, although the percent recoveries were severely low for lead, the associated sample results were qualified as estimated (J/UJ) since the post digestion spike recoveries were within the QC limits for this analyte.

Relative percent differences (RPD) were within QC limits.

VIII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits with the following exceptions:

DUP ID (Associated Samples)	Analyte	RPD (Limits)	Difference (Limits)	Flag	A or P
LDW20-IT411DUP (LDW20-SS411 LDW20-IT411DUP)	Lead	60.9 (≤20)	-	J (all detects)	A

IX. Serial Dilution

Serial dilution was not performed for this SDG.

X. Laboratory Control Samples

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

XI. Field Duplicates

No field duplicates were identified in this SDG.

XII. Internal Standards (ICP-MS)

Raw data were not reviewed for Stage 2B validation.

XIII. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

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

Due to MS/MSD %R and DUP RPD, data were qualified as estimated in two samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4
Metals - Data Qualification Summary - SDG 20F0392

Sample	Analyte	Flag	A or P	Reason
LDW20-SS411 LDW20-IT411DUP	Lead	J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)
LDW20-SS411 LDW20-IT411DUP	Lead	J (all detects)	A	Duplicate sample analysis (RPD)

Duwamish AOC4
Metals - Laboratory Blank Data Qualification Summary - SDG 20F0392

No Sample Data Qualified in this SDG

Duwamish AOC4
Metals - Field Blank Data Qualification Summary - SDG 20F0392

No Sample Data Qualified in this SDG

LDC #: 48785F4a

SDG #: 20F0392

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 8/19/20

Page: 1 of 2

Reviewer:

2nd Reviewer:

METHOD: Metals (EPA SW 846 Method 6020A/7471B)

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.	ICP/MS Tune	A	
III.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	SW	
VI.	Field Blanks	N	
VII.	Matrix Spike/Matrix Spike Duplicates	SW	
VIII.	Duplicate sample analysis	SW	
IX.	Serial Dilution	N	
X.	Laboratory control samples	A	LCS
XI.	Field Duplicates	N	
XII.	Internal Standard (ICP-MS)	N	not reviewed
XIII.	Sample Result Verification	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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-IT301	20F0392-01	Sediment	06/22/20
2	LDW20-IT302	20F0392-02	Sediment	06/22/20
3	LDW20-IT306	20F0392-03	Sediment	06/22/20
4	LDW20-IT309	20F0392-04	Sediment	06/22/20
5	LDW20-IT312	20F0392-05	Sediment	06/22/20
6	LDW20-IT316	20F0392-06	Sediment	06/22/20
7	LDW20-IT320	20F0392-07	Sediment	06/22/20
8	LDW20-IT323	20F0392-08	Sediment	06/22/20
9	LDW20-IT308	20F0392-09	Sediment	06/22/20
10	LDW20-IT401	20F0392-10	Sediment	06/22/20
11	LDW20-IT406	20F0392-11	Sediment	06/22/20
12	LDW20-IT411	20F0392-12	Sediment	06/22/20
13	LDW20-SS411	20F0392-13	Sediment	06/22/20
14	LDW20-IT411MS	20F0392-12MS	Sediment	06/22/20
15	LDW20-IT411MSD	20F0392-12MSD	Sediment	06/22/20

LDC #: 48785F4a

SDG #: 20F0392

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 8/19/20

Reviewer:

2nd Reviewer:

METHOD: Metals (EPA SW 846 Method 6020A/7471B)

	Client ID	Lab ID	Matrix	Date
16	LDW20-IT411DUP	20F0392-12DUP	Sediment	06/22/20
17				
18				
19				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
13	As, Cd, Cr, Cu, Pb, Ag, Zn, Hg
1 to 12	As
QC: 14-16	As, Cd, Cr, Cu, Pb, Ag, Zn

Analysis Method

ICP	
ICP-MS	As, Cd, Cr, Cu, Pb, Ag, Zn
CVAA	Hg

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)
Soil preparation factor applied (if applicable):

Sample Concentration, unless otherwise noted: mg/Kg Associated Samples: 13, 16

				Sample Identification									
Analyte	**PB (mg/Kg)**	**Maximum ICB/CCB (ug/L)**	**Action Level**	No Qual									
Cr	0.27												

Comments: The listed analyte concentrtaion is the highest ICB or CCB detected in the analysis. The action level, when applicable, is established at 5X the highest ICB, CCB, or PB concentration.

VALIDATION FINDINGS WORKSHEETS
Matrix Spike/Matrix Spike Duplicates

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)

MS/MSD analysis was performed by the laboratory. All MS/MSD percent recoveries (%R) and relative percent differences (RPDs) were within the acceptable limits with the following exceptions:

MS/MSD ID	Matrix	Analyte	MS %R	MSD %R	%R Limit	RPD	RPD Limit	Associated Samples	Qualification	Det/ND
14, 15	s	Pb	0.148	26.8	75-125			16, 13	J/UJ/A*	Det
									*(PS=98.3)	

Comments:

Laboratory Duplicates

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)

Laboratory duplicate analysis was performed by the laboratory. All laboratory duplicates were with the relative percent difference (RPD) for samples >5X the reporting limits with the exceptions listed below. If samples were <5X the reporting limits, the difference was within 1X the reporting limit for water samples and within 2X the reporting limit for soil samples for all samples with the exceptions listed below.

Duplicate ID	Matrix	Analyte	RPD	RPD Limit	Difference (units)	Difference Limit	Associated Samples	Qualification	Det/ND
16	s	Pb	60.9	20			16, 13	J/UJ/A	Det

Comments:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 20, 2020

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0392

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT301	20F0392-01	Sediment	06/22/20
LDW20-IT302	20F0392-02	Sediment	06/22/20
LDW20-IT306	20F0392-03	Sediment	06/22/20
LDW20-IT309	20F0392-04	Sediment	06/22/20
LDW20-IT312	20F0392-05	Sediment	06/22/20
LDW20-IT316	20F0392-06	Sediment	06/22/20
LDW20-IT320	20F0392-07	Sediment	06/22/20
LDW20-IT323	20F0392-08	Sediment	06/22/20
LDW20-IT308	20F0392-09	Sediment	06/22/20
LDW20-IT401	20F0392-10	Sediment	06/22/20
LDW20-IT406	20F0392-11	Sediment	06/22/20
LDW20-IT411	20F0392-12	Sediment	06/22/20
LDW20-SS411	20F0392-13	Sediment	06/22/20
LDW20-IT306DUP	20F0392-03DUP	Sediment	06/22/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). 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 methods:

Total Organic Carbon by Environmental Protection Agency (EPA) SW 846 Method 9060A
Total Solids by Standard Method 2540G

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration of each method were met.

III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met for each method when applicable.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. 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.

VII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

VIII. Laboratory Control Samples/Standard Reference Materials

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

Standard reference materials (SRM) were analyzed as required by the methods. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

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

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4
Wet Chemistry - Data Qualification Summary - SDG 20F0392

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 20F0392

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 20F0392

No Sample Data Qualified in this SDG

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 19, 2020

Parameters: Polychlorinated Dioxins/Dibenzofurans

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0392

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT301	20F0392-01	Sediment	06/22/20
LDW20-IT312	20F0392-05	Sediment	06/22/20
LDW20-IT320	20F0392-07	Sediment	06/22/20
LDW20-IT406	20F0392-11	Sediment	06/22/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for High Resolution Superfund Methods Data Review (April 2016). 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 Dioxins/Dibenzofurans by Environmental Protection Agency (EPA) Method 1613B

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 10.9°C and 20.3°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required frequency.

Retention time windows were established for all homologues. The chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomer was less than or equal to 25%.

The static resolving power was at least 10,000 (10% valley definition).

III. Initial Calibration and Initial Calibration Verification

A five point initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for unlabeled compounds and less than or equal to 35.0% for labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were within the QC limits for unlabeled compounds and labeled compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

All of the continuing calibration results were within the QC limits for unlabeled compounds and labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

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	Compound	Concentration	Associated Samples
BIG0062-BLK1	07/09/20	1,2,3,4,6,7,8-HpCDF 1,2,3,4,6,7,8-HpCDD OCDF OCDD	0.0645 ng/Kg 0.319 ng/Kg 0.727 ng/Kg 2.68 ng/Kg	All samples in SDG 20F0392

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Compound	Reported Concentration	Modified Final Concentration
LDW20-IT320	OCDF	2.68 ng/Kg	2.68U ng/Kg

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/Standard Reference Materials

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

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Labeled Compounds

All percent recoveries (%R) for labeled compounds used to quantitate target compounds were within QC limits.

XI. Compound Quantitation

All compound quantitations were within validation criteria with the following exceptions:

Sample	Compound	Flag	A or P
All samples in SDG 20F0392	All compounds reported as estimated maximum possible concentration (EMPC) and greater than the reporting limit.	J (all detects)	A
All samples in SDG 20F0392	All compounds reported as estimated maximum possible concentration (EMPC) and less than the reporting limit.	U (all non-detects)	A
LDW20-IT406	All compounds flagged "X" due to chlorinated diphenyl ether (CDPE) interference.	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B 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 compounds reported as EMPC and CDPE interference, data were qualified as estimated or not detected in four samples.

Due to laboratory blank contamination, data were qualified as not detected in one sample.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Data Qualification Summary - SDG 20F0392

Sample	Compound	Flag	A or P	Reason
LDW20-IT301 LDW20-IT312 LDW20-IT320 LDW20-IT406	All compounds reported as estimated maximum possible concentration (EMPC) and greater than the reporting limit.	J (all detects)	A	Compound quantitation (EMPC)
LDW20-IT301 LDW20-IT312 LDW20-IT320 LDW20-IT406	All compounds reported as estimated maximum possible concentration (EMPC) and less than the reporting limit.	U (all non-detects)	A	Compound quantitation (EMPC)
LDW20-IT406	All compounds flagged "X" due to chlorinated diphenyl ether (CDPE) interference.	J (all detects)	A	Compound quantitation

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG 20F0392

Sample	Compound	Modified Final Concentration	A or P
LDW20-IT320	OCDF	2.68U ng/Kg	

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Field Blank Data Qualification Summary - SDG 20F0392

No Sample Data Qualified in this SDG

LDC #: 48785F21 **VALIDATION COMPLETENESS WORKSHEET** Date: 08/17/20
SDG #: 20F0392 Stage 2B Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer: JVG
2nd Reviewer:

METHOD: HRGC/HRMS Polychlorinated Dioxins/Dibenzofurans (EPA Method 1613B)

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	SW / A	Cooler temps = 12.7°C, 10.9°C, 20.3°C (insufficient time to cool)
II.	HRGC/HRMS Instrument performance check	A	
III.	Initial calibration/ICV	A / A	ICAL ≤ 20/35 ? ICV ≤ QC limits
IV.	Continuing calibration	A	CCV ≤ QC limits
V.	Laboratory Blanks	SW	
VI.	Field blanks	N	
VII.	Matrix spike/Matrix spike duplicates	N	
VIII.	Laboratory control samples	A	LCS, SRM
IX.	Field duplicates	N	
X.	Labeled Compounds	A	
XI.	Compound quantitation RL/LOQ/LODs	~~A~~ N	EMPC = J dets (>RL); U (<RL)
XII.	Target compound identification	N	
XIII.	System performance	N	
XIV.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	LDW20-IT301	20F0392-01	Sediment	06/22/20
2	LDW20-IT312	20F0392-05	Sediment	06/22/20
3	LDW20-IT320	20F0392-07	Sediment	06/22/20
4	LDW20-IT406	20F0392-11	Sediment	06/22/20
5				
6				
7				
8				
9				
10				

Notes:

+	BIG0062_BLK1						

VALIDATION FINDINGS WORKSHEET

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

A. 2,3,7,8-TCDD	F. 1,2,3,4,6,7,8-HpCDD	K. 1,2,3,4,7,8-HxCDF	P. 1,2,3,4,7,8,9-HpCDF	U. Total HpCDD
B. 1,2,3,7,8-PeCDD	G. OCDD	L. 1,2,3,6,7,8-HxCDF	Q. OCDF	V. Total TCDF
C. 1,2,3,4,7,8-HxCDD	H. 2,3,7,8-TCDF	M. 2,3,4,6,7,8-HxCDF	R. Total TCDD	W. Total PeCDF
D. 1,2,3,6,7,8-HxCDD	I. 1,2,3,7,8-PeCDF	N. 1,2,3,7,8,9-HxCDF	S. Total PeCDD	X. Total HxCDF
E. 1,2,3,7,8,9-HxCDD	J. 2,3,4,7,8-PeCDF	O. 1,2,3,4,6,7,8-HpCDF	T. Total HxCDD	Y. Total HpCDF

Notes:_____

LDC #: 48785 F21

VALIDATION FINDINGS WORKSHEET
Blanks

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

(Y) N N/A Were all samples associated with a method blank?
Y (N) N/A Was a method blank performed for each matrix and whenever a sample extraction was performed?
Y (N) N/A Was the method blank contaminated?

Blank extraction date: 07/09/20 **Blank analysis date:** 07/10/20 **Associated samples:** All

Conc. units: ng/kg

Compound	Blank ID	Sample Identification								
	BIG0062	Blk1 (5X)		3						
O	0.0645*	0.3225		~~0.223~~ JVG 2.68*/U						
F	0.319 *	1.595								
Q	0.727 *	3.635		2.68*/U						
G	2.68	13.4								
* EMPC										

Blank extraction date: _____ **Blank analysis date:** _____

Conc. units: _____ Associated Samples: _____

Compound	Blank ID	Sample Identification								

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
All contaminants within five times the method blank concentration were qualified as not detected, "U".

LDC #: 48785P1

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported RLs

Page: 1 of 1
Reviewer: _____
2nd Reviewer: _____

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B/SGS AXYS Method MLA-017)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were the correct labeled compound, quantitation ions and relative response factors (RRF) used to quantitate the compound?
Y N N/A Compound quantitation and RLs were adjusted to reflect all sample dilutions and dry weight factors (if necessary).

#	Date	Sample ID	Finding	Associated Samples	Qualifications
		All	All results flagged as EMPC		Jdets/A
		4	All results flagged "X" by the lab due to chlorinated		Jdets/A
			diphenyl ether (CDPE) interference		

Comments: See sample calculation verification worksheet for recalculations

LDC #: 48785F6 **VALIDATION COMPLETENESS WORKSHEET** Date: 8/9/20
SDG #: 20F0392 Stage 2B Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM 2540G)

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	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	A	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	CS
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	A	LCS, SRM
IX.	Field duplicates	N	
X.	Sample result verification	N	
XI	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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-IT301	20F0392-01	Sediment	06/22/20
2	LDW20-IT302	20F0392-02	Sediment	06/22/20
3	LDW20-IT306	20F0392-03	Sediment	06/22/20
4	LDW20-IT309	20F0392-04	Sediment	06/22/20
5	LDW20-IT312	20F0392-05	Sediment	06/22/20
6	LDW20-IT316	20F0392-06	Sediment	06/22/20
7	LDW20-IT320	20F0392-07	Sediment	06/22/20
8	LDW20-IT323	20F0392-08	Sediment	06/22/20
9	LDW20-IT308	20F0392-09	Sediment	06/22/20
10	LDW20-IT401	20F0392-10	Sediment	06/22/20
11	LDW20-IT406	20F0392-11	Sediment	06/22/20
12	LDW20-IT411	20F0392-12	Sediment	06/22/20
13	LDW20-SS411	20F0392-13	Sediment	06/22/20
14	LDW20-IT306DUP	20F0392-03DUP	Sediment	06/22/20
15				
16				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1 to 13	Total solids, TOC
QC: 14	TS

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 19, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0407

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS306	20F0407-01	Sediment	06/23/20
LDW20-SS308	20F0407-02	Sediment	06/23/20
LDW20-SS401	20F0407-03	Sediment	06/23/20
LDW20-SS406	20F0407-04	Sediment	06/23/20
LDW20-SS415	20F0407-05	Sediment	06/23/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). 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:

Semivolatile Organic Compounds (SVOCs) by Environmental Protection Agency (EPA) SW 846 Method 8270E

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 16.0°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. 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.

IX. Laboratory Control Samples/Standard Reference Materials

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

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

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

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4
Semivolatiles - Data Qualification Summary - SDG 20F0407

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0407

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0407

No Sample Data Qualified in this SDG

LDC #: 48785G2a
SDG #: 20F0407
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 08/17/20
Page: 1 of 1
Reviewer:
2nd Reviewer:

METHOD: GC/MS Semivolatiles (EPA SW 846 Method 8270E)

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	SW / A	Cooler temp. = 16.0°C (Insufficient time to cool)
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A / A	ICAL ≤ 20% ICV ≤ 30%
IV.	Continuing calibration	A	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	N	
IX.	Laboratory control samples	A	LCS SRM
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS306	20F0407-01	Sediment	06/23/20
2	LDW20-SS308	20F0407-02	Sediment	06/23/20
3	LDW20-SS401	20F0407-03	Sediment	06/23/20
4	LDW20-SS406	20F0407-04	Sediment	06/23/20
5	LDW20-SS415	20F0407-05	Sediment	06/23/20
6				
7				
8				
9				

Notes:

	BIG0210-BLK1						

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 20, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0407

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS306	20F0407-01	Sediment	06/23/20
LDW20-SS308	20F0407-02	Sediment	06/23/20
LDW20-SS401	20F0407-03	Sediment	06/23/20
LDW20-SS406	20F0407-04	Sediment	06/23/20
LDW20-SS415	20F0407-05	Sediment	06/23/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). 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:

Semivolatile Organic Compounds (SVOCs) by Environmental Protection Agency (EPA) SW 846 Method 8270E in Selected Ion Monitoring (SIM) mode

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 16.0°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For compounds where average relative response factors (RRFs) were utilized, percent relative standard deviations (%RSD) were less than or equal to 20.0%.

In the case where the laboratory used a calibration curve to evaluate the compounds, all coefficients of determination (r^2) were greater than or equal to 0.990.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all compounds with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
06/26/20	N-Nitrosodiphenylamine	41.9	All samples in SDG 20F0407	J (all detects) UJ (all non-detects)	A

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
07/15/20	Benzyl alcohol	22.0	All samples in SDG 20F0407	J (all detects) UJ (all non-detects)	A
	Pentachlorophenol	28.7		J (all detects) UJ (all non-detects)	

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. 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.

IX. Laboratory Control Samples/Standard Reference Materials

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

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

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

Due to ICV %D and continuing calibration %D, data were qualified as estimated in five samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4
Semivolatiles – Data Qualification Summary - SDG 20F0407

Sample	Compound	Flag	A or P	Reason
LDW20-SS306 LDW20-SS308 LDW20-SS401 LDW20-SS406 LDW20-SS415	N-Nitrosodiphenylamine	J (all detects) UJ (all non-detects)	A	Initial calibration verification (%D)
LDW20-SS306 LDW20-SS308 LDW20-SS401 LDW20-SS406 LDW20-SS415	Benzyl alcohol Pentachlorophenol	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	A	Continuing calibration (%D)

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0407

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0407

No Sample Data Qualified in this SDG

LDC #: 48785G2b **VALIDATION COMPLETENESS WORKSHEET** Date: 08/17/20
SDG #: 20F0407 Stage 2B Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer: JAC
2nd Reviewer: [illegible]

METHOD: GC/MS ~~Polynuclear Aromatic Hydrocarbons~~ SVOA (EPA SW 846 Method 8270E-SIM)

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	SW / A	Cooler temp. = 16.0°C (Insufficient time to cool)
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A / SW	ICAL ≤ 20% r ICV ≤ 30%
IV.	Continuing calibration	SW	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	N	
IX.	Laboratory control samples	A	LCS, SRM
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS306	20F0407-01	Sediment	06/23/20
2	LDW20-SS308	20F0407-02	Sediment	06/23/20
3	LDW20-SS401	20F0407-03	Sediment	06/23/20
4	LDW20-SS406	20F0407-04	Sediment	06/23/20
5	LDW20-SS415	20F0407-05	Sediment	06/23/20
6				
7				
8				
9				

Notes:

	BIG0210-BLK2						

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

A. Phenol	AA. 2-Chloronaphthalene	AAA. Butylbenzylphthalate	AAAA. Dibenzothiophene	A1. N-Nitrosodiethylamine
B. Bis (2-chloroethyl) ether	BB. 2-Nitroaniline	BBB. 3,3'-Dichlorobenzidine	BBBB. Benzo(a)fluoranthene	B1. N-Nitrosodi-n-butylamine
C. 2-Chlorophenol	CC. Dimethylphthalate	CCC. Benzo(a)anthracene	CCCC. Benzo(b)fluorene	C1. N-Nitrosomethylethylamine
D. 1,3-Dichlorobenzene	DD. Acenaphthylene	DDD. Chrysene	DDDD. cis/trans-Decalin	D1. N-Nitrosomorpholine
E. 1,4-Dichlorobenzene	EE. 2,6-Dinitrotoluene	EEE. Bis(2-ethylhexyl)phthalate	EEEE. Biphenyl	E1. N-Nitrosopyrrolidine
F. 1,2-Dichlorobenzene	FF. 3-Nitroaniline	FFF. Di-n-octylphthalate	FFFF. Retene	F1. Phenacetin
G. 2-Methylphenol	GG. Acenaphthene	GGG. Benzo(b)fluoranthene	GGGG. C30-Hopane	G1. 2-Acetylaminofluorene
H. 2,2'-Oxybis(1-chloropropane)	HH. 2,4-Dinitrophenol	HHH. Benzo(k)fluoranthene	HHHH. 1-Methylphenanthrene	H1. Pronamide
I. 4-Methylphenol	II. 4-Nitrophenol	III. Benzo(a)pyrene	IIII. 1,4-Dioxane	I1. Methyl methanesulfonate
J. N-Nitroso-di-n-propylamine	JJ. Dibenzofuran	JJJ. Indeno(1,2,3-cd)pyrene	JJJJ. Acetophenone	J1. Ethyl methanesulfonate
K. Hexachloroethane	KK. 2,4-Dinitrotoluene	KKK. Dibenz(a,h)anthracene	KKKK. Atrazine	K1. o,o',o''-Triethylphosphorothioate
L. Nitrobenzene	LL. Diethylphthalate	LLL. Benzo(g,h,i)perylene	LLLL. Benzaldehyde	L1. n-Phenylene diamine
M. Isophorone	MM. 4-Chlorophenyl-phenyl ether	MMM. Bis(2-Chloroisopropyl)ether	MMMM. Caprolactam	M1. 1,4-Naphthoquinone
N. 2-Nitrophenol	NN. Fluorene	NNN. Aniline	NNNN. 2,6-Dichlorophenol	N1. N-Nitro-o-toluidine
O. 2,4-Dimethylphenol	OO. 4-Nitroaniline	OOO. N-Nitrosodimethylamine	OOOO. 1,2-Diphenylhydrazine	O1. 1,3,5-Trinitrobenzene
P. Bis(2-chloroethoxy)methane	PP. 4,6-Dinitro-2-methylphenol	PPP. Benzoic Acid	PPPP. 3-Methylphenol	P1. Pentachlorobenzene
Q. 2,4-Dichlorophenol	QQ. N-Nitrosodiphenylamine	QQQ. Benzyl alcohol	QQQQ. 3&4-Methylphenol	Q1. 4-Aminobiphenyl
R. 1,2,4-Trichlorobenzene	RR. 4-Bromophenyl-phenylether	RRR. Pyridine	RRRR. 4-Dimethyldibenzothiophene (4MDT)	R1. 2-Naphthylamine
S. Naphthalene	SS. Hexachlorobenzene	SSS. Benzidine	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	S1. Triphenylene
T. 4-Chloroaniline	TT. Pentachlorophenol	TTT. 1-Methylnaphthalene	TTTT. 1-Methyldibenzothiophene (1MDT)	T1. Octachlorostyrene
U. Hexachlorobutadiene	UU. Phenanthrene	UUU.Benzo(b)thiophene	UUUU.. 2,3,4,6-Tetrachlorophenol	U1. Famphur
V. 4-Chloro-3-methylphenol	VV. Anthracene	VVV.Benzonaphthothiophene	VVVV. 1,2,4,5-Tetrachlorobenzene	V1. 1,4-phenylenediamine
W. 2-Methylnaphthalene	WW. Carbazole	WWW.Benzo(e)pyrene	WWWW.. 2-Picoline	W1. Methapyrilene
X. Hexachlorocyclopentadiene	XX. Di-n-butylphthalate	XXX. 2,6-Dimethylnaphthalene	XXXX. 3-Methylcholanthrene	X1. Pentachloroethane
Y. 2,4,6-Trichlorophenol	YY. Fluoranthene	YYY. 2,3,5-Trimethylnaphthalene	YYYY. a,a-Dimethylphenethylamine	Y1. 3,3'-Dimethylbenzidine
Z. 2,4,5-Trichlorophenol	ZZ. Pyrene	ZZZ. Perylene	ZZZZ. Hexachloropropene	Z1. o-Toluidine

LDC #: 48785G26

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: [signature]

METHOD: GC/MS SVOA (EPA SW 846 Method 8270~~C~~ E-SIM)
Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

(Y) N N/A Was an initial calibration verification standard analyzed after each ICAL for each instrument?
Y (N) N/A Were all %D within the validation criteria of ≤~~20~~/30% %D ?

#	Date	Standard ID	Compound	Finding %D (Limit: ≤~~20.0%~~/(30%))	Associated Samples	Qualifications
	04/26/20	SIF0393-SCV1	QQ	41.9	All (ND + Det)	J/UJ/A

ICVsvoa.wpd

LDC #: 48785G26

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD: GC/MS BNA (EPA SW 846 Method 8270~~C~~ D-SIM)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

~~Y~~ N N/A Was a continuing calibration standard analyzed at least once every 12 hours of sample analysis for each instrument?

Y N N/A Were percent differences (%D) and relative response factors (RRF) within method criteria for all CCC's and SPCC's ?

Y (N) N/A Were all %D and RRFs within the validation criteria of ≤20 %D and ≥0.05 RRF ?

#	Date	Standard ID	Compound	Finding %D (Limit: ≤20.0%)	Finding RRF (Limit: ≥0.05)	Associated Samples	Qualifications
	07/15/20	NT10200715035	QQQ	22.0		All (ND + Det)	J/UJ/A
			TT	28.7			

CONCAL.wpd

LDC Report# 48785G3a

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 20, 2020

Parameters: Hexachlorobenzene

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0407

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS306	20F0407-01	Sediment	06/23/20
LDW20-SS308	20F0407-02	Sediment	06/23/20
LDW20-SS401	20F0407-03	Sediment	06/23/20
LDW20-SS406	20F0407-04	Sediment	06/23/20
LDW20-SS415	20F0407-05	Sediment	06/23/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). 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:

Hexachlorobenzene by Environmental Protection Agency (EPA) SW 846 Method 8081B

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 16.0°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC Instrument Performance Check

Instrument performance was checked at 12 hour intervals.

The individual 4,4'-DDT and Endrin breakdowns (%BD) were less than or equal to 15.0%.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0%.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0%.

IV. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0%.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

All internal standard areas and retention times were within QC limits.

VIII. 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.

IX. Laboratory Control Samples

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

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

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

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4
Hexachlorobenzene - Data Qualification Summary - SDG 20F0407

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Laboratory Blank Data Qualification Summary - SDG 20F0407

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Field Blank Data Qualification Summary - SDG 20F0407

No Sample Data Qualified in this SDG

LDC #: 48785G3a
SDG #: 20F0407
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 08/17/20
Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD: GC Hexachlorobenzene (EPA SW846 Method 8081B)

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	SW / A	Cooler temp. = 16.0°C (Insufficient time to cool)
II.	GC Instrument Performance Check	N	
III.	Initial calibration/ICV	A / A	ICAL ≤ 20% ICV ≤ 20%
IV.	Continuing calibration	A	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes /Int. Stnd	A/A	
VIII.	Matrix spike/Matrix spike duplicates	N	
IX.	Laboratory control samples	A	LCS
X.	Field duplicates	N	
XI.	Compound quantitation/RL/LOQ/LODs	N	
XII.	Target compound 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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS306	20F0407-01	Sediment	06/23/20
2	LDW20-SS308	20F0407-02	Sediment	06/23/20
3	LDW20-SS401	20F0407-03	Sediment	06/23/20
4	LDW20-SS406	20F0407-04	Sediment	06/23/20
5	LDW20-SS415	20F0407-05	Sediment	06/23/20
6				
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9				
10				
11				

Notes:

—	BIG0212-BLK1						

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 19, 2020

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0407

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS306	20F0407-01	Sediment	06/23/20
LDW20-SS308	20F0407-02	Sediment	06/23/20
LDW20-SS401	20F0407-03	Sediment	06/23/20
LDW20-SS406	20F0407-04	Sediment	06/23/20
LDW20-SS415	20F0407-05	Sediment	06/23/20
LDW20-SS415RE	20F0407-05RE	Sediment	06/23/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). 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) by Environmental Protection Agency (EPA) SW 846 Method 8082A

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 16.0°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Standard	Column	Compound	%D	Associated Samples	Flag	A or P
07/02/20	SIG0056-SCV1	1C	Aroclor-1260	21.8	All samples in SDG 20F0407	J (all detects)	A

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

All internal standard areas and retention times were within QC limits.

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/Standard Reference Materials

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

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Compound Quantitation

The sample results for detected compounds from the two columns were within 40% relative percent difference (RPD) with the following exceptions:

Sample	Compound	RPD	Flag	A or P
LDW20-SS306	Aroclor-1260	40.2	J (all detects)	A
LDW20-SS308	Aroclor-1260	42.8	J (all detects)	A
LDW20-SS401	Aroclor-1254 Aroclor-1260	42 48.8	J (all detects) J (all detects)	A
LDW20-SS406	Aroclor-1242 Aroclor-1254	48.2 40.6	J (all detects) J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XI. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XII. Overall Assessment of Data

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

In the case where more than one result was reported for an individual sample, the least technically acceptable results were deemed not reportable as follows:

Sample	Compound	Reason	Flag	A or P
LDW20-SS415	Aroclor-1242 Aroclor-1254	Results exceeded calibration range.	Not reportable	-
LDW20-SS415RE	All compounds except Aroclor-1242 Aroclor-1254	Results from undiluted analyses were more usable.	Not reportable	-

Due to ICV %D and RPD between two columns, data were qualified as estimated in five samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4
Polychlorinated Biphenyls - Data Qualification Summary - SDG 20F0407

Sample	Compound	Flag	A or P	Reason
LDW20-SS306 LDW20-SS308 LDW20-SS401 LDW20-SS406 LDW20-SS415	Aroclor-1260	J (all detects)	A	Initial calibration verification (%D)
LDW20-SS306 LDW20-SS308	Aroclor-1260	J (all detects)	A	Compound quantitation (RPD between two columns)
LDW20-SS401	Aroclor-1254 Aroclor-1260	J (all detects) J (all detects)	A	Compound quantitation (RPD between two columns)
LDW20-SS406	Aroclor-1242 Aroclor-1254	J (all detects) J (all detects)	A	Compound quantitation (RPD between two columns)
LDW20-SS415	Aroclor-1242 Aroclor-1254	Not reportable	-	Overall assessment of data
LDW20-SS415RE	All compounds except Aroclor-1242 Aroclor-1254	Not reportable	-	Overall assessment of data

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 20F0407

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 20F0407

No Sample Data Qualified in this SDG

LDC #: 48785G3b
SDG #: 20F0407
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 08/17/20
Page: 1 of 1
Reviewer: DK
2nd Reviewer: [illegible]

METHOD: GC Polychlorinated Biphenyls (EPA SW846 Method 8082A)

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	SW/A	Cooler temp = 16.0°C (Insufficient time to cool)
II.	Initial calibration/ICV	A/SW	ICAL ∈ 20% ICV ≤ 20%
III.	Continuing calibration	A	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes /IS	A/A	
VII.	Matrix spike/Matrix spike duplicates	N	
VIII.	Laboratory control samples	A	LCS, SRM
IX.	Field duplicates	N	
X.	Compound quantitation/RL/LOQ/LODs	SW	
XI.	Target compound identification	N	
XII.	Overall assessment of data	SW	

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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS306	20F0407-01	Sediment	06/23/20
2	LDW20-SS308	20F0407-02	Sediment	06/23/20
3	LDW20-SS401	20F0407-03	Sediment	06/23/20
4	LDW20-SS406	20F0407-04	Sediment	06/23/20
5	LDW20-SS415	20F0407-05	Sediment	06/23/20
6	LDW20-SS415RE	20F0407-05RE	Sediment	06/23/20
7				
8				
9				
10				
11				
12				
13				

Notes:

	BIG0214-BLK1						

VALIDATION FINDINGS WORKSHEET

METHOD: Pesticide/PCBs (EPASW 846 Method 8081/8082)

A. alpha-BHC	K. Endrin	U. Toxaphene	EE. 2,4'-DDT	OO. trans–Heptachlor epoxide
B. beta-BHC	L. Endosulfan II	V. Aroclor-1016	FF. Hexachlorobenzene	PP. Mirex
C. delta-BHC	M. 4,4'-DDD	W. Aroclor-1221	GG. Chlordane	QQ cis-Chlordane
D. gamma-BHC	N. Endosulfan sulfate	X. Aroclor-1232	HH. Chlordane (Technical)	RR. trans-Chlordane
E. Heptachlor	O. 4,4'-DDT	Y. Aroclor-1242	II. Aroclor 1262	SS.
F. Aldrin	P. Methoxychlor	Z. Aroclor-1248	JJ. Aroclor 1268	TT.
G. Heptachlor epoxide	Q. Endrin ketone	AA. Aroclor-1254	KK. Oxychlordane	UU.
H. Endosulfan I	R. Endrin aldehyde	BB. Aroclor-1260	LL. trans-Nonachlor	VV
I. Dieldrin	S. alpha-Chlordane	CC. 2,4'-DDD	MM. cis-Nonachlor	WW.
J. 4,4'-DDE	T. gamma-Chlordane	DD. 2,4'-DDE	NN. cis–Heptachlor epoxide	XX.

Notes:_____

_____

_____

LDC #: 48785G36

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

Reviewer: JVG
2nd Reviewer:

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".
What type of initial calibration verification calculation was performed? %D or %R
Y N N/A Was an initial calibration verification standard analyzed after each ICAL for each instrument?
Y N N/A Did the initial calibration verification standards meet the %D / %R validation criteria of ≤20.0% / 80-120%?

#	Date	Standard ID	Detector/ Column	Compound	%D (Limit ≤ 20.0)	Associated Samples	Qualifications
	07/02/20	SIG0056-SCV1	1C	BB	21.8	All (Det)	J (UJ/A (qual BB only)

LDC #: 48785G36

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD: / GC __ HPLC

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Level IV/D Only

(Y) N N/A Were CRQLs adjusted for sample dilutions, dry weight factors, etc.?
(Y) N N/A Did the reported results for detected target compounds agree within 10.0% of the recalculated results?
Y (N) N/A Did the percent difference of detected compounds between two columns./detectors ≤40%?
If no, please see findings bellow.

#	Compound Name	Sample ID	(%RPD)/%D Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	BB	1	40.2	J dets / A
	BB	2	42.8	
	AA	3	42	
	BB	↓	48.8	
	Y	4	48.2	
	AA	↓	40.6	

Comments: See sample calculation verification worksheet for recalculations

LDC #: 48785 G3b

VALIDATION FINDINGS WORKSHEET
Overall Assessment of Data

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD: GC Pesticides/PCBs (EPA SW846 Method 8081/8082)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

All available information pertaining to the data were reviewed using professional judgement to compliment the determination of the overall quality of the data.

(Y) N N/A Was the overall quality and usability of the data acceptable?

#	Compound Name	Finding	Associated sample	Qualifications
	Y, AA	> cal range	5	NR / A
	All except Y, AA	dil	6	↓

Comments: _____

OVR cpd.wpd

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 20, 2020

Parameters: Metals

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0407

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS306	20F0407-01	Sediment	06/23/20
LDW20-SS308	20F0407-02	Sediment	06/23/20
LDW20-SS401	20F0407-03	Sediment	06/23/20
LDW20-SS406	20F0407-04	Sediment	06/23/20
LDW20-SS415	20F0407-05	Sediment	06/23/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). 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 methods:

Arsenic, Cadmium, Chromium, Copper, Lead, Silver, and Zinc by Environmental Protection Agency (EPA) SW 846 Method 6020A
Mercury by EPA SW 846 Method 7471B

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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.

All technical holding time requirements were met.

II. ICPMS Tune

The mass calibration was within 0.1 AMU and the percent relative standard deviation (%RSD) was less than or equal to 5%.

III. Instrument Calibration

Initial and continuing calibrations were performed as required by the methods.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

IV. ICP Interference Check Sample Analysis

The frequency of interference check sample (ICS) analysis was met. All criteria were within QC limits.

V. Laboratory Blanks

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

Blank ID	Analyte	Maximum Concentration	Associated Samples
PB (prep blank)	Mercury	0.0224 mg/Kg	All samples in SDG 20F0407

Data qualification by the laboratory blanks was based on the maximum contaminant concentration in the laboratory blanks in the analysis of each analyte. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VIII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

IX. Serial Dilution

Serial dilution was not performed for this SDG.

X. Laboratory Control Samples

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

XI. Field Duplicates

No field duplicates were identified in this SDG.

XII. Internal Standards (ICP-MS)

Raw data were not reviewed for Stage 2B validation.

XIII. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

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

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4
Metals - Data Qualification Summary - SDG 20F0407

No Sample Data Qualified in this SDG

Duwamish AOC4
Metals - Laboratory Blank Data Qualification Summary - SDG 20F0407

No Sample Data Qualified in this SDG

Duwamish AOC4
Metals - Field Blank Data Qualification Summary - SDG 20F0407

No Sample Data Qualified in this SDG

LDC #: 48785G4a
SDG #: 20F0407
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 8/19/20
Page: 1 of 1
Reviewer: C
2nd Reviewer: A

METHOD: Metals (EPA SW 846 Method 6020A/7471B)

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.	ICP/MS Tune	A	
III.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	SW	
VI.	Field Blanks	N	
VII.	Matrix Spike/Matrix Spike Duplicates	A	MS/D (20F0352)
VIII.	Duplicate sample analysis	A	DUP J
IX.	Serial Dilution	N	
X.	Laboratory control samples	A	LCS
XI.	Field Duplicates	N	
XII.	Internal Standard (ICP-MS)	N	not reviewed
XIII.	Sample Result Verification	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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS306	20F0407-01	Sediment	06/23/20
2	LDW20-SS308	20F0407-02	Sediment	06/23/20
3	LDW20-SS401	20F0407-03	Sediment	06/23/20
4	LDW20-SS406	20F0407-04	Sediment	06/23/20
5	LDW20-SS415	20F0407-05	Sediment	06/23/20
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Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1 to 5	As, Cd, Cr, Cu, Pb, Ag, Zn, Hg

Analysis Method

ICP	
ICP-MS	As, Cd, Cr, Cu, Pb, Ag, Zn
CVAA	Hg

VALIDATION FINDINGS WORKSHEET
Laboratory Blank Contamination (PB/ICB/CCB)

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)
Soil preparation factor applied (if applicable):

Sample Concentration, unless otherwise noted: mg/Kg Associated Samples: All

				Sample Identification													
Analyte	**PB (mg/Kg)**	**Maximum ICB/CCB (ug/L)**	**Action Level**	No quals													
Hg	0.0224																

Comments: The listed analyte concentrtaion is the highest ICB or CCB detected in the analysis. The action level, when applicable, is established at 5X the highest ICB, CCB, or PB concentration.

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 20, 2020

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0407

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS306	20F0407-01	Sediment	06/23/20
LDW20-SS308	20F0407-02	Sediment	06/23/20
LDW20-SS401	20F0407-03	Sediment	06/23/20
LDW20-SS406	20F0407-04	Sediment	06/23/20
LDW20-SS415	20F0407-05	Sediment	06/23/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). 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 methods:

Total Organic Carbon by Environmental Protection Agency (EPA) SW 846 Method 9060A
Total Solids by Standard Method 2540G

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration of each method were met.

III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met for each method when applicable.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. 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.

VII. Duplicate Sample Analysis

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

VIII. Laboratory Control Samples/Standard Reference Materials

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

Standard reference materials (SRM) were analyzed as required by the methods. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

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

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4
Wet Chemistry - Data Qualification Summary - SDG 20F0407

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 20F0407

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 20F0407

No Sample Data Qualified in this SDG

LDC #: 48785G6 **VALIDATION COMPLETENESS WORKSHEET** Date: 8/19/20
SDG #: 20F0407 Stage 2B Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer:
2nd Reviewer:

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM 2540G)

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	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	A	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	
VII.	Duplicate sample analysis	N	
VIII.	Laboratory control samples	A	LCS, SRM
IX.	Field duplicates	N	
X.	Sample result verification	N	
XI	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS306	20F0407-01	Sediment	06/23/20
2	LDW20-SS308	20F0407-02	Sediment	06/23/20
3	LDW20-SS401	20F0407-03	Sediment	06/23/20
4	LDW20-SS406	20F0407-04	Sediment	06/23/20
5	LDW20-SS415	20F0407-05	Sediment	06/23/20
6				
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16				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1 to 5	Total solids, TOC

LDC Report# 48785G21

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 19, 2020

Parameters: Polychlorinated Dioxins/Dibenzofurans

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0407

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS406	20F0407-04	Sediment	06/23/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for High Resolution Superfund Methods Data Review (April 2016). 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 Dioxins/Dibenzofurans by Environmental Protection Agency (EPA) Method 1613B

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 16.0°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required frequency.

Retention time windows were established for all homologues. The chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomer was less than or equal to 25%.

The static resolving power was at least 10,000 (10% valley definition).

III. Initial Calibration and Initial Calibration Verification

A five point initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for unlabeled compounds and less than or equal to 35.0% for labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were within the QC limits for unlabeled compounds and labeled compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

All of the continuing calibration results were within the QC limits for unlabeled compounds and labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

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	Compound	Concentration	Associated Samples
BIG0062-BLK1	07/09/20	1,2,3,4,6,7,8-HpCDF 1,2,3,4,6,7,8-HpCDD OCDF OCDD	0.0645 ng/Kg 0.319 ng/Kg 0.727 ng/Kg 2.68 ng/Kg	All samples in SDG 20F0407

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks.

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/Standard Reference Materials

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

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Labeled Compounds

All percent recoveries (%R) for labeled compounds used to quantitate target compounds were within QC limits.

XI. Compound Quantitation

All compound quantitations were within validation criteria with the following exceptions:

Sample	Compound	Flag	A or P
All samples in SDG 20F0407	All compounds reported as estimated maximum possible concentration (EMPC) and greater than the reporting limit.	J (all detects)	A

Sample	Compound	Flag	A or P
All samples in SDG 20F0407	All compounds reported as estimated maximum possible concentration (EMPC) and less than the reporting limit.	U (all non-detects)	A

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B 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 compounds reported as EMPC, data were qualified as estimated or not detected in one sample.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Data Qualification Summary - SDG 20F0407

Sample	Compound	Flag	A or P	Reason
LDW20-SS406	All compounds reported as estimated maximum possible concentration (EMPC) and greater than the reporting limit.	J (all detects)	A	Compound quantitation (EMPC)
LDW20-SS406	All compounds reported as estimated maximum possible concentration (EMPC) and less than the reporting limit.	U (all non-detects)	A	Compound quantitation (EMPC)

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG 20F0407

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Field Blank Data Qualification Summary - SDG 20F0407

No Sample Data Qualified in this SDG

LDC #: 48785G21 **VALIDATION COMPLETENESS WORKSHEET** Date: 08/17/20
SDG #: 20F0407 Stage 2B Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer: DG
2nd Reviewer: [signature]

METHOD: HRGC/HRMS Polychlorinated Dioxins/Dibenzofurans (EPA Method 1613B)

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	SW, A	Cooler temp = 16.0°C (Insufficient time to cool)
II.	HRGC/HRMS Instrument performance check	A	
III.	Initial calibration/ICV	A, A	ICAL ≤ 20/35 %; ICV ≤ QC limits
IV.	Continuing calibration	A	CCV ≤ QC limits
V.	Laboratory Blanks	SW	
VI.	Field blanks	N	
VII.	Matrix spike/Matrix spike duplicates	N	
VIII.	Laboratory control samples	A	LCS, SRM
IX.	Field duplicates	N	
X.	Labeled Compounds	A	
XI.	Compound quantitation RL/LOQ/LODs	N	EMPC = J dets (>RL); U(<RL)
XII.	Target compound 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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS406	20F0407-04	Sediment	06/23/20
2				
3				
4				
5				
6				
7				
8				
9				
10				

Notes:

	BIG0062-BLK1						

VALIDATION FINDINGS WORKSHEET

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

A. 2,3,7,8-TCDD	F. 1,2,3,4,6,7,8-HpCDD	K. 1,2,3,4,7,8-HxCDF	P. 1,2,3,4,7,8,9-HpCDF	U. Total HpCDD
B. 1,2,3,7,8-PeCDD	G. OCDD	L. 1,2,3,6,7,8-HxCDF	Q. OCDF	V. Total TCDF
C. 1,2,3,4,7,8-HxCDD	H. 2,3,7,8-TCDF	M. 2,3,4,6,7,8-HxCDF	R. Total TCDD	W. Total PeCDF
D. 1,2,3,6,7,8-HxCDD	I. 1,2,3,7,8-PeCDF	N. 1,2,3,7,8,9-HxCDF	S. Total PeCDD	X. Total HxCDF
E. 1,2,3,7,8,9-HxCDD	J. 2,3,4,7,8-PeCDF	O. 1,2,3,4,6,7,8-HpCDF	T. Total HxCDD	Y. Total HpCDF

Notes:_____

LDC #: 48785G21

VALIDATION FINDINGS WORKSHEET
Blanks

Reviewer: JVG
2nd Reviewer:

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were all samples associated with a method blank?
Y N N/A Was a method blank performed for each matrix and whenever a sample extraction was performed?
Y N N/A Was the method blank contaminated?

Blank extraction date: 07/09/20 **Blank analysis date:** 07/13/20 **Associated samples:** All (75X)

Conc. units: ng/kg

Compound	Blank ID	Sample Identification								
	BIG0062	BLK1 (5X)								
O	0.0645 *	0.3225								
F	0.319 *	1.595								
Q	0.727 *	3.635								
G	2.68	13.4								
	* EMPC									

Blank extraction date: _____ **Blank analysis date:** _____

Conc. units: _____ Associated Samples: _____

Compound	Blank ID	Sample Identification								

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
All contaminants within five times the method blank concentration were qualified as not detected, "U".

LDC Report# 48785H3b

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 19, 2020

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0437

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC392	20F0437-01	Sediment	06/24/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). 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) by Environmental Protection Agency (EPA) SW 846 Method 8082A

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 14.4°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Standard	Column	Compound	%D	Associated Samples	Flag	A or P
07/17/20	SIG0253-SCV1	1C	Aroclor-1260	27.9	All samples in SDG 20F0437	UJ (all non-detects)	A

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

All internal standard areas and retention times were within QC limits.

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/Standard Reference Materials

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

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XI. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XII. Overall Assessment of Data

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

Due to ICV %D, data were qualified as estimated in one sample.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4
Polychlorinated Biphenyls - Data Qualification Summary - SDG 20F0437

Sample	Compound	Flag	A or P	Reason
LDW20-SC392	Aroclor-1260	UJ (all non-detects)	A	Initial calibration verification (%D)

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 20F0437

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 20F0437

No Sample Data Qualified in this SDG

LDC #: 48785H3b
SDG #: 20F0437
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 08/19/20
Page: 1 of 1
Reviewer:
2nd Reviewer:

METHOD: GC Polychlorinated Biphenyls (EPA SW846 Method 8082A)

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	SW/A	cooler temp = 14.4°C (insufficient time to cool)
II.	Initial calibration/ICV	A/SW	ICAL ≤ 20% ICV ≤ 20%
III.	Continuing calibration	A	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes /IS	A/A	
VII.	Matrix spike/Matrix spike duplicates	N	
VIII.	Laboratory control samples	A	LCS, SRM
IX.	Field duplicates	N	
X.	Compound quantitation/RL/LOQ/LODs	N	
XI.	Target compound identification	N	
XII.	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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SC392	20F0437-01	Sediment	06/24/20
2				
3				
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11				
12				
13				

Notes:

1	BI60259-BLK1						

VALIDATION FINDINGS WORKSHEET

METHOD: Pesticide/PCBs (EPASW 846 Method 8081/8082)

A. alpha-BHC	K. Endrin	U. Toxaphene	EE. 2,4'-DDT	OO. trans–Heptachlor epoxide
B. beta-BHC	L. Endosulfan II	V. Aroclor-1016	FF. Hexachlorobenzene	PP. Mirex
C. delta-BHC	M. 4,4'-DDD	W. Aroclor-1221	GG. Chlordane	QQ cis-Chlordane
D. gamma-BHC	N. Endosulfan sulfate	X. Aroclor-1232	HH. Chlordane (Technical)	RR. trans-Chlordane
E. Heptachlor	O. 4,4'-DDT	Y. Aroclor-1242	II. Aroclor 1262	SS.
F. Aldrin	P. Methoxychlor	Z. Aroclor-1248	JJ. Aroclor 1268	TT.
G. Heptachlor epoxide	Q. Endrin ketone	AA. Aroclor-1254	KK. Oxychlordane	UU.
H. Endosulfan I	R. Endrin aldehyde	BB. Aroclor-1260	LL. trans-Nonachlor	VV
I. Dieldrin	S. alpha-Chlordane	CC. 2,4'-DDD	MM. cis-Nonachlor	WW.
J. 4,4'-DDE	T. gamma-Chlordane	DD. 2,4'-DDE	NN. cis–Heptachlor epoxide	XX.

Notes:_____

LDC #: 48785H36

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

Reviewer: JVG
2nd Reviewer:

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".
What type of initial calibration verification calculation was performed? /%D or ___%R
Y N N/A Was an initial calibration verification standard analyzed after each ICAL for each instrument?
Y (N) N/A Did the initial calibration verification standards meet the %D / %R validation criteria of ≤20.0% / 80-120%?

#	Date	Standard ID	Detector/ Column	Compound	%D (Limit ≤ 20.0)	Associated Samples	Qualifications
	07/17/20	SIG0253_SCV1	2C	BB	27.9	All (ND)	J/UJ/A

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 20, 2020

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0437

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC392	20F0437-01	Sediment	06/24/20
LDW20-SC392DUP	20F0437-01DUP	Sediment	06/24/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). 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 methods:

Total Organic Carbon by Environmental Protection Agency (EPA) SW 846 Method 9060A
Total Solids by Standard Method 2540G

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration of each method were met.

III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met for each method when applicable.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. 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.

VII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

VIII. Laboratory Control Samples/Standard Reference Materials

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

Standard reference materials (SRM) were analyzed as required by the methods. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

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

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4
Wet Chemistry - Data Qualification Summary - SDG 20F0437

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 20F0437

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 20F0437

No Sample Data Qualified in this SDG

LDC #: 48785H6
SDG #: 20F0437
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 8/19/20
Page: 1 of 1
Reviewer: CG
2nd Reviewer: AT

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM 2540G)

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	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	A	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	CS
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	A	LCS, SRM
IX.	Field duplicates	N	
X.	Sample result verification	N	
XI	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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SC392	20F0437-01	Sediment	06/24/20
2	LDW20-SC392DUP	20F0437-01DUP	Sediment	06/24/20
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1	Total solids, TOC
QC: 2	TS

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 19, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0438

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS301	20F0438-01	Sediment	06/24/20
LDW20-SS302	20F0438-02	Sediment	06/24/20
LDW20-SS309	20F0438-03	Sediment	06/24/20
LDW20-SS323	20F0438-04	Sediment	06/24/20
LDW20-SS404	20F0438-05	Sediment	06/24/20
LDW20-SS407	20F0438-06	Sediment	06/24/20
LDW20-SS404MS	20F0438-05MS	Sediment	06/24/20
LDW20-SS404MSD	20F0438-05MSD	Sediment	06/24/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). 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:

Semivolatile Organic Compounds (SVOCs) by Environmental Protection Agency (EPA) SW 846 Method 8270E

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 9.1°C and 10.4°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples/Standard Reference Materials

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

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

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

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4
Semivolatiles - Data Qualification Summary - SDG 20F0438

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0438

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0438

No Sample Data Qualified in this SDG

LDC #: 48785I2a

SDG #: 20F0438

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 08/17/20

Page: 1 of 1

Reviewer: [illegible]

2nd Reviewer: [illegible]

METHOD: GC/MS Semivolatiles (EPA SW 846 Method 8270E)

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	SW/A	cooler temp. = 9.1°C, 10.4°C (Insufficient time to cool)
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	ICAL ≤ 20% ICV ≤ 30%
IV.	Continuing calibration	A	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	A	LCS, SRM
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS301	20F0438-01	Sediment	06/24/20
2	LDW20-SS302	20F0438-02	Sediment	06/24/20
3	LDW20-SS309	20F0438-03	Sediment	06/24/20
4	LDW20-SS323	20F0438-04	Sediment	06/24/20
5	LDW20-SS404	20F0438-05	Sediment	06/24/20
6	LDW20-SS407	20F0438-06	Sediment	06/24/20
7	LDW20-SS404MS	20F0438-05MS	Sediment	06/24/20
8	LDW20-SS404MSD	20F0438-05MSD	Sediment	06/24/20
9				

Notes:

-	MBG0210-MB1						

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 20, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0438

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS301	20F0438-01	Sediment	06/24/20
LDW20-SS302	20F0438-02	Sediment	06/24/20
LDW20-SS309	20F0438-03	Sediment	06/24/20
LDW20-SS323	20F0438-04	Sediment	06/24/20
LDW20-SS404	20F0438-05	Sediment	06/24/20
LDW20-SS407	20F0438-06	Sediment	06/24/20
LDW20-SS404MS	20F0438-05MS	Sediment	06/24/20
LDW20-SS404MSD	20F0438-05MSD	Sediment	06/24/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). 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:

Semivolatile Organic Compounds (SVOCs) by Environmental Protection Agency (EPA) SW 846 Method 8270E in Selected Ion Monitoring (SIM) mode

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 9.1°C and 10.4°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For compounds where average relative response factors (RRFs) were utilized, percent relative standard deviations (%RSD) were less than or equal to 20.0%.

In the case where the laboratory used a calibration curve to evaluate the compounds, all coefficients of determination (r^2) were greater than or equal to 0.990.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all compounds with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
06/26/20	N-Nitrosodiphenylamine	41.9	All samples in SDG 20F0438	UJ (all non-detects)	A

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
07/15/20	Benzyl alcohol	22.0	All samples in SDG 20F0438	J (all detects) UJ (all non-detects)	A
	Pentachlorophenol	28.7		J (all detects) UJ (all non-detects)	

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples/Standard Reference Materials

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

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

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

Due to ICV %D and continuing calibration %D, data were qualified as estimated in six samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4
Semivolatiles – Data Qualification Summary - SDG 20F0438

Sample	Compound	Flag	A or P	Reason
LDW20-SS301 LDW20-SS302 LDW20-SS309 LDW20-SS323 LDW20-SS404 LDW20-SS407	N-Nitrosodiphenylamine	UJ (all non-detects)	A	Initial calibration verification (%D)
LDW20-SS301 LDW20-SS302 LDW20-SS309 LDW20-SS323 LDW20-SS404 LDW20-SS407	Benzyl alcohol Pentachlorophenol	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	A	Continuing calibration (%D)

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0438

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0438

No Sample Data Qualified in this SDG

LDC #: 48785l2b

SDG #: 20F0438

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 08/17/20

Page: 1 of 1

Reviewer: JW

2nd Reviewer:

METHOD: GC/MS ~~Polynuclear Aromatic Hydrocarbon~~ SVOA s (EPA SW 846 Method 8270E-SIM)

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	SW/A	Cooler temp. = 9.1°C, 10.4°C (Insufficient time to cool)
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/SW	ICAL ≤ 20% ICV ≤ 30%
IV.	Continuing calibration	SW	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	A	LCS, SRM
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS301	20F0438-01	Sediment	06/24/20
2	LDW20-SS302	20F0438-02	Sediment	06/24/20
3	LDW20-SS309	20F0438-03	Sediment	06/24/20
4	LDW20-SS323	20F0438-04	Sediment	06/24/20
5	LDW20-SS404	20F0438-05	Sediment	06/24/20
6	LDW20-SS407	20F0438-06	Sediment	06/24/20
7	LDW20-SS404MS	20F0438-05MS	Sediment	06/24/20
8	LDW20-SS404MSD	20F0438-05MSD	Sediment	06/24/20
9				

Notes:

	BIG0210-BLK2						

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

A. Phenol	AA. 2-Chloronaphthalene	AAA. Butylbenzylphthalate	AAAA. Dibenzothiophene	A1. N-Nitrosodiethylamine
B. Bis (2-chloroethyl) ether	BB. 2-Nitroaniline	BBB. 3,3'-Dichlorobenzidine	BBBB. Benzo(a)fluoranthene	B1. N-Nitrosodi-n-butylamine
C. 2-Chlorophenol	CC. Dimethylphthalate	CCC. Benzo(a)anthracene	CCCC. Benzo(b)fluorene	C1. N-Nitrosomethylethylamine
D. 1,3-Dichlorobenzene	DD. Acenaphthylene	DDD. Chrysene	DDDD. cis/trans-Decalin	D1. N-Nitrosomorpholine
E. 1,4-Dichlorobenzene	EE. 2,6-Dinitrotoluene	EEE. Bis(2-ethylhexyl)phthalate	EEEE. Biphenyl	E1. N-Nitrosopyrrolidine
F. 1,2-Dichlorobenzene	FF. 3-Nitroaniline	FFF. Di-n-octylphthalate	FFFF. Retene	F1. Phenacetin
G. 2-Methylphenol	GG. Acenaphthene	GGG. Benzo(b)fluoranthene	GGGG. C30-Hopane	G1. 2-Acetylaminofluorene
H. 2,2'-Oxybis(1-chloropropane)	HH. 2,4-Dinitrophenol	HHH. Benzo(k)fluoranthene	HHHH. 1-Methylphenanthrene	H1. Pronamide
I. 4-Methylphenol	II. 4-Nitrophenol	III. Benzo(a)pyrene	IIII. 1,4-Dioxane	I1. Methyl methanesulfonate
J. N-Nitroso-di-n-propylamine	JJ. Dibenzofuran	JJJ. Indeno(1,2,3-cd)pyrene	JJJJ. Acetophenone	J1. Ethyl methanesulfonate
K. Hexachloroethane	KK. 2,4-Dinitrotoluene	KKK. Dibenz(a,h)anthracene	KKKK. Atrazine	K1. o,o',o''-Triethylphosphorothioate
L. Nitrobenzene	LL. Diethylphthalate	LLL. Benzo(g,h,i)perylene	LLLL. Benzaldehyde	L1. n-Phenylene diamine
M. Isophorone	MM. 4-Chlorophenyl-phenyl ether	MMM. Bis(2-Chloroisopropyl)ether	MMMM. Caprolactam	M1. 1,4-Naphthoquinone
N. 2-Nitrophenol	NN. Fluorene	NNN. Aniline	NNNN. 2,6-Dichlorophenol	N1. N-Nitro-o-toluidine
O. 2,4-Dimethylphenol	OO. 4-Nitroaniline	OOO. N-Nitrosodimethylamine	OOOO. 1,2-Diphenylhydrazine	O1. 1,3,5-Trinitrobenzene
P. Bis(2-chloroethoxy)methane	PP. 4,6-Dinitro-2-methylphenol	PPP. Benzoic Acid	PPPP. 3-Methylphenol	P1. Pentachlorobenzene
Q. 2,4-Dichlorophenol	QQ. N-Nitrosodiphenylamine	QQQ. Benzyl alcohol	QQQQ. 3&4-Methylphenol	Q1. 4-Aminobiphenyl
R. 1,2,4-Trichlorobenzene	RR. 4-Bromophenyl-phenylether	RRR. Pyridine	RRRR. 4-Dimethyldibenzothiophene (4MDT)	R1. 2-Naphthylamine
S. Naphthalene	SS. Hexachlorobenzene	SSS. Benzidine	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	S1. Triphenylene
T. 4-Chloroaniline	TT. Pentachlorophenol	TTT. 1-Methylnaphthalene	TTTT. 1-Methyldibenzothiophene (1MDT)	T1. Octachlorostyrene
U. Hexachlorobutadiene	UU. Phenanthrene	UUU.Benzo(b)thiophene	UUUU.. 2,3,4,6-Tetrachlorophenol	U1. Famphur
V. 4-Chloro-3-methylphenol	VV. Anthracene	VVV.Benzonaphthothiophene	VVVV. 1,2,4,5-Tetrachlorobenzene	V1. 1,4-phenylenediamine
W. 2-Methylnaphthalene	WW. Carbazole	WWW.Benzo(e)pyrene	WWWW.. 2-Picoline	W1. Methapyrilene
X. Hexachlorocyclopentadiene	XX. Di-n-butylphthalate	XXX. 2,6-Dimethylnaphthalene	XXXX. 3-Methylcholanthrene	X1. Pentachloroethane
Y. 2,4,6-Trichlorophenol	YY. Fluoranthene	YYY. 2,3,5-Trimethylnaphthalene	YYYY. a,a-Dimethylphenethylamine	Y1. 3,3'-Dimethylbenzidine
Z. 2,4,5-Trichlorophenol	ZZ. Pyrene	ZZZ. Perylene	ZZZZ. Hexachloropropene	Z1. o-Toluidine

LDC #: 48785 I26

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: Ø

METHOD: GC/MS SVOA (EPA SW 846 Method 8270E-SIM)
Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

(Y) N N/A Was an initial calibration verification standard analyzed after each ICAL for each instrument?
Y (N) N/A Were all %D within the validation criteria of ≤~~20~~/30% %D ?

#	Date	Standard ID	Compound	Finding %D (Limit: ≤~~20.0~~% (30%))	Associated Samples	Qualifications
	06/26/20	SIF0393-SCV1	QQ	41.9	All (ND)	J/UJ/A

ICVsvoa.wpd

LDC #: 48785 I26

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD: GC/MS BNA (EPA SW 846 Method 8270C)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

(Y) N N/A Was a continuing calibration standard analyzed at least once every 12 hours of sample analysis for each instrument?

(Y) N N/A Were percent differences (%D) and relative response factors (RRF) within method criteria for all CCC's and SPCC's ?

Y (N) N/A Were all %D and RRFs within the validation criteria of ≤20 %D and ≥0.05 RRF ?

#	Date	Standard ID	Compound	Finding %D (Limit: ≤20.0%)	Finding RRF (Limit: ≥0.05)	Associated Samples	Qualifications
	07/15/20	NT10206715035	QQQ	22.0		All (ND + Det)	J/UJ/A
			TT	28.7		↓	↓

CONCAL.wpd

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 20, 2020

Parameters: Hexachlorobenzene

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0438

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS301	20F0438-01	Sediment	06/24/20
LDW20-SS302	20F0438-02	Sediment	06/24/20
LDW20-SS309	20F0438-03	Sediment	06/24/20
LDW20-SS323	20F0438-04	Sediment	06/24/20
LDW20-SS404	20F0438-05	Sediment	06/24/20
LDW20-SS407	20F0438-06	Sediment	06/24/20
LDW20-SS404MS	20F0438-05MS	Sediment	06/24/20
LDW20-SS404MSD	20F0438-05MSD	Sediment	06/24/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). 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:

Hexachlorobenzene by Environmental Protection Agency (EPA) SW 846 Method 8081B

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 9.1°C and 10.4°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC Instrument Performance Check

Instrument performance was checked at 12 hour intervals.

The individual 4,4'-DDT and Endrin breakdowns (%BD) were less than or equal to 15.0%.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0%.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0%.

IV. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0%.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

All internal standard areas and retention times were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples

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

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

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

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4
Hexachlorobenzene - Data Qualification Summary - SDG 20F0438

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Laboratory Blank Data Qualification Summary - SDG 20F0438

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Field Blank Data Qualification Summary - SDG 20F0438

No Sample Data Qualified in this SDG

LDC #: 48785I3a
SDG #: 20F0438
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 08/17/20
Page: 1 of 1
Reviewer: JV6
2nd Reviewer: CL

METHOD: GC Hexachlorobenzene (EPA SW846 Method 8081B)

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	SW/A	Cooler temp. = 9.1°C, 10.4°C (Insufficient time to cool)
II.	GC Instrument Performance Check	N	
III.	Initial calibration/ICV	A/A	ICAL ≤ 20 % ICV ≤ 20 %
IV.	Continuing calibration	A	CCV ≤ 20 %
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes / IS	A/A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	A	LCS
X.	Field duplicates	N	
XI.	Compound quantitation/RL/LOQ/LODs	N	
XII.	Target compound 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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS301	20F0438-01	Sediment	06/24/20
2	LDW20-SS302	20F0438-02	Sediment	06/24/20
3	LDW20-SS309	20F0438-03	Sediment	06/24/20
4	LDW20-SS323	20F0438-04	Sediment	06/24/20
5	LDW20-SS404	20F0438-05	Sediment	06/24/20
6	LDW20-SS407	20F0438-06	Sediment	06/24/20
7	LDW20-SS404MS	20F0438-05MS	Sediment	06/24/20
8	LDW20-SS404MSD	20F0438-05MSD	Sediment	06/24/20
9				
10				
11				

Notes:

	BIG0212-BLK1						

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: September 1, 2020

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0438

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS301	20F0438-01	Sediment	06/24/20
LDW20-SS302	20F0438-02	Sediment	06/24/20
LDW20-SS309	20F0438-03	Sediment	06/24/20
LDW20-SS323	20F0438-04	Sediment	06/24/20
LDW20-SS404	20F0438-05	Sediment	06/24/20
LDW20-SS407	20F0438-06	Sediment	06/24/20
LDW20-SS404MS	20F0438-05MS	Sediment	06/24/20
LDW20-SS404MSD	20F0438-05MSD	Sediment	06/24/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). 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) by Environmental Protection Agency (EPA) SW 846 Method 8082A

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 9.1°C and 10.4°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Standard	Column	Compound	%D	Associated Samples	Flag	A or P
07/02/20	SIG0056-SCV1	1C	Aroclor-1260	21.8	All samples in SDG 20F0438	J (all detects) UJ (all non-detects)	A

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

All internal standard areas and retention times were within QC limits.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VIII. Laboratory Control Samples/Standard Reference Materials

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

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Compound Quantitation

The sample results for detected compounds from the two columns were within 40% relative percent difference (RPD) with the following exceptions:

Sample	Compound	RPD	Flag	A or P
LDW20-SS302	Aroclor-1248 Aroclor-1260	53.7 71.1	J (all detects) J (all detects)	A
LDW20-SS309	Aroclor-1260	50.8	J (all detects)	A
LDW20-SS323	Aroclor-1254 Aroclor-1260	42.6 45.2	J (all detects) J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XI. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XII. Overall Assessment of Data

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

Due to ICV %D and RPD between two columns, data were qualified as estimated in six samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4
Polychlorinated Biphenyls - Data Qualification Summary - SDG 20F0438

Sample	Compound	Flag	A or P	Reason
LDW20-SS301 LDW20-SS302 LDW20-SS309 LDW20-SS323 LDW20-SS404 LDW20-SS407	Aroclor-1260	J (all detects) UJ (all non-detects)	A	Initial calibration verification (%D)
LDW20-SS302	Aroclor-1248 Aroclor-1260	J (all detects) J (all detects)	A	Compound quantitation (RPD between two columns)
LDW20-SS309	Aroclor-1260	J (all detects)	A	Compound quantitation (RPD between two columns)
LDW20-SS323	Aroclor-1254 Aroclor-1260	J (all detects) J (all detects)	A	Compound quantitation (RPD between two columns)

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 20F0438

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 20F0438

No Sample Data Qualified in this SDG

LDC #: 48785I3b

SDG #: 20F0438

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 08/17/20

Page: 1 of 1

Reviewer: JG

2nd Reviewer: CF

METHOD: GC Polychlorinated Biphenyls (EPA SW846 Method 8082A)

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	SW / A	Cooler temp. = 9.1°C, 10.4°C (Insufficient time to cool)
II.	Initial calibration/ICV	A/SW	
III.	Continuing calibration	A	ICAL ≤ 20? ICV ≤ 20?
IV.	Laboratory Blanks	A	CCV ≤ 20 %
V.	Field blanks	N	
VI.	Surrogate spikes	A	
VII.	Matrix spike/Matrix spike duplicates	A	
VIII.	Laboratory control samples	A	LCS, SRM
IX.	Field duplicates	N	
X.	Compound quantitation/RL/LOQ/LODs	SW	
XI.	Target compound identification	N	
XII.	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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS301	20F0438-01	Sediment	06/24/20
2	LDW20-SS302	20F0438-02	Sediment	06/24/20
3	LDW20-SS309	20F0438-03	Sediment	06/24/20
4	LDW20-SS323	20F0438-04	Sediment	06/24/20
5	LDW20-SS404	20F0438-05	Sediment	06/24/20
6	LDW20-SS407	20F0438-06	Sediment	06/24/20
7	LDW20-SS404MS	20F0438-05MS	Sediment	06/24/20
8	LDW20-SS404MSD	20F0438-05MSD	Sediment	06/24/20
9				
10				
11				
12				
13				

Notes:

	BIG0214-BLK1						

VALIDATION FINDINGS WORKSHEET

METHOD: Pesticide/PCBs (EPASW 846 Method 8081/8082)

A. alpha-BHC	K. Endrin	U. Toxaphene	EE. 2,4'-DDT	OO. trans–Heptachlor epoxide
B. beta-BHC	L. Endosulfan II	V. Aroclor-1016	FF. Hexachlorobenzene	PP. Mirex
C. delta-BHC	M. 4,4'-DDD	W. Aroclor-1221	GG. Chlordane	QQ cis-Chlordane
D. gamma-BHC	N. Endosulfan sulfate	X. Aroclor-1232	HH. Chlordane (Technical)	RR. trans-Chlordane
E. Heptachlor	O. 4,4'-DDT	Y. Aroclor-1242	II. Aroclor 1262	SS.
F. Aldrin	P. Methoxychlor	Z. Aroclor-1248	JJ. Aroclor 1268	TT.
G. Heptachlor epoxide	Q. Endrin ketone	AA. Aroclor-1254	KK. Oxychlordane	UU.
H. Endosulfan I	R. Endrin aldehyde	BB. Aroclor-1260	LL. trans-Nonachlor	VV
I. Dieldrin	S. alpha-Chlordane	CC. 2,4'-DDD	MM. cis-Nonachlor	WW.
J. 4,4'-DDE	T. gamma-Chlordane	DD. 2,4'-DDE	NN. cis–Heptachlor epoxide	XX.

Notes:_____

LDC #: 48785I36

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

Reviewer: JVG
2nd Reviewer: 9

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".
What type of initial calibration verification calculation was performed? ___%D or ___%R
Y N N/A Was an initial calibration verification standard analyzed after each ICAL for each instrument?
Y (N) N/A Did the initial calibration verification standards meet the %D / %R validation criteria of ≤20.0% / 80-120%?

#	Date	Standard ID	Detector/ Column	Compound	%D (Limit ≤ 20.0)	Associated Samples	Qualifications
	07/02/20	SIG0056-SCV1	1C	BB	21.8	All (ND + Det)	J/UJ/A (qual BB only)

LDC #: 48785I36

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported RLs

Reviewer: JVG
2nd Reviewer: _____

METHOD: GC

Y (N) N/A Were the relative percent difference of detected compounds between two columns <40%?

#	Sample ID	Compound Name	%RPD Between Two Columns (Limit < 40%)	Qualifications
	2	Z	53.7	Tdet/A
		BB	71.1	
	3	BB	50.8	
	4	AA	42.6	
		BB	45.2	

Comments: See sample calculation verification worksheet for recalculations

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 20, 2020

Parameters: Metals

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0438

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS301	20F0438-01	Sediment	06/24/20
LDW20-SS302	20F0438-02	Sediment	06/24/20
LDW20-SS309	20F0438-03	Sediment	06/24/20
LDW20-SS323	20F0438-04	Sediment	06/24/20
LDW20-SS404	20F0438-05	Sediment	06/24/20
LDW20-SS407	20F0438-06	Sediment	06/24/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). 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 methods:

Arsenic, Cadmium, Chromium, Copper, Lead, Silver, and Zinc by Environmental Protection Agency (EPA) SW 846 Method 6020A
Mercury by EPA SW 846 Method 7471B

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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.

All technical holding time requirements were met.

II. ICPMS Tune

The mass calibration was within 0.1 AMU and the percent relative standard deviation (%RSD) was less than or equal to 5%.

III. Instrument Calibration

Initial and continuing calibrations were performed as required by the methods.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

IV. ICP Interference Check Sample Analysis

The frequency of interference check sample (ICS) analysis was met. All criteria were within QC limits.

V. Laboratory Blanks

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

Blank ID	Analyte	Maximum Concentration	Associated Samples
ICB/CCB	Chromium	0.27 mg/Kg	All samples in SDG 20F0438

Data qualification by the laboratory blanks was based on the maximum contaminant concentration in the laboratory blanks in the analysis of each analyte. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW20-IT411MS/MSD (All samples in SDG 20F0438)	Lead	0.148 (75-125)	26.8 (75-125)	J (all detects)	A

For LDW20-IT411MS/MSD (from SDG 20F0392), although the percent recoveries were severely low for lead, the associated sample results were qualified as estimated (J/UJ) since the post digestion spike recoveries were within the QC limits for this analyte.

Relative percent differences (RPD) were within QC limits.

VIII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits with the following exceptions:

DUP ID (Associated Samples)	Analyte	RPD (Limits)	Difference (Limits)	Flag	A or P
LDW20-IT411DUP (All samples in SDG 20F0438)	Lead	60.9 (≤20)	-	J (all detects)	A

IX. Serial Dilution

Serial dilution was not performed for this SDG.

X. Laboratory Control Samples

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

XI. Field Duplicates

No field duplicates were identified in this SDG.

XII. Internal Standards (ICP-MS)

Raw data were not reviewed for Stage 2B validation.

XIII. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

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

Due to MS/MSD %R and DUP RPD, data were qualified as estimated in six samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4
Metals - Data Qualification Summary - SDG 20F0438

Sample	Analyte	Flag	A or P	Reason
LDW20-SS301 LDW20-SS302 LDW20-SS309 LDW20-SS323 LDW20-SS404 LDW20-SS407	Lead	J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)
LDW20-SS301 LDW20-SS302 LDW20-SS309 LDW20-SS323 LDW20-SS404 LDW20-SS407	Lead	J (all detects)	A	Duplicate sample analysis (RPD)

Duwamish AOC4
Metals - Laboratory Blank Data Qualification Summary - SDG 20F0438

No Sample Data Qualified in this SDG

Duwamish AOC4
Metals - Field Blank Data Qualification Summary - SDG 20F0438

No Sample Data Qualified in this SDG

LDC #: 48785I4a

SDG #: 20F0438

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 8/9/20

Page: 1 of 1

Reviewer:

2nd Reviewer:

METHOD: Metals (EPA SW 846 Method 6020A/7471B)

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.	ICP/MS Tune	A	
III.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	SW	
VI.	Field Blanks	N	
VII.	Matrix Spike/Matrix Spike Duplicates	SW	MS (20F0392)
VIII.	Duplicate sample analysis	SW	DUP
IX.	Serial Dilution	N	
X.	Laboratory control samples	A	LCS
XI.	Field Duplicates	N	
XII.	Internal Standard (ICP-MS)	N	not reviewed
XIII.	Sample Result Verification	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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS301	20F0438-01	Sediment	06/24/20
2	LDW20-SS302	20F0438-02	Sediment	06/24/20
3	LDW20-SS309	20F0438-03	Sediment	06/24/20
4	LDW20-SS323	20F0438-04	Sediment	06/24/20
5	LDW20-SS404	20F0438-05	Sediment	06/24/20
6	LDW20-SS407	20F0438-06	Sediment	06/24/20
7				
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11				
12				
13				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1 to 6	As, Cd, Cr, Cu, Pb, Ag, Zn, Hg

Analysis Method

ICP	
ICP-MS	As, Cd, Cr, Cu, Pb, Ag, Zn
CVAA	Hg

VALIDATION FINDINGS WORKSHEET
Laboratory Blank Contamination (PB/ICB/CCB)

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)
Soil preparation factor applied (if applicable):

Sample Concentration, unless otherwise noted: mg/Kg Associated Samples: All

				Sample Identification													
Analyte	**PB (mg/Kg)**	**Maximum ICB/CCB (ug/L)**	**Action Level**	No quals													
Cr	0.27																

Comments: The listed analyte concentrtaion is the highest ICB or CCB detected in the analysis. The action level, when applicable, is established at 5X the highest ICB, CCB, or PB concentration.

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)

MS/MSD analysis was performed by the laboratory. All MS/MSD percent recoveries (%R) and relative percent differences (RPDs) were within the acceptable limits with the following exceptions:

MS/MSD ID	Matrix	Analyte	MS %R	MSD %R	%R Limit	RPD	RPD Limit	Associated Samples	Qualification	Det/ND
LDW20-IT411MS/MSD	s	Pb	0.148	26.8	75-125			All	J/UJ/A*	Det
(SDG: 20F0392)									*PS = 98.3	

Comments:

Laboratory Duplicates

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)

Laboratory duplicate analysis was performed by the laboratory. All laboratory duplicates were with the relative percent difference (RPD) for samples >5X the reporting limits with the exceptions listed below. If samples were <5X the reporting limits, the difference was within 1X the reporting limit for water samples and within 2X the reporting limit for soil samples for all samples with the exceptions listed below.

Duplicate ID	Matrix	Analyte	RPD	RPD Limit	Difference (units)	Difference Limit	Associated Samples	Qualification	Det/ND
LDW20-IT411DUP	s	Pb	60.9	20			All	J/UJ/A	Det
(SDG: 20F0392)									

Comments:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 20, 2020

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0438

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS301	20F0438-01	Sediment	06/24/20
LDW20-SS302	20F0438-02	Sediment	06/24/20
LDW20-SS309	20F0438-03	Sediment	06/24/20
LDW20-SS323	20F0438-04	Sediment	06/24/20
LDW20-SS404	20F0438-05	Sediment	06/24/20
LDW20-SS407	20F0438-06	Sediment	06/24/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). 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 methods:

Total Organic Carbon by Environmental Protection Agency (EPA) SW 846 Method 9060A
Total Solids by Standard Method 2540G

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or 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 compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration of each method were met.

III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met for each method when applicable.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. 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.

VII. Duplicate Sample Analysis

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

VIII. Laboratory Control Samples/Standard Reference Materials

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

Standard reference materials (SRM) were analyzed as required by the methods. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

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

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4
Wet Chemistry - Data Qualification Summary - SDG 20F0438

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 20F0438

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 20F0438

No Sample Data Qualified in this SDG

LDC #: 48785I6
SDG #: 20F0438
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 8/19/20
Page: of
Reviewer:
2nd Reviewer:

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM 2540G)

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	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	A	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	CS
VII.	Duplicate sample analysis	N	"
VIII.	Laboratory control samples	A	LCS, SRM
IX.	Field duplicates	N	
X.	Sample result verification	N	
XI	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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS301	20F0438-01	Sediment	06/24/20
2	LDW20-SS302	20F0438-02	Sediment	06/24/20
3	LDW20-SS309	20F0438-03	Sediment	06/24/20
4	LDW20-SS323	20F0438-04	Sediment	06/24/20
5	LDW20-SS404	20F0438-05	Sediment	06/24/20
6	LDW20-SS407	20F0438-06	Sediment	06/24/20
7				
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14				
15				
16				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
All	Total solids, TOC

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 19, 2020

Parameters: Polychlorinated Dioxins/Dibenzofurans

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0438

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS301	20F0438-01	Sediment	06/24/20

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 Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for High Resolution Superfund Methods Data Review (April 2016). 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 Dioxins/Dibenzofurans by Environmental Protection Agency (EPA) Method 1613B

All sample results were subjected to Stage 2B 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 compound or 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 compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or 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.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperature for samples in this SDG was reported at 9.1°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required frequency.

Retention time windows were established for all homologues. The chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomer was less than or equal to 25%.

The static resolving power was at least 10,000 (10% valley definition).

III. Initial Calibration and Initial Calibration Verification

A five point initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for unlabeled compounds and less than or equal to 35.0% for labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were within the QC limits for unlabeled compounds and labeled compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

All of the continuing calibration results were within the QC limits for unlabeled compounds and labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

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	Compound	Concentration	Associated Samples
BIG0062-BLK1	07/09/20	1,2,3,4,6,7,8-HpCDF 1,2,3,4,6,7,8-HpCDD OCDF OCDD	0.0645 ng/Kg 0.319 ng/Kg 0.727 ng/Kg 2.68 ng/Kg	All samples in SDG 20F0438

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks.

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/Standard Reference Materials

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

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Labeled Compounds

All percent recoveries (%R) for labeled compounds used to quantitate target compounds were within QC limits.

XI. Compound Quantitation

All compound quantitations were within validation criteria with the following exceptions:

Sample	Compound	Flag	A or P
All samples in SDG 20F0438	All compounds reported as estimated maximum possible concentration (EMPC) and greater than the reporting limit.	J (all detects)	A

Sample	Compound	Flag	A or P
All samples in SDG 20F0438	All compounds reported as estimated maximum possible concentration (EMPC) and less than the reporting limit.	U (all non-detects)	A

Sample	Compound	Finding	Criteria	Flag	A or P
All samples in SDG 20F0438	OCDD	Sample result exceeded calibration range.	Reported result should be within calibration range.	J (all detects)	P

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B 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 compounds reported as EMPC and results exceeding calibration range, data were qualified as estimated or not detected in one sample.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Data Qualification Summary - SDG 20F0438

Sample	Compound	Flag	A or P	Reason
LDW20-SS301	All compounds reported as estimated maximum possible concentration (EMPC) and greater than the reporting limit.	J (all detects)	A	Compound quantitation (EMPC)
LDW20-SS301	All compounds reported as estimated maximum possible concentration (EMPC) and less than the reporting limit.	U (all non-detects)	A	Compound quantitation (EMPC)
LDW20-SS301	OCDD	J (all detects)	P	Compound quantitation (exceeded range)

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG 20F0438

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Field Blank Data Qualification Summary - SDG 20F0438

No Sample Data Qualified in this SDG

LDC #: 48785I21 **VALIDATION COMPLETENESS WORKSHEET** Date: 08/17/20
SDG #: 20F0438 Stage 2B Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer: JVG
2nd Reviewer: CT

METHOD: HRGC/HRMS Polychlorinated Dioxins/Dibenzofurans (EPA Method 1613B)

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	SW/A	Cooler temp. = 9.1°C, ~~10.4°C~~ (Insufficient time to cool)
II.	HRGC/HRMS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	ICAL ≤ 20/35%; ICV ≤ QC limits
IV.	Continuing calibration	A	CCV ≤ QC limits
V.	Laboratory Blanks	SW	
VI.	Field blanks	N	
VII.	Matrix spike/Matrix spike duplicates	N	
VIII.	Laboratory control samples	A	LCS, SRM
IX.	Field duplicates	N	
X.	Labeled Compounds	A	
XI.	Compound quantitation RL/LOQ/LODs	SW	EMPC = J dets (≥RL); U (<RL)
XII.	Target compound identification	N	≤ > calib range
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:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS301	20F0438-01	Sediment	06/24/20
2				
3				
4				
5				
6				
7				
8				
9				
10				

Notes:

	BIG0062-BLK1						

VALIDATION FINDINGS WORKSHEET

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

A. 2,3,7,8-TCDD	F. 1,2,3,4,6,7,8-HpCDD	K. 1,2,3,4,7,8-HxCDF	P. 1,2,3,4,7,8,9-HpCDF	U. Total HpCDD
B. 1,2,3,7,8-PeCDD	G. OCDD	L. 1,2,3,6,7,8-HxCDF	Q. OCDF	V. Total TCDF
C. 1,2,3,4,7,8-HxCDD	H. 2,3,7,8-TCDF	M. 2,3,4,6,7,8-HxCDF	R. Total TCDD	W. Total PeCDF
D. 1,2,3,6,7,8-HxCDD	I. 1,2,3,7,8-PeCDF	N. 1,2,3,7,8,9-HxCDF	S. Total PeCDD	X. Total HxCDF
E. 1,2,3,7,8,9-HxCDD	J. 2,3,4,7,8-PeCDF	O. 1,2,3,4,6,7,8-HpCDF	T. Total HxCDD	Y. Total HpCDF

Notes:_____

LDC #: 48785 I21

VALIDATION FINDINGS WORKSHEET
Blanks

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were all samples associated with a method blank?
Y N N/A Was a method blank performed for each matrix and whenever a sample extraction was performed?
Y N N/A Was the method blank contaminated?

Blank extraction date: 07/09/20 **Blank analysis date:** 07/13/20 **Associated samples:** All

Conc. units: ng/kg

Compound	Blank ID	Sample Identification								
	BIS0062-BLK1 (SV)									
O	0.0645 *	0.3225								
F	0.319 *	1.595								
Q	0.727 *	3.635								
G	2.68	13.4								
	* EMPC									

Blank extraction date: _____ **Blank analysis date:** _____

Conc. units: _____ Associated Samples: _____

Compound	Blank ID	Sample Identification								

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
All contaminants within five times the method blank concentration were qualified as not detected, "U".