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

August 27, 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 July 29, 2020. Attachment 1 is a summary of the samples that were reviewed for each analysis.

LDC Project #48765_RV1:

SDG #	Fraction
20F0212, 20F0218, 20F0233 20F0235, 20F0288, 20F0293 20F0295, 20F0300, 20F0337 20F0361, 20F0405	Semivolatiles, Hexachlorobenzene, Polychlorinated Biphenyls, Metals, Wet Chemistry, Polychlorinated Dioxins/Dibenzofurans

The data validation was performed under Stage 2B & 4 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 #48765 (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	20F0212	07/29/20	08/19/20	0	8	0	8	0	8	0	9	0	8	0	9	0	8	-	-	0	9	0	9												
B	20F0218	07/29/20	08/19/20	0	11	0	11	0	11	0	11	0	11	0	11	0	11	0	3	0	11	0	11												
C	20F0233	07/29/20	08/19/20	0	7	0	7	0	7	0	10	0	7	0	10	0	7	0	4	0	10	0	10												
D	20F0235	07/29/20	08/19/20	0	10	0	10	0	10	0	11	0	10	0	10	0	10	-	-	0	10	0	10												
E	20F0288	07/29/20	08/19/20	0	8	0	8	0	8	0	12	0	8	0	8	0	8	0	4	0	12	0	12												
F	20F0293	07/29/20	08/19/20	0	12	0	12	0	12	0	12	0	12	0	12	0	12	0	3	0	12	0	12												
G	20F0295	07/29/20	08/19/20	0	2	0	6	0	2	0	13	0	2	0	9	0	2	0	3	0	13	0	13												
H	20F0300	07/29/20	08/19/20	0	11	0	11	0	11	0	11	0	11	0	11	0	11	0	4	0	11	0	11												
I	20F0337	07/29/20	08/19/20	-	-	-	-	-	-	0	7	-	-	0	6	-	-	0	1	0	6	0	6												
J	20F0361	07/29/20	08/19/20	-	-	-	-	-	-	0	2	-	-	0	1	-	-	-	-	0	1	0	1												
K	20F0405	07/29/20	08/19/20	-	-	0	1	-	-	0	7	-	-	0	4	-	-	0	1	0	4	0	4												
Total	T/PG			0	69	0	74	0	69	0	105	0	69	0	91	0	69	0	23	0	99	0	99	0	0	0	0	0	0	0	0	0	0	0	767

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 14, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0212

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT248	20F0212-01	Sediment	06/11/20
LDW20-IT253	20F0212-02	Sediment	06/11/20
LDW20-IT253FD	20F0212-03	Sediment	06/11/20
LDW20-IT272	20F0212-04	Sediment	06/11/20
LDW20-SC269B	20F0212-05	Sediment	06/11/20
LDW20-SC261B	20F0212-06	Sediment	06/11/20
LDW20-SC255B	20F0212-07	Sediment	06/11/20
LDW20-SC245B	20F0212-08	Sediment	06/11/20
LDW20-IT253FDMS	20F0212-03MS	Sediment	06/11/20
LDW20-IT253FDMSD	20F0212-03MSD	Sediment	06/11/20

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 15.4°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.

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
BIF0666-SRM1	Anthracene	50.6 (57-143)	All samples in SDG 20F0212	J (all detects)	P

X. Field Duplicates

Samples LDW20-IT253 and LDW20-IT253FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/Kg)		RPD
	LDW20-IT253	LDW20-IT253FD	
Naphthalene	19.8U	5.9	Not calculable
2-Methylnaphthalene	19.8U	6.2	Not calculable
Acenaphthene	29.9	30.2	1
Dibenzofuran	6.3	7.9	23
Fluorene	10.1	8.4	18
Phenanthrene	36.2	24.0	41
Anthracene	20.3	8.7	80

Compound	Concentration (ug/Kg)		RPD
	LDW20-IT253	LDW20-IT253FD	
Fluoranthene	113	149	27
Pyrene	87.4	114	26
Butylbenzylphthalate	19.8U	9.3	Not calculable
Benzo(a)anthracene	50.3	31.9	45
Chrysene	95.9	38.8	85
Bis(2-ethylhexyl)phthalate	37.9	43.9	15
Benzofluoranthenes, total	84.0	71.5	16
Benzo(a)pyrene	33.1	23.5	34
Indeno(1,2,3-cd)pyrene	22.8	17.9	24
Dibenz(a,h)anthracene	7.4	19.9U	Not calculable
Benzo(g,h,i)perylene	23.8	21.9	8

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 eight samples.

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

Duwamish AOC4
Semivolatiles - Data Qualification Summary - SDG 20F0212

Sample	Compound	Flag	A or P	Reason
LDW20-IT248 LDW20-IT253 LDW20-IT253FD LDW20-IT272 LDW20-SC269B LDW20-SC261B LDW20-SC255B LDW20-SC245B	Anthracene	J (all detects)	P	Standard reference materials (%R)

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0212

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0212

No Sample Data Qualified in this SDG

LDC #: 48765A2a
SDG #: 20F0212
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 7/8/20
Page: 1 of 1
Reviewer:
2nd Reviewer: A

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	A	Temp @ Rec'd 5.4°C - same day
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A A	RSD ≤ 20%. r² 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 /SRM	A A/M	LCS
X.	Field duplicates	A/M	1=2+3
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-IT248	20F0212-01	Sediment	06/11/20
2	LDW20-IT253	20F0212-02	Sediment	06/11/20
3	LDW20-IT253FD	20F0212-03	Sediment	06/11/20
4	LDW20-IT272	20F0212-04	Sediment	06/11/20
5	LDW20-SC269B	20F0212-05	Sediment	06/11/20
6	LDW20-SC261B	20F0212-06	Sediment	06/11/20
7	LDW20-SC255B	20F0212-07	Sediment	06/11/20
8	LDW20-SC245B	20F0212-08	Sediment	06/11/20
9	LDW20-IT253FDMS	20F0212-03MS	Sediment	06/11/20
10	LDW20-IT253FDMSD	20F0212-03MSD	Sediment	06/11/20
11				
12				
13	BIF0666-BK1			
14				

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 48T65B201

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS)

Page: 1 of 1
Reviewer:
2nd Reviewer:

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

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?

#	Date	LCS/LCSD ID	Compound	~~LCS~~ SRM %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		B1F0666-SRM1	VV	50.6 (57-143)	( )	( )	All (dets)	J/UJ/P
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
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				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		

LDC#: 48765A2a

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: JVC
2nd Reviewer: A

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	19.8U	5.9	NC
W	19.8U	6.2	NC
GG	29.9	30.2	1
JJ	6.3	7.9	23
NN	10.1	8.4	18
UU	36.2	24.0	41
VV	20.3	8.7	80
YY	113	149	27
ZZ	87.4	114	26
AAA	19.8U	9.3	NC
CCC	50.3	31.9	45
DDD	95.9	38.8	85
EEE	37.9	43.9	15
ZZZZ	84.0	71.5	16
III	33.1	23.5	34
JJJ	22.8	17.9	24
KKK	7.4	19.9U	NC
LLL	23.8	21.9	8

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 14, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0212

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT248	20F0212-01	Sediment	06/11/20
LDW20-IT253	20F0212-02	Sediment	06/11/20
LDW20-IT253FD	20F0212-03	Sediment	06/11/20
LDW20-IT272	20F0212-04	Sediment	06/11/20
LDW20-SC269B	20F0212-05	Sediment	06/11/20
LDW20-SC261B	20F0212-06	Sediment	06/11/20
LDW20-SC255B	20F0212-07	Sediment	06/11/20
LDW20-SC245B	20F0212-08	Sediment	06/11/20
LDW20-IT253FDMS	20F0212-03MS	Sediment	06/11/20
LDW20-IT253FDMSD	20F0212-03MSD	Sediment	06/11/20

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 15.4°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 20F0212	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
07/09/20	Benzoic acid Pentachlorophenol	33.8 40.3	All samples in SDG 20F0212	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-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 with the following exceptions:

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
BIF0666-BLK2	06/25/20	1,4-Dichlorobenzene 1,2-Dichlorobenzene	0.8 ug/Kg 0.9 ug/Kg	All samples in SDG 20F0212

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-IT248	1,4-Dichlorobenzene 1,2-Dichlorobenzene	1.0 ug/Kg 0.7 ug/Kg	1.0U ug/Kg 0.7U ug/Kg
LDW20-IT253	1,4-Dichlorobenzene	0.6 ug/Kg	0.6U ug/Kg
LDW20-IT253FD	1,4-Dichlorobenzene	0.8 ug/Kg	0.8U ug/Kg
LDW20-IT272	1,4-Dichlorobenzene	1.0 ug/Kg	1.0U ug/Kg
LDW20-SC269B	1,4-Dichlorobenzene	1.0 ug/Kg	1.0U ug/Kg
LDW20-SC261B	1,4-Dichlorobenzene	1.0 ug/Kg	1.0U ug/Kg
LDW20-SC255B	1,4-Dichlorobenzene	1.1 ug/Kg	1.1U ug/Kg
LDW20-SC245B	1,4-Dichlorobenzene	1.1 ug/Kg	1.1U 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 with the following exceptions:

Spike ID (Associated Samples)	Compound	RPD (Limits)	Flag	A or P
LDW20-IT253FDMS/MSD (LDW20-IT253FD)	2,4-Dimethylphenol	37.2 (≤30)	NA	-

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
BIF0666-SRM2	2,4-Dimethylphenol	20.5 (40-160)	All samples in SDG 20F0212	J (all detects) UJ (all non-detects)	P

X. Field Duplicates

Samples LDW20-IT253 and LDW20-IT253FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/Kg)		RPD
	LDW20-IT253	LDW20-IT253FD	
1,4-Dichlorobenzene	0.6	0.8	29
Benzoic acid	53.8	45.7	16

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 eight samples.

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

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

Duwamish AOC4
Semivolatiles – Data Qualification Summary - SDG 20F0212

Sample	Compound	Flag	A or P	Reason
LDW20-IT248 LDW20-IT253 LDW20-IT253FD LDW20-IT272 LDW20-SC269B LDW20-SC261B LDW20-SC255B LDW20-SC245B	N-Nitrosodiphenylamine	J (all detects) UJ (all non-detects)	A	Initial calibration verification (%D)
LDW20-IT248 LDW20-IT253 LDW20-IT253FD LDW20-IT272 LDW20-SC269B LDW20-SC261B LDW20-SC255B LDW20-SC245B	Benzoic acid Pentachlorophenol	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	A	Continuing calibration (%D)
LDW20-IT248 LDW20-IT253 LDW20-IT253FD LDW20-IT272 LDW20-SC269B LDW20-SC261B LDW20-SC255B LDW20-SC245B	2,4-Dimethylphenol	J (all detects) UJ (all non-detects)	P	Standard reference materials (%R)

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0212

Sample	Compound	Modified Final Concentration	A or P
LDW20-IT248	1,4-Dichlorobenzene 1,2-Dichlorobenzene	1.0U ug/Kg 0.7U ug/Kg	A
LDW20-IT253	1,4-Dichlorobenzene	0.6U ug/Kg	A
LDW20-IT253FD	1,4-Dichlorobenzene	0.8U ug/Kg	A
LDW20-IT272	1,4-Dichlorobenzene	1.0U ug/Kg	A
LDW20-SC269B	1,4-Dichlorobenzene	1.0U ug/Kg	A
LDW20-SC261B	1,4-Dichlorobenzene	1.0U ug/Kg	A
LDW20-SC255B	1,4-Dichlorobenzene	1.1U ug/Kg	A
LDW20-SC245B	1,4-Dichlorobenzene	1.1U ug/Kg	A

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0212

No Sample Data Qualified in this SDG

LDC #: 48765A2b

SDG #: 20F0212

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 8/19/20

Page: 1 of 1

Reviewer: A

2nd Reviewer: AC

METHOD: GC/MS ~~Polynuclear Aromatic Hydrocarbons~~ SVOCs (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	A	Temp @ 8.6-15.4°C - ~~Samp~~ Same day
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A SW	RSD ≤ 20% or r² ≥ 0.99 ICV ≤ ±30%
IV.	Continuing calibration	SW	CCV ≤ ±30%
V.	Laboratory Blanks	SW	
VI.	Field blanks	A	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	SW	
IX.	Laboratory control samples SRM	A SW	LCS
X.	Field duplicates	SW	1 = 2+3
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-IT248	20F0212-01	Sediment	06/11/20
2	LDW20-IT253	20F0212-02	Sediment	06/11/20
3	LDW20-IT253FD	20F0212-03	Sediment	06/11/20
4	LDW20-IT272	20F0212-04	Sediment	06/11/20
5	LDW20-SC269B	20F0212-05	Sediment	06/11/20
6	LDW20-SC261B	20F0212-06	Sediment	06/11/20
7	LDW20-SC255B	20F0212-07	Sediment	06/11/20
8	LDW20-SC245B	20F0212-08	Sediment	06/11/20
9	LDW20-IT253FDMS	20F0212-03MS	Sediment	06/11/20
10	LDW20-IT253FDMSD	20F0212-03MSD	Sediment	06/11/20
11				
12				
13				
14				

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 48765A2b

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

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

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

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 ≤30 %D ?

#	Date	Standard ID	Compound	Finding %D (Limit: ≤30.0%)	Associated Samples	Qualifications
	6/26/20	SF0393-SCV1	XX	41.9	All (dets+ND)	J/UJ/A

LDC #: 48765A-b

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

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

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

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 for each instrument?

Y N N/A Were percent differences (%D) ≤20 % and relative response factors (RRF) within the method criteria?

#	Date	Standard ID	Compound	Finding %D (Limit: ≤20.0%)	Finding RRF (Limit)	Associated Samples	Qualifications
	7/9/20	NT102007090S	PFP	33.8		All (dets+ND)	J/UJ/A
			TT	40.3			J

LDC #: 48765A2b

VALIDATION FINDINGS WORKSHEET
Blanks

Page: 1 of 1
Reviewer: 9
2nd Reviewer: K

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

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: 6/25/20 **Blank analysis date:** 7/9/20
Conc. units: ug/kg Associated Samples: All

Compound	Blank ID	Sample Identification								
	BI0666-BK2	1	2	3	4	5	6	7	8	
E	0.8	1.0/U	0.9/U	0.8/U	1.0/U	1.0/U	1.0/U	1.1/U	1.1/U	
F	0.9	0.7/U								

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:
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 #: 48765A2b

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

Page: 1 of 1
Reviewer: q
2nd Reviewer: A

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

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

[✓ Y] N N/A Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.

[✓ Y] N N/A Was a MS/MSD analyzed every 20 samples of each matrix?

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

#	MS/MSD ID	Compound	MS %R (Limits)	MSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	9/10	O	( )	( )	37.2 (≤30)	3 (ND)	Jdets/A
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
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			( )	( )	( )		
			( )	( )	( )		

LDC #: 48765A-6

Page: 1 of 1
Reviewer:
2nd Reviewer:

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS)

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

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?

#	Date	LCS/LCSD ID	Compound	~~LCS~~ SRM %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		BTF0666-SRM2	O	20.5 (40-160)	( )	( )	All (det + ND)	J/UJ/P
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
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				( )	( )	( )		
				( )	( )	( )		

LDC#: 48765A2b

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: PG
2nd Reviewer: [illegible]

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	
E	0.6	0.8	29
PPP	53.8	45.7	16

V:\FIELD DUPLICATES\Field Duplicates\FD_Organics\2020\48765A2b windward duwamish.wpd

LDC Report# 48765A3a

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 14, 2020

Parameters: Hexachlorobenzene

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0212

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT248	20F0212-01	Sediment	06/11/20
LDW20-IT253	20F0212-02	Sediment	06/11/20
LDW20-IT253FD	20F0212-03	Sediment	06/11/20
LDW20-IT272	20F0212-04	Sediment	06/11/20
LDW20-SC269B	20F0212-05	Sediment	06/11/20
LDW20-SC261B	20F0212-06	Sediment	06/11/20
LDW20-SC255B	20F0212-07	Sediment	06/11/20
LDW20-SC245B	20F0212-08	Sediment	06/11/20
LDW20-IT253MS	20F0212-02MS	Sediment	06/11/20
LDW20-IT253MSD	20F0212-02MSD	Sediment	06/11/20

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 15.4°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

Samples LDW20-IT253 and LDW20-IT253FD 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 20F0212

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Laboratory Blank Data Qualification Summary - SDG 20F0212

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Field Blank Data Qualification Summary - SDG 20F0212

No Sample Data Qualified in this SDG

LDC #: 48765A3a
SDG #: 20F0212
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 8/13/20
Page: 1 of 1
Reviewer: A
2nd Reviewer: A

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	A	Temp @ 9.1 & 9 = 15.4°C – same day
II.	GC Instrument Performance Check	A	
III.	Initial calibration/ICV	A / A	RSD ≤ 20%. RPD ≤ 20%
IV.	Continuing calibration	A	
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 = 2+3.
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-IT248	20F0212-01	Sediment	06/11/20
2	LDW20-IT253	20F0212-02	Sediment	06/11/20
3	LDW20-IT253FD	20F0212-03	Sediment	06/11/20
4	LDW20-IT272	20F0212-04	Sediment	06/11/20
5	LDW20-SC269B	20F0212-05	Sediment	06/11/20
6	LDW20-SC261B	20F0212-06	Sediment	06/11/20
7	LDW20-SC255B	20F0212-07	Sediment	06/11/20
8	LDW20-SC245B	20F0212-08	Sediment	06/11/20
9	LDW20-IT253MS	20F0212-02MS	Sediment	06/11/20
10	LDW20-IT253MSD	20F0212-02MSD	Sediment	06/11/20
11				

Notes:

LDC Report# 48765A3b

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 14, 2020

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0212

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT248	20F0212-01	Sediment	06/11/20
LDW20-IT253	20F0212-02	Sediment	06/11/20
LDW20-IT253FD	20F0212-03	Sediment	06/11/20
LDW20-IT272	20F0212-04	Sediment	06/11/20
LDW20-SC269B	20F0212-05	Sediment	06/11/20
LDW20-SC261B	20F0212-06	Sediment	06/11/20
LDW20-SC255B	20F0212-07	Sediment	06/11/20
LDW20-SC245B	20F0212-08	Sediment	06/11/20
LDW20-IT268	20F0212-09	Sediment	06/11/20
LDW20-IT253FDMS	20F0212-03MS	Sediment	06/11/20
LDW20-IT253FDMSD	20F0212-03MSD	Sediment	06/11/20

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 15.4°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
06/10/20	SIF0176-SCV1	2C	Aroclor-1260	21.0	All samples in SDG 20F0212	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

Samples LDW20-IT253 and LDW20-IT253FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/Kg)		RPD
	LDW20-IT253	LDW20-IT253FD	
Aroclor-1248	27.4	9.3	99
Aroclor-1254	22.7	8.6	90
Aroclor-1260	25.7	12.7	68

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-IT253	Aroclor-1248	55.7	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 nine 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 20F0212

Sample	Compound	Flag	A or P	Reason
LDW20-IT248 LDW20-IT253 LDW20-IT253FD LDW20-IT272 LDW20-SC269B LDW20-SC261B LDW20-SC255B LDW20-SC245B LDW20-IT268	Aroclor-1260	J (all detects)	A	Initial calibration verification (%D)
LDW20-IT253	Aroclor-1248	J (all detects)	A	Compound quantitation (RPD between two columns)

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 20F0212

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 20F0212

No Sample Data Qualified in this SDG

LDC #: 48765A3b
SDG #: 20F0212
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 8/12/20
Page: 1 of 1
Reviewer: A
2nd Reviewer: M

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	A	9.1.2 Temp @ 8°C / 15.4°C - Samples day
II.	Initial calibration/ICV	A SW	RSD ≤ 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 / SRM	A	LCS
IX.	Field duplicates	SW	D=2+3
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-IT248	20F0212-01	Sediment	06/11/20
2	LDW20-IT253	20F0212-02	Sediment	06/11/20
3	LDW20-IT253FD	20F0212-03	Sediment	06/11/20
4	LDW20-IT272	20F0212-04	Sediment	06/11/20
5	LDW20-SC269B	20F0212-05	Sediment	06/11/20
6	LDW20-SC261B	20F0212-06	Sediment	06/11/20
7	LDW20-SC255B	20F0212-07	Sediment	06/11/20
8	LDW20-SC245B	20F0212-08	Sediment	06/11/20
9	LDW20-IT268	20F0212-09	Sediment	06/11/20
10	LDW20-IT253FDMS	20F0212-03MS	Sediment	06/11/20
11	LDW20-IT253FDMSD	20F0212-03MSD	Sediment	06/11/20
12				

Notes:

VALIDATION FINDINGS WORKSHEET

METHOD: Pesticides

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

Notes:_____

LDC #: 48765A2b

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

Page: 1 of 1
Reviewer: 9
2nd Reviewer: 9

METHOD: ✓ GC __ HPLC

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	SIF01T635V1	~~RB35~~ 2C	BB	21.0	All (dots)	J/UJ/A
							(~~Aroclor 1254, BB~~)

LDC#: 48765A3b

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: PG
2nd Reviewer: MC

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
	2	3	
Aroclor 1248	27.4	9.3	99
Aroclor 1254	22.7	8.6	90
Aroclor 1260	25.7	12.7	68

V:\FIELD DUPLICATES\Field Duplicates\FD_Organics\2020\48765A3b windward duwamish.wpd

LDC #: 48765A3b

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

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

METHOD: ✓ GC __ HPLC

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 relative percent differences of detected compounds between two columns/detectors ≤40%?
If no, please see findings bellow.

#	Compound Name	Sample ID	%RPD Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	Z	1	55.7	J dets/P

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 25, 2020

Parameters: Metals

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0212

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT248	20F0212-01	Sediment	06/11/20
LDW20-IT253	20F0212-02	Sediment	06/11/20
LDW20-IT253FD	20F0212-03	Sediment	06/11/20
LDW20-IT272	20F0212-04	Sediment	06/11/20
LDW20-SC269B	20F0212-05	Sediment	06/11/20
LDW20-SC261B	20F0212-06	Sediment	06/11/20
LDW20-SC255B	20F0212-07	Sediment	06/11/20
LDW20-SC245B	20F0212-08	Sediment	06/11/20
LDW20-IT268	20F0212-09	Sediment	06/11/20
LDW20-IT248MS	20F0212-01MS	Sediment	06/11/20
LDW20-IT248MSD	20F0212-01MSD	Sediment	06/11/20
LDW20-IT248DUP	20F0212-01DUP	Sediment	06/11/20

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	0.02 ug/L	LDW20-IT248 LDW20-IT248DUP

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-IT248	Silver	0.14 mg/Kg	0.14U mg/Kg
LDW20-IT248DUP	Silver	0.14 mg/Kg	0.14U 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 with the following exceptions:

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW20-IT248MS/MSD (LDW20-IT248 LDW20-IT253 LDW20-IT253FD LDW20-IT272 LDW20-SC269B LDW20-SC261B LDW20-SC255B LDW20-SC245B LDW20-IT248DUP)	Mercury	132 (75-125)	145 (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

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

XI. Field Duplicates

Samples LDW20-IT253 and LDW20-IT253FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (mg/Kg)		RPD
	LDW20-IT253	LDW20-IT253FD	
Arsenic	6.56	6.41	2

Analyte	Concentration (mg/Kg)		RPD
	LDW20-IT253	LDW20-IT253FD	
Cadmium	0.09	0.09	0
Chromium	15.7	15.2	3
Copper	27.1	26.5	2
Lead	12.1	9.58	23
Mercury	0.0487	0.0380	25
Silver	0.09	0.07	25
Zinc	53.7	53.6	0

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 nine samples.

Due to laboratory blank contamination, data were qualified as not detected 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 20F0212

Sample	Analyte	Flag	A or P	Reason
LDW20-IT248 LDW20-IT253 LDW20-IT253FD LDW20-IT272 LDW20-SC269B LDW20-SC261B LDW20-SC255B LDW20-SC245B LDW20-IT248DUP	Mercury	J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)

Duwamish AOC4
Metals - Laboratory Blank Data Qualification Summary - SDG 20F0212

Sample	Analyte	Modified Final Concentration	A or P
LDW20-IT248	Silver	0.14U mg/Kg	A
LDW20-IT248DUP	Silver	0.14U mg/Kg	A

Duwamish AOC4
Metals - Field Blank Data Qualification Summary - SDG 20F0212

No Sample Data Qualified in this SDG

LDC #: 48765A4a **VALIDATION COMPLETENESS WORKSHEET** Date: 8/7/20
SDG #: 20F0212 Stage 2B Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer: CA
2nd Reviewer: CA

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
XI.	Field Duplicates	SW	(2,3)
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-IT248	20F0212-01	Sediment	06/11/20
2	LDW20-IT253	20F0212-02	Sediment	06/11/20
3	LDW20-IT253FD	20F0212-03	Sediment	06/11/20
4	LDW20-IT272	20F0212-04	Sediment	06/11/20
5	LDW20-SC269B	20F0212-05	Sediment	06/11/20
6	LDW20-SC261B	20F0212-06	Sediment	06/11/20
7	LDW20-SC255B	20F0212-07	Sediment	06/11/20
8	LDW20-SC245B	20F0212-08	Sediment	06/11/20
9	LDW20-IT248MS	20F0212-01MS	Sediment	06/11/20
10	LDW20-IT248MSD	20F0212-01MSD	Sediment	06/11/20
11	LDW20-IT248DUP	20F0212-01DUP	Sediment	06/11/20
12	LDW20-IT268	20F0212-09	"	"
13				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1 to 8	As, Cd, Cr, Cu, Pb, Ag, Zn, Hg
9	As
QC: 9-11	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: 1, 11

				Sample Identification								
Analyte	**PB (units)**	**Maximum ICB/CCB (ug/L)**	**Action Level**	1	11							
Ag		0.02		0.14	0.14							

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
9, 10	s	Hg	132	145	75-125			1 to 8 J1	Jdet/A	Det

Comments:

Method: Metals

Analyte	Concentration (mg/Kg)		RPD
	2	3	
Arsenic	6.56	6.41	2
Cadmium	0.09	0.09	0
Chromium	15.7	15.2	3
Copper	27.1	26.5	2
Lead	12.1	9.58	23
Mercury	0.0487	0.0380	25
Silver	0.09	0.07	25
Zinc	53.7	53.6	0

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0212

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT248	20F0212-01	Sediment	06/11/20
LDW20-IT253	20F0212-02	Sediment	06/11/20
LDW20-IT253FD	20F0212-03	Sediment	06/11/20
LDW20-IT272	20F0212-04	Sediment	06/11/20
LDW20-SC269B	20F0212-05	Sediment	06/11/20
LDW20-SC261B	20F0212-06	Sediment	06/11/20
LDW20-SC255B	20F0212-07	Sediment	06/11/20
LDW20-SC245B	20F0212-08	Sediment	06/11/20
LDW20-IT268	20F0212-09	Sediment	06/11/20
LDW20-IT272MS	20F0212-04MS	Sediment	06/11/20
LDW20-IT272DUP	20F0212-04DUP	Sediment	06/11/20

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

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

IX. Field Duplicates

Samples LDW20-IT253 and LDW20-IT253FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (%)		RPD
	LDW20-IT253	LDW20-IT253FD	
Total solids	74.06	75.99	3

Analyte	Concentration (%)		RPD
	LDW20-IT253	LDW20-IT253FD	
Total organic carbon	0.57	0.56	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 20F0212

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 20F0212

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 20F0212

No Sample Data Qualified in this SDG

LDC #: 48765A6
SDG #: 20F0212
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 8/17/20
Page: 1 of 1
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	A	
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	SW	(2,3)
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-IT248	20F0212-01	Sediment	06/11/20
2	LDW20-IT253	20F0212-02	Sediment	06/11/20
3	LDW20-IT253FD	20F0212-03	Sediment	06/11/20
4	LDW20-IT272	20F0212-04	Sediment	06/11/20
5	LDW20-SC269B	20F0212-05	Sediment	06/11/20
6	LDW20-SC261B	20F0212-06	Sediment	06/11/20
7	LDW20-SC255B	20F0212-07	Sediment	06/11/20
8	LDW20-SC245B	20F0212-08	Sediment	06/11/20
9	LDW20-IT268	20F0212-09	Sediment	06/11/20
10	LDW20-IT272MS	20F0212-04MS	Sediment	06/11/20
11	LDW20-IT272DUP	20F0212-04DUP	Sediment	06/11/20
12				
13				
14				
15				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1 to 9	Total solids, TOC
QC: 10, 11	TOC

METHOD: Inorganics

Analyte	Concentration (%)		RPD
	2	3	
Total solids	74.06	75.99	3
TOC	0.57	0.56	2

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 14, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0218

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS169	20F0218-01	Sediment	06/11/20
LDW20-SS113	20F0218-02	Sediment	06/11/20
LDW20-SS146	20F0218-03	Sediment	06/11/20
LDW20-SS139	20F0218-04	Sediment	06/11/20
LDW20-SS127	20F0218-05	Sediment	06/11/20
LDW20-SS127-FD	20F0218-06	Sediment	06/11/20
LDW20-SS133	20F0218-07	Sediment	06/11/20
LDW20-SS140	20F0218-08	Sediment	06/11/20
LDW20-SS142	20F0218-09	Sediment	06/11/20
LDW20-SS144	20F0218-10	Sediment	06/11/20
LDW20-SS148	20F0218-11	Sediment	06/11/20

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 temperature for samples in this SDG was reported at 9.5°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.

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
BIF0666-SRM1	Anthracene	50.6 (57-143)	All samples in SDG 20F0218	J (all detects) UJ (all non-detects)	P

X. Field Duplicates

Samples LDW20-SS127 and LDW20-SS127-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-SS127	LDW20-SS127-FD	
Phenol	12.7	11.1	13
Naphthalene	19.8U	6.4	Not calculable
Acenaphthylene	19.8U	12.6	Not calculable
Dimethylphthalate	14.8	10.4	35
Phenanthrene	43.8	97.0	76
Anthracene	10.2	20.8	68
Fluoranthene	102	666	147

Compound	Concentration (ug/Kg)		RPD
	LDW20-SS127	LDW20-SS127-FD	
Pyrene	94.2	372	119
Butylbenzylphthalate	10.2	19.8U	Not calculable
Benzo(a)anthracene	40.9	119	98
Chrysene	75.5	227	100
Bis(2-ethylhexyl)phthalate	61.1	142	80
Benzofluoranthenes, total	108	463	124
Benzo(a)pyrene	40.3	123	101
Indeno(1,2,3-cd)pyrene	31.4	94.4	100
Dibenz(a,h)anthracene	9.8	29.5	100
Benzo(g,h,i)perylene	33.3	81.3	84

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 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 20F0218

Sample	Compound	Flag	A or P	Reason
LDW20-SS169 LDW20-SS113 LDW20-SS146 LDW20-SS139 LDW20-SS127 LDW20-SS127-FD LDW20-SS133 LDW20-SS140 LDW20-SS142 LDW20-SS144 LDW20-SS148	Anthracene	J (all detects) UJ (all non-detects)	P	Standard reference materials (%R)

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0218

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0218

No Sample Data Qualified in this SDG

LDC #: 48765B2a
SDG #: 20F0218
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 8/12/20
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	A / KW	Temp @ 9.5°C - same day
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A / A	RSD ≤ 20%. r² ICV ≤ 30%
IV.	Continuing calibration	A	%R ≤ 20%.
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples / SRM	A / KW	LCS, SRM
X.	Field duplicates	KW	5 = 5 + 6
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-SS169	20F0218-01	Sediment	06/11/20
2	LDW20-SS113	20F0218-02	Sediment	06/11/20
3	LDW20-SS146	20F0218-03	Sediment	06/11/20
4	LDW20-SS139	20F0218-04	Sediment	06/11/20
5	LDW20-SS127	20F0218-05	Sediment	06/11/20
6	LDW20-SS127-FD	20F0218-06	Sediment	06/11/20
7	LDW20-SS133	20F0218-07	Sediment	06/11/20
8	LDW20-SS140	20F0218-08	Sediment	06/11/20
9	LDW20-SS142	20F0218-09	Sediment	06/11/20
10	LDW20-SS144	20F0218-10	Sediment	06/11/20
11	LDW20-SS148	20F0218-11	Sediment	06/11/20
12				
13				
14				

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 48765B29

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS)

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

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

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?

#	Date	LCS/LCSD ID	Compound	~~LCS~~ SRM %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		B1F0666-SRM1	VV	50.6 (57-143)	( )	( )	All (dets + ND)	J/UJ/P
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
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				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		

LDC#: 48765B2a

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
	5	6	
A	12.7	11.1	13
S	19.8U	6.4	NC
DD	19.8U	12.6	NC
CC	14.8	10.4	35
UU	43.8	97.0	76
VV	10.2	20.8	68
YY	102	666	147
ZZ	94.2	372	119
AAA	10.2	19.8U	NC
CCC	40.9	119	98
DDD	75.5	227	100
EEE	61.1	142	80
ZZZZ	108	463	124
III	40.3	123	101
JJJ	31.4	94.4	100
KKK	9.8	29.5	100
LLL	33.3	81.3	84

LDC Report# 48765B2b

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 14, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0218

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS169	20F0218-01	Sediment	06/11/20
LDW20-SS113	20F0218-02	Sediment	06/11/20
LDW20-SS146	20F0218-03	Sediment	06/11/20
LDW20-SS139	20F0218-04	Sediment	06/11/20
LDW20-SS127	20F0218-05	Sediment	06/11/20
LDW20-SS127-FD	20F0218-06	Sediment	06/11/20
LDW20-SS133	20F0218-07	Sediment	06/11/20
LDW20-SS140	20F0218-08	Sediment	06/11/20
LDW20-SS142	20F0218-09	Sediment	06/11/20
LDW20-SS144	20F0218-10	Sediment	06/11/20
LDW20-SS148	20F0218-11	Sediment	06/11/20

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 temperature for samples in this SDG was reported at 9.5°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 20F0218	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
07/09/20	Benzoic acid Pentachlorophenol	33.8 40.3	LDW20-SS169	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	A
07/10/20	Benzyl alcohol	26.8	LDW20-SS113 LDW20-SS146 LDW20-SS139 LDW20-SS127 LDW20-SS127-FD LDW20-SS133 LDW20-SS140 LDW20-SS142 LDW20-SS144 LDW20-SS148	J (all detects) UJ (all non-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 with the following exceptions:

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
BIF0666-BLK2	06/25/20	1,4-Dichlorobenzene 1,2-Dichlorobenzene	0.8 ug/Kg 0.9 ug/Kg	All samples in SDG 20F0218

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-SS127	1,4-Dichlorobenzene	0.6 ug/Kg	0.6U ug/Kg
LDW20-SS140	1,4-Dichlorobenzene	0.7 ug/Kg	0.7U ug/Kg
LDW20-SS142	1,4-Dichlorobenzene	1.8 ug/Kg	1.8U 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 not within QC limits. No data were qualified since there were no associated samples in 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
BIF0666-SRM2	2,4-Dimethylphenol	20.5 (40-160)	All samples in SDG 20F0218	UJ (all non-detects)	P

X. Field Duplicates

Samples LDW20-SS127 and LDW20-SS127-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-SS127	LDW20-SS127-FD	
1,4-Dichlorobenzene	0.6	4.9U	Not calculable
Benzyl alcohol	16.2	16.1	1
Benzoic acid	53.9	42.6	23

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 eleven 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
Semivolatiles – Data Qualification Summary - SDG 20F0218

Sample	Compound	Flag	A or P	Reason
LDW20-SS169 LDW20-SS113 LDW20-SS146 LDW20-SS139 LDW20-SS127 LDW20-SS127-FD LDW20-SS133 LDW20-SS140 LDW20-SS142 LDW20-SS144 LDW20-SS148	N-Nitrosodiphenylamine	J (all detects) UJ (all non-detects)	A	Initial calibration verification (%D)
LDW20-SS169	Benzoic acid Pentachlorophenol	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	A	Continuing calibration (%D)
LDW20-SS113 LDW20-SS146 LDW20-SS139 LDW20-SS127 LDW20-SS127-FD LDW20-SS133 LDW20-SS140 LDW20-SS142 LDW20-SS144 LDW20-SS148	Benzyl alcohol	J (all detects) UJ (all non-detects)	A	Continuing calibration (%D)
LDW20-SS169 LDW20-SS113 LDW20-SS146 LDW20-SS139 LDW20-SS127 LDW20-SS127-FD LDW20-SS133 LDW20-SS140 LDW20-SS142 LDW20-SS144 LDW20-SS148	2,4-Dimethylphenol	UJ (all non-detects)	P	Standard reference materials (%R)

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0218

Sample	Compound	Modified Final Concentration	A or P
LDW20-SS127	1,4-Dichlorobenzene	0.6U ug/Kg	A
LDW20-SS140	1,4-Dichlorobenzene	0.7U ug/Kg	A
LDW20-SS142	1,4-Dichlorobenzene	1.8U ug/Kg	A

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0218

No Sample Data Qualified in this SDG

LDC #: 48765B2b

SDG #: 20F0218

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 9/2/20

Page: 1 of 1

Reviewer: [illegible]

2nd Reviewer: [illegible]

METHOD: GC/MS ~~Polynuclear Aromatic Hydrocarbons~~ SVOAs (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	A	Temp 9.5°C - same day
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/SW	RSD ≤ 20% or r² 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	SW	RPD out - No assoc'd spl
IX.	Laboratory control samples / SRM	A/SW	LCS. SRM
X.	Field duplicates	SW	D=5+6
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-SS169	20F0218-01	Sediment	06/11/20
2	LDW20-SS113	20F0218-02	Sediment	06/11/20
3	LDW20-SS146	20F0218-03	Sediment	06/11/20
4	LDW20-SS139	20F0218-04	Sediment	06/11/20
5	LDW20-SS127	20F0218-05	Sediment	06/11/20
6	LDW20-SS127-FD	20F0218-06	Sediment	06/11/20
7	LDW20-SS133	20F0218-07	Sediment	06/11/20
8	LDW20-SS140	20F0218-08	Sediment	06/11/20
9	LDW20-SS142	20F0218-09	Sediment	06/11/20
10	LDW20-SS144	20F0218-10	Sediment	06/11/20
11	LDW20-SS148	20F0218-11	Sediment	06/11/20
12				
13				
14				

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 48765B2b

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: GC/MS BNA (EPA SW 846 Method 8270D)
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 ≤30 %D ?

#	Date	Standard ID	Compound	Finding %D (Limit: ≤30.0%)	Associated Samples	Qualifications
	6/26/20	5HF0393-SCV1	QQ	41.9	All (dets + ND)	J/UJ/A

LDC #: 18765B>6

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Page: 1 of 1
Reviewer: A
2nd Reviewer: M

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

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 for each instrument?

Y (N) N/A Were percent differences (%D) ≤20 % and relative response factors (RRF) within the method criteria?

#	Date	Standard ID	Compound	Finding %D (Limit: ≤20.0%)	Finding RRF (Limit)	Associated Samples	Qualifications
	7/9/20	NT10200T0903S	PPP	33.8		BLK, 1 (detect+ND)	J (all det) / UJ (ND)
			TT	40.3			
	7/10/20	NT10206T1003S	QQQ	26.8		2-11. MB (detect+ND)	J (all det) / UJ (ND)

LDC #: 48765B3b

VALIDATION FINDINGS WORKSHEET
Blanks

Reviewer: 9
2nd Reviewer: 1

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

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: 6/25/20 **Blank analysis date:** 7/9/20
Conc. units: ug/kg Associated Samples: All

Compound	Blank ID	Sample Identification								
BIF0666-BK2		5	8	9						
E	0.8	0.6/4	0.7/4	1.8/4						
F	0.9									

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:
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 #: 43765B2b

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS)

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

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

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?

#	Date	LCS/LCSD ID	Compound	~~LCS~~ SRM %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		B1F0666-SRM2	O	20.5 (40-160)	( )	( )	All (ND)	J/UJ/P
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
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				( )	( )	( )		
				( )	( )	( )		

LDC#: 48765B2b

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: PG
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
	5	6	
E	0.6	4.9U	NC
QQQ	16.2	16.1	1
PPP	53.9	42.6	23

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LDC Report# 48765B3a

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 14, 2020

Parameters: Hexachlorobenzene

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0218

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS169	20F0218-01	Sediment	06/11/20
LDW20-SS113	20F0218-02	Sediment	06/11/20
LDW20-SS146	20F0218-03	Sediment	06/11/20
LDW20-SS139	20F0218-04	Sediment	06/11/20
LDW20-SS127	20F0218-05	Sediment	06/11/20
LDW20-SS127-FD	20F0218-06	Sediment	06/11/20
LDW20-SS133	20F0218-07	Sediment	06/11/20
LDW20-SS140	20F0218-08	Sediment	06/11/20
LDW20-SS142	20F0218-09	Sediment	06/11/20
LDW20-SS144	20F0218-10	Sediment	06/11/20
LDW20-SS148	20F0218-11	Sediment	06/11/20
LDW20-SS169MS	20F0218-01MS	Sediment	06/11/20
LDW20-SS169MSD	20F0218-01MSD	Sediment	06/11/20

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 temperature for samples in this SDG was reported at 9.5°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-SS127 and LDW20-SS127-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-SS127	LDW20-SS127-FD	
Hexachlorobenzene	1.03	1.00	3

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 20F0218

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Laboratory Blank Data Qualification Summary - SDG 20F0218

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Field Blank Data Qualification Summary - SDG 20F0218

No Sample Data Qualified in this SDG

LDC #: 48765B3a
SDG #: 20F0218
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 8/13/20
Page: 1 of 1
Reviewer: 2
2nd Reviewer: K

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	A	Temp @ 9.5°C - same day
II.	GC Instrument Performance Check	A	
III.	Initial calibration/ICV	A/A	RSD ≤ 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	A/	D=5+6
XI.	Compound quantitation/RL/LOQ/LODs	N	
XII.	Target compound identification	N	
XIII.	System Performance	N	
XIV	Overall assessment of data		

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-SS169	20F0218-01	Sediment	06/11/20
2	LDW20-SS113	20F0218-02	Sediment	06/11/20
3	LDW20-SS146	20F0218-03	Sediment	06/11/20
4	LDW20-SS139	20F0218-04	Sediment	06/11/20
5	LDW20-SS127	20F0218-05	Sediment	06/11/20
6	LDW20-SS127-FD	20F0218-06	Sediment	06/11/20
7	LDW20-SS133	20F0218-07	Sediment	06/11/20
8	LDW20-SS140	20F0218-08	Sediment	06/11/20
9	LDW20-SS142	20F0218-09	Sediment	06/11/20
10	LDW20-SS144	20F0218-10	Sediment	06/11/20
11	LDW20-SS148	20F0218-11	Sediment	06/11/20
12	LDW20-SS169MS	20F0218-01MS	Sediment	06/11/20
13	LDW20-SS169MSD	20F0218-01MSD	Sediment	06/11/20
14				
15				

LDC#: 48765B3a

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Page: 1 of 1
Reviewer: PG
2nd Reviewer:

METHOD: GC HCB (EPA SW 846 Method 8081B)

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
	5	6	
Hexachlorobenzene	1.03	1.00	3

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Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 14, 2020

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0218

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS169	20F0218-01	Sediment	06/11/20
LDW20-SS113	20F0218-02	Sediment	06/11/20
LDW20-SS146	20F0218-03	Sediment	06/11/20
LDW20-SS139	20F0218-04	Sediment	06/11/20
LDW20-SS127	20F0218-05	Sediment	06/11/20
LDW20-SS127-FD	20F0218-06	Sediment	06/11/20
LDW20-SS133	20F0218-07	Sediment	06/11/20
LDW20-SS140	20F0218-08	Sediment	06/11/20
LDW20-SS142	20F0218-09	Sediment	06/11/20
LDW20-SS144	20F0218-10	Sediment	06/11/20
LDW20-SS148	20F0218-11	Sediment	06/11/20

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 temperature for samples in this SDG was reported at 9.5°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 20F0218	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

Samples LDW20-SS127 and LDW20-SS127-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-SS127	LDW20-SS127-FD	
Aroclor-1248	15.5	16.8	8
Aroclor-1254	28.8	28.1	2
Aroclor-1260	51.8	47.6	8

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-SS146	Aroclor-1248	62.6	J (all detects)	A
LDW20-SS139	Aroclor-1248	52.1	J (all detects)	A
LDW20-SS127-FD	Aroclor-1248	48.9	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 20F0218

Sample	Compound	Flag	A or P	Reason
LDW20-SS169 LDW20-SS113 LDW20-SS146 LDW20-SS139 LDW20-SS127 LDW20-SS127-FD LDW20-SS133 LDW20-SS140 LDW20-SS142 LDW20-SS144 LDW20-SS148	Aroclor-1260	J (all detects)	A	Initial calibration verification (%D)
LDW20-SS146 LDW20-SS139 LDW20-SS127-FD	Aroclor-1248	J (all detects)	A	Compound quantitation (RPD between two columns)

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 20F0218

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 20F0218

No Sample Data Qualified in this SDG

LDC #: 48765B3b
SDG #: 20F0218
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 8/12/20
Page: 1 of 1
Reviewer: [illegible]
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	A	Temps @ 9.5°C - same day
II.	Initial calibration/ICV	A/SW	RSD ≤ 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	N	
VIII.	Laboratory control samples /SRM	A	LCS
IX.	Field duplicates	A/SW	6 = 5+6
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-SS169	20F0218-01	Sediment	06/11/20
2	LDW20-SS113	20F0218-02	Sediment	06/11/20
3	LDW20-SS146	20F0218-03	Sediment	06/11/20
4	LDW20-SS139	20F0218-04	Sediment	06/11/20
5	LDW20-SS127	20F0218-05	Sediment	06/11/20
6	LDW20-SS127-FD	20F0218-06	Sediment	06/11/20
7	LDW20-SS133	20F0218-07	Sediment	06/11/20
8	LDW20-SS140	20F0218-08	Sediment	06/11/20
9	LDW20-SS142	20F0218-09	Sediment	06/11/20
10	LDW20-SS144	20F0218-10	Sediment	06/11/20
11	LDW20-SS148	20F0218-11	Sediment	06/11/20
12				

Notes:

VALIDATION FINDINGS WORKSHEET

METHOD: Pesticides

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

Notes:_____

LDC #: 48765B36

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

Page: 1 of 1
Reviewer: 9
2nd Reviewer: [illegible]

METHOD: / GC __ HPLC

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
	6/16/20	SHF0176SQ11	2C	BB	21.0	All (dets)	J/UJ/A
							~~f/and 2: AA, BB~~

ICV-qc.wpd

LDC#: 48765B3b

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: PG
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
	5	6	
Aroclor 1248	15.5	16.8	8
Aroclor 1254	28.8	28.1	2
Aroclor 1260	51.8	47.6	8

V:\FIELD DUPLICATES\Field Duplicates\FD_Organics\2020\48765B3b windward duwamish.wpd

LDC #: 48765B3b

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Page: 1 of 1
Reviewer: q
2nd Reviewer: q

METHOD: ✓ GC __ HPLC

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 relative percent differences of detected compounds between two columns/detectors ≤40%?
If no, please see findings bellow.

#	Compound Name	Sample ID	%RPD Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	Z	3	62.6	J dets/A
	Z	4	52.1	↓
	Z	6	48.9	↓

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Metals

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0218

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS169	20F0218-01	Sediment	06/11/20
LDW20-SS113	20F0218-02	Sediment	06/11/20
LDW20-SS146	20F0218-03	Sediment	06/11/20
LDW20-SS139	20F0218-04	Sediment	06/11/20
LDW20-SS127	20F0218-05	Sediment	06/11/20
LDW20-SS127-FD	20F0218-06	Sediment	06/11/20
LDW20-SS133	20F0218-07	Sediment	06/11/20
LDW20-SS140	20F0218-08	Sediment	06/11/20
LDW20-SS142	20F0218-09	Sediment	06/11/20
LDW20-SS144	20F0218-10	Sediment	06/11/20
LDW20-SS148	20F0218-11	Sediment	06/11/20

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.

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-IT248MS/MSD (All samples in SDG 20F0218)	Mercury	132 (75-125)	145 (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

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

XI. Field Duplicates

Samples LDW20-SS127 and LDW20-SS127-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-SS127	LDW20-SS127-FD	
Arsenic	10.8	12.1	11
Cadmium	0.19U	0.07	Not calculable
Chromium	19.1	21.7	13
Copper	38.3	45.1	16
Lead	18.6	21.9	16
Mercury	0.124	0.317	88
Silver	0.09	0.11	20
Zinc	60.8	75.2	21

XII. Internal Standards (ICP-MS)

ICP-MS was not utilized in this SDG.

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 eleven samples.

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

Duwamish AOC4
Metals - Data Qualification Summary - SDG 20F0218

Sample	Analyte	Flag	A or P	Reason
LDW20-SS169 LDW20-SS113 LDW20-SS146 LDW20-SS139 LDW20-SS127 LDW20-SS127-FD LDW20-SS133 LDW20-SS140 LDW20-SS142 LDW20-SS144 LDW20-SS148	Mercury	J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)

Duwamish AOC4
Metals - Laboratory Blank Data Qualification Summary - SDG 20F0218

No Sample Data Qualified in this SDG

Duwamish AOC4
Metals - Field Blank Data Qualification Summary - SDG 20F0218

No Sample Data Qualified in this SDG

LDC #: 48765B4a
SDG #: 20F0218
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 8/17/20
Page: 1 of 1
Reviewer: [illegible]
2nd Reviewer: [illegible]

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	A	
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
XI.	Field Duplicates	SW	(5,6)
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-SS169	20F0218-01	Sediment	06/11/20
2	LDW20-SS113	20F0218-02	Sediment	06/11/20
3	LDW20-SS146	20F0218-03	Sediment	06/11/20
4	LDW20-SS139	20F0218-04	Sediment	06/11/20
5	LDW20-SS127	20F0218-05	Sediment	06/11/20
6	LDW20-SS127-FD	20F0218-06	Sediment	06/11/20
7	LDW20-SS133	20F0218-07	Sediment	06/11/20
8	LDW20-SS140	20F0218-08	Sediment	06/11/20
9	LDW20-SS142	20F0218-09	Sediment	06/11/20
10	LDW20-SS144	20F0218-10	Sediment	06/11/20
11	LDW20-SS148	20F0218-11	Sediment	06/11/20
12				
13				

Notes:

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

Analysis Method

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

Matrix Spike/Matrix Spike Duplicates

Reviewer:CR

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-IT248MS/MSD	s	Hg	132	145	75-125			All	Jdet/A	Det

Comments:

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Method: Metals

Analyte	Concentration (mg/Kg)		RPD
	5	6	
Arsenic	10.8	12.1	11
Cadmium	0.19U	0.07	NC
Chromium	19.1	21.7	13
Copper	38.3	45.1	16
Lead	18.6	21.9	16
Mercury	0.124	0.317	88
Silver	0.09	0.11	20
Zinc	60.8	75.2	21

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0218

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS169	20F0218-01	Sediment	06/11/20
LDW20-SS113	20F0218-02	Sediment	06/11/20
LDW20-SS146	20F0218-03	Sediment	06/11/20
LDW20-SS139	20F0218-04	Sediment	06/11/20
LDW20-SS127	20F0218-05	Sediment	06/11/20
LDW20-SS127-FD	20F0218-06	Sediment	06/11/20
LDW20-SS133	20F0218-07	Sediment	06/11/20
LDW20-SS140	20F0218-08	Sediment	06/11/20
LDW20-SS142	20F0218-09	Sediment	06/11/20
LDW20-SS144	20F0218-10	Sediment	06/11/20
LDW20-SS148	20F0218-11	Sediment	06/11/20
LDW20-SS169DUP	20F0218-01DUP	Sediment	06/11/20

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

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

IX. Field Duplicates

Samples LDW20-SS127 and LDW20-SS127-FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (%)		RPD
	LDW20-SS127	LDW20-SS127-FD	
Total solids	52.94	50.38	5

Analyte	Concentration (%)		RPD
	LDW20-SS127	LDW20-SS127-FD	
Total organic carbon	1.59	1.68	6

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 20F0218

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 20F0218

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 20F0218

No Sample Data Qualified in this SDG

LDC #: 48765B6
SDG #: 20F0218
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 8/17/26
Page: 1 of 1
Reviewer: CT
2nd Reviewer: CT

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 1A	
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	A	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	A	MS(20F0212)
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	SW	(5,6)
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-SS169	20F0218-01	Sediment	06/11/20
2	LDW20-SS113	20F0218-02	Sediment	06/11/20
3	LDW20-SS146	20F0218-03	Sediment	06/11/20
4	LDW20-SS139	20F0218-04	Sediment	06/11/20
5	LDW20-SS127	20F0218-05	Sediment	06/11/20
6	LDW20-SS127-FD	20F0218-06	Sediment	06/11/20
7	LDW20-SS133	20F0218-07	Sediment	06/11/20
8	LDW20-SS140	20F0218-08	Sediment	06/11/20
9	LDW20-SS142	20F0218-09	Sediment	06/11/20
10	LDW20-SS144	20F0218-10	Sediment	06/11/20
11	LDW20-SS148	20F0218-11	Sediment	06/11/20
12	LDW20-SS169DUP	20F0218-01DUP	Sediment	06/11/20
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
QC: 12	TS

Field Duplicates

METHOD: Inorganics

Analyte	Concentration (%)		RPD
	5	6	
Total solids	52.94	50.38	5
TOC	1.59	1.68	6

LDC Report# 48765B21

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Polychlorinated Dioxins/Dibenzofurans

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0218

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS146	20F0218-03	Sediment	06/11/20
LDW20-SS127	20F0218-05	Sediment	06/11/20
LDW20-SS127-FD	20F0218-06	Sediment	06/11/20
LDW20-SS146DUP	20F0218-03DUP	Sediment	06/11/20

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

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

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance 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 Total HpCDD	0.140 ng/Kg 0.0330 ng/Kg 0.535 ng/Kg 1.37 ng/Kg 6.33 ng/Kg 0.284 ng/Kg	All samples in SDG 20F0218

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-SS146	1,2,3,4,7,8,9-HpCDF	0.968 ng/Kg	0.968U ng/Kg

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-SS146DUP (LDW20-SS146)	1,2,3,4,6,7,8-HpCDF 1,2,3,4,6,7,8-HpCDD OCDF OCDD	28.3 (≤25) 40.4 (≤25) 45.6 (≤25) 48.2 (≤25)	J (all detects) J (all detects) 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

Samples LDW20-SS127 and LDW20-SS127-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-SS127	LDW20-SS127-FD	
2,3,7,8-TCDF	0.635	0.951	40
2,3,7,8-TCDD	0.351	0.364	4
1,2,3,7,8-PeCDF	0.604	0.502	18
2,3,4,7,8-PeCDF	0.886	0.849	4
1,2,3,7,8-PeCDD	0.940	0.871	8
1,2,3,4,7,8-HxCDF	1.99	2.05	3
1,2,3,6,7,8-HxCDF	0.850	0.802	6
2,3,4,6,7,8-HxCDF	1.00	1.08	8
1,2,3,7,8,9-HxCDF	0.420	0.472	12
1,2,3,4,7,8-HxCDD	0.899	0.949	5
1,2,3,6,7,8-HxCDD	3.04	3.26	7
1,2,3,7,8,9-HxCDD	2.40	2.29	5
1,2,3,4,6,7,8-HpCDF	18.8	18.9	1
1,2,3,4,7,8,9-HpCDF	1.49	1.38	8
1,2,3,4,6,7,8-HpCDD	90.1	118	27
OCDF	46.8	48.1	3
OCDD	743	1090	38
Total TCDF	14.5	13.0	11
Total TCDD	2.54	1.59	46

Compound	Concentration (ng/Kg)		RPD
	LDW20-SS127	LDW20-SS127-FD	
Total PeCDF	11.6	11.3	3
Total PeCDD	1.68	5.79	110
Total HxCDF	25.3	24.5	3
Total HxCDD	23.5	33.0	34
Total HpCDF	61.9	61.5	1
Total HpCDD	197	339	53

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 20F0218	All compounds reported as estimated maximum possible concentration (EMPC) and greater than the reporting limit.	J (all detects)	A
All samples in SDG 20F0218	All compounds reported as estimated maximum possible concentration (EMPC) and less than the reporting limit.	U (all non-detects)	A
All samples in SDG 20F0218	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 in three 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 20F0218

Sample	Compound	Flag	A or P	Reason
LDW20-SS146	1,2,3,4,6,7,8-HpCDF 1,2,3,4,6,7,8-HpCDD OCDF OCDD	J (all detects) J (all detects) J (all detects) J (all detects)	A	Duplicate sample analysis (RPD)
LDW20-SS146 LDW20-SS127 LDW20-SS127-FD LDW20-SS146DUP	All compounds reported as estimated maximum possible concentration (EMPC) and greater than the reporting limit.	J (all detects)	A	Compound quantitation (EMPC)
LDW20-SS146 LDW20-SS127 LDW20-SS127-FD LDW20-SS146DUP	All compounds reported as estimated maximum possible concentration (EMPC) and less than the reporting limit.	U (all non-detects)	A	Compound quantitation (EMPC)
LDW20-SS146 LDW20-SS127 LDW20-SS127-FD LDW20-SS146DUP	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 20F0218

Sample	Compound	Modified Final Concentration	A or P
LDW20-SS146	1,2,3,4,7,8,9-HpCDF	0.968U ng/Kg	A

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Field Blank Data Qualification Summary - SDG 20F0218

No Sample Data Qualified in this SDG

LDC #: 48765B21 **VALIDATION COMPLETENESS WORKSHEET** Date: 8/13/20
SDG #: 20F0218 Stage 2B Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer: [illegible]
2nd Reviewer: [illegible]

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	A	~~Temp @ 9.5°C - Same day~~ A
II.	HRGC/HRMS Instrument performance check	A	
III.	Initial calibration/ICV	A / A	RSD ≤ 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 /~~SDUP~~	N/SW	LCS
VIII.	Laboratory control samples /SRM	A	LCS
IX.	Field duplicates	SW	D = 2+3
X.	Labeled Compounds	A	
XI.	Compound quantitation RL/LOQ/LODs	A/N	EMPC results - Dets/ND
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-SS146	20F0218-03	Sediment	06/11/20
2	LDW20-SS127	20F0218-05	Sediment	06/11/20
3	LDW20-SS127-FD	20F0218-06	Sediment	06/11/20
4	LDW20-SS146DUP	20F0218-03DUP	Sediment	06/11/20
5				
6				
7				
8				
9				
10				

Notes:

VALIDATION FINDINGS WORKSHEET

METHOD: HRGC/HRMS Dioxins/Dibenzofurans

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 #: 48765B21

VALIDATION FINDINGS WOR/UHEET
Blanks

Reviewer: PG
2nd Reviewer:

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

Blank extraction date: 7/6/20 **Blank analysis date:** 7/9/20
Conc. units: ng/kg **Associated samples:** All qual U

Compound	Blank ID	Sample Identification											
	BIF0803-BLK1	5X	1										
O	0.140	0.7											
P	0.0330	0.165	0.968										
F	0.535	2.675											
Q	1.37	6.85											
G	6.33	31.65											
U	0.284	1.42											
			<										

LDC #: 48765B7

VALIDATION FINDINGS WORKSHEET
Duplicate Analysis

Page: 1 of 1
Reviewer: 4
2nd Reviewer: 4

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) ≤ 35?

#	Date	Duplicate ID	Matrix	Compound	RPD (Limits)	Associated Samples	Qualifications
		1	S	O	28.3 (≤35)	1 (all)	~~1 all~~ J (all) A
				F	40.4		
				D	45.6		
				4	48.2		

LDC#: 48765B21

VALIDATION FINDINGS WORKSHEET
Field Duplicates

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

METHOD: HRGC/HRMS Polychlorinated Dioxins/Dibenzofurans (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	0.635	0.951	40
A	0.351	0.364	4
I	0.604	0.502	18
J	0.886	0.849	4
B	0.940	0.871	8
K	1.99	2.05	3
L	0.850	0.802	6
M	1.00	1.08	8
N	0.420	0.472	12
C	0.899	0.949	5
D	3.04	3.26	7
E	2.40	2.29	5
O	18.8	18.9	1
P	1.49	1.38	8
F	90.1	118	27
Q	46.8	48.1	3
G	743	1090	38
V	14.5	13.0	11
R	2.54	1.59	46
W	11.6	11.3	3
S	1.68	5.79	110
X	25.3	24.5	3
T	23.5	33.0	34
Y	61.9	61.5	1
U	197	339	53

LDC #: 48765B1

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported RLs

Reviewer: 9
2nd Reviewer: KC

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 > RL		Jdets/A
		↓	↓ < RL		U/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 14, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0233

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20SC230B	20F0233-04	Sediment	06/12/20
LDW20-SC223A	20F0233-05	Sediment	06/12/20
LDW20-SC222B	20F0233-06	Sediment	06/12/20
LDW20-SC220A	20F0233-07	Sediment	06/12/20
LDW20-SC217A	20F0233-08	Sediment	06/12/20
LDW20-SC219C	20F0233-09	Sediment	06/12/20
LDW20-SC212A	20F0233-10	Sediment	06/12/20

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 6.5°C and 9.5°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 (r2) 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.

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
BIF0719-SRM1	Acenaphthylene Anthracene Bis(2-ethylhexyl)phthalate	51.4 (52-148) 51.8 (57-143) 61.5 (62-138)	All samples in SDG 20F0233	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 SRM %R, data were qualified as estimated in seven samples.

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

Duwamish AOC4
Semivolatiles - Data Qualification Summary - SDG 20F0233

Sample	Compound	Flag	A or P	Reason
LDW20SC230B LDW20-SC223A LDW20-SC222B LDW20-SC220A LDW20-SC217A LDW20-SC219C LDW20-SC212A	Acenaphthylene Anthracene Bis(2-ethylhexyl)phthalate	J (all detects) UJ (all non-detects)	A	Standard reference materials (%R)

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0233

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0233

No Sample Data Qualified in this SDG

LDC #: 48765C2a

SDG #: 20F0233

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 8/13/20

Page: 1 of 1

Reviewer:

2nd Reviewer: A

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	A	Temp @ 6.5° & 9.5°C - same day
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	RSD ≤ 20% . r² ICV ≤ 20%
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	MS
IX.	Laboratory control samples LCS/LCSD	A/A	LCS
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	LDW20SC230B	20F0233-04	Sediment	06/12/20
2	LDW20-SC223A	20F0233-05	Sediment	06/12/20
3	LDW20-SC222B	20F0233-06	Sediment	06/12/20
4	LDW20-SC220A	20F0233-07	Sediment	06/12/20
5	LDW20-SC217A	20F0233-08	Sediment	06/12/20
6	LDW20-SC219C	20F0233-09	Sediment	06/12/20
7	LDW20-SC212A	20F0233-10	Sediment	06/12/20
8				
9				

Notes:

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 48716C29

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS)

Page: 1 of 1
Reviewer: q
2nd Reviewer: ↑

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

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?

#	Date	LCS/LCSD ID	Compound	~~LCS~~ SRM %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		B1F0719-SRM1	DD	51.4 (52-148)	( )	( )	All (dets+ND)	J/UJ/A
			VV	51.8 (57-143)	( )	( )		↓
			EEE	61.5 (62-138)	( )	( )		✓
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
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				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		

LDC Report# 48765C2b

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 14, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0233

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC230B	20F0233-04	Sediment	06/12/20
LDW20-SC223A	20F0233-05	Sediment	06/12/20
LDW20-SC222B	20F0233-06	Sediment	06/12/20
LDW20-SC220A	20F0233-07	Sediment	06/12/20
LDW20-SC217A	20F0233-08	Sediment	06/12/20
LDW20-SC219C	20F0233-09	Sediment	06/12/20
LDW20-SC212A	20F0233-10	Sediment	06/12/20

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 6.5°C and 9.5°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	65.7	All samples in SDG 20F0233	J (all 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
07/10/20	Benzoic acid Pentachlorophenol	32.0 50.0	All samples in SDG 20F0233	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-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 with the following exceptions:

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
BIF0719-BLK2	06/26/20	1,4-Dichlorobenzene	0.7 ug/Kg	All samples in SDG 20F0233

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-SC230B	1,4-Dichlorobenzene	1.3 ug/Kg	1.3U ug/Kg
LDW20-SC223A	1,4-Dichlorobenzene	0.8 ug/Kg	0.8U ug/Kg
LDW20-SC222B	1,4-Dichlorobenzene	1.6 ug/Kg	1.6U ug/Kg
LDW20-SC220A	1,4-Dichlorobenzene	1.2 ug/Kg	1.2U ug/Kg
LDW20-SC217A	1,4-Dichlorobenzene	1.8 ug/Kg	1.8U ug/Kg
LDW20-SC219C	1,4-Dichlorobenzene	1.4 ug/Kg	1.4U ug/Kg
LDW20-SC212A	1,4-Dichlorobenzene	1.3 ug/Kg	1.3U 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

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
BIF0719-SRM2	2,4-Dimethylphenol	34.2 (40-160)	All samples in SDG 20F0233	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 seven samples.

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

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

Duwamish AOC4
Semivolatiles – Data Qualification Summary - SDG 20F0233

Sample	Compound	Flag	A or P	Reason
LDW20-SC230B LDW20-SC223A LDW20-SC222B LDW20-SC220A LDW20-SC217A LDW20-SC219C LDW20-SC212A	N-Nitrosodiphenylamine	J (all detects)	A	Initial calibration verification (%D)
LDW20-SC230B LDW20-SC223A LDW20-SC222B LDW20-SC220A LDW20-SC217A LDW20-SC219C LDW20-SC212A	Benzoic acid Pentachlorophenol	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	A	Continuing calibration (%D)
LDW20-SC230B LDW20-SC223A LDW20-SC222B LDW20-SC220A LDW20-SC217A LDW20-SC219C LDW20-SC212A	2,4-Dimethylphenol	UJ (all non-detects)	P	Standard reference materials (%R)

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0233

Sample	Compound	Modified Final Concentration	A or P
LDW20-SC230B	1,4-Dichlorobenzene	1.3U ug/Kg	A
LDW20-SC223A	1,4-Dichlorobenzene	0.8U ug/Kg	A
LDW20-SC222B	1,4-Dichlorobenzene	1.6U ug/Kg	A
LDW20-SC220A	1,4-Dichlorobenzene	1.2U ug/Kg	A
LDW20-SC217A	1,4-Dichlorobenzene	1.8U ug/Kg	A
LDW20-SC219C	1,4-Dichlorobenzene	1.4U ug/Kg	A
LDW20-SC212A	1,4-Dichlorobenzene	1.3U ug/Kg	A

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0233

No Sample Data Qualified in this SDG

LDC #: 48765C2b

SDG #: 20F0233

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 8/18/20

Page: 1 of 1

Reviewer:

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	A	Temp @ 6.5-7.5°C - same day
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A MW	RSD ≤ 20%. r² ICV ≤ 30%
IV.	Continuing calibration	MW	CCV ≤ 30%
V.	Laboratory Blanks	MW	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples / ~~SRM~~	A/MW	LCS
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	LDW20SC230B	20F0233-04	Sediment	06/12/20
2	LDW20-SC223A	20F0233-05	Sediment	06/12/20
3	LDW20-SC222B	20F0233-06	Sediment	06/12/20
4	LDW20-SC220A	20F0233-07	Sediment	06/12/20
5	LDW20-SC217A	20F0233-08	Sediment	06/12/20
6	LDW20-SC219C	20F0233-09	Sediment	06/12/20
7	LDW20-SC212A	20F0233-10	Sediment	06/12/20
8				
9				

Notes:

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 43765C2h

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

Page: 1 of 1
Reviewer: 9
2nd Reviewer: 9

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

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 ≤30 %D ?

#	Date	Standard ID	Compound	Finding %D (Limit: ≤30.0%)	Associated Samples	Qualifications
	6/26/20	SIF0395-SCV1	88	65.7	All (dots)	J/UJ/A
	6/26/20	SIF0393-SCV1	88	71.9		

LDC #: 45765C2b

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Page: 1 of 1
Reviewer: 9
2nd Reviewer:

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

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 for each instrument?

Y N N/A Were percent differences (%D) ≤20 % and relative response factors (RRF) within the method criteria?

#	Date	Standard ID	Compound	Finding %D (Limit: ≤20.0%)	Finding RRF (Limit)	Associated Samples	Qualifications
	7/10/20	NT142007100335	TPP	32.0		All (dets+NDs)	J/UJ/A
			TT	50.0			J

LDC #: 48166c3b

VALIDATION FINDINGS WORKSHEET
Blanks

Page: 1 of 1
Reviewer: 9
2nd Reviewer: 9

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

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: 6/4/20 **Blank analysis date:** 7/19/20
Conc. units: ug/kg Associated Samples: All

Compound	Blank ID	Sample Identification								
BEP	BT19-BK3	1	2	3	4	5	6	7		
E	0.7	1.3/U	0.3/U	1.6/U	1.7/U	1.8/U	1.4/U	1.3/U		

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:
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 #: 18765C2b

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS)

Page: 1 of 1
Reviewer: 9
2nd Reviewer: 4

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

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?

#	Date	LCS/LCSD ID	Compound	~~LCS~~ SRM %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		B1F0719-SRM2	O	34.2 (40-160)	( )	( )	All (ND)	J/UJ/A
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
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Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 14, 2020

Parameters: Hexachlorobenzene

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0233

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20SC230B	20F0233-04	Sediment	06/12/20
LDW20-SC223A	20F0233-05	Sediment	06/12/20
LDW20-SC222B	20F0233-06	Sediment	06/12/20
LDW20-SC220A	20F0233-07	Sediment	06/12/20
LDW20-SC217A	20F0233-08	Sediment	06/12/20
LDW20-SC219C	20F0233-09	Sediment	06/12/20
LDW20-SC212A	20F0233-10	Sediment	06/12/20

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 6.5°C and 9.5°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 20F0233

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Laboratory Blank Data Qualification Summary - SDG 20F0233

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Field Blank Data Qualification Summary - SDG 20F0233

No Sample Data Qualified in this SDG

LDC #: 48765C3a
SDG #: 20F0233
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 8/20/20
Page: 1 of 1
Reviewer: 1
2nd Reviewer: AC

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	A	Temp @ 6.5 - 9.5 °C - same day
II.	GC Instrument Performance Check	A	
III.	Initial calibration/ICV	A A	RSD ≤ 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	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	LDW20SC230B	20F0233-04	Sediment	06/12/20
2	LDW20-SC223A	20F0233-05	Sediment	06/12/20
3	LDW20-SC222B	20F0233-06	Sediment	06/12/20
4	LDW20-SC220A	20F0233-07	Sediment	06/12/20
5	LDW20-SC217A	20F0233-08	Sediment	06/12/20
6	LDW20-SC219C	20F0233-09	Sediment	06/12/20
7	LDW20-SC212A	20F0233-10	Sediment	06/12/20
8				
9				
10				
11				

Notes:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 27, 2020

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0233

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT257	20F0233-01	Sediment	06/12/20
LDW20-IT258	20F0233-02	Sediment	06/12/20
LDW20-IT266	20F0233-03	Sediment	06/12/20
LDW20-SC230B	20F0233-04	Sediment	06/12/20
LDW20-SC223A	20F0233-05	Sediment	06/12/20
LDW20-SC222B	20F0233-06	Sediment	06/12/20
LDW20-SC220A	20F0233-07	Sediment	06/12/20
LDW20-SC217A	20F0233-08	Sediment	06/12/20
LDW20-SC219C	20F0233-09	Sediment	06/12/20
LDW20-SC212A	20F0233-10	Sediment	06/12/20
LDW20-IT266MS	20F0233-03MS	Sediment	06/12/20
LDW20-IT266MSD	20F0233-03MSD	Sediment	06/12/20

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 6.5°C and 9.5°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 20F0233	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. Surrogate recoveries (%R) were not within QC limits for sample LDW20-SC230B. No data were qualified for samples analyzed at greater than or equal to 5X dilution.

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 with the following exceptions:

Spike ID (Associated Samples)	Compound	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW20-IT266MS/MSD (LDW20-IT266)	Aroclor-1260	142 (58-120)	142 (58-120)	J (all detects)	A

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-IT258	Aroclor-1260	55.8	J (all detects)	A
LDW20-IT266	Aroclor-1260	54.4	J (all detects)	A
LDW20-SC230B	Aroclor-1254 Aroclor-1260	41.2 43.1	J (all detects) J (all detects)	A
LDW20-SC222B	Aroclor-1248 Aroclor-1260	42.3 47.5	J (all detects) J (all detects)	A
LDW20-SC220A	Aroclor-1254	49.7	J (all detects)	A
LDW20-SC217A	Aroclor-1248 Aroclor-1260	46.2 48.1	J (all detects) J (all detects)	A

Sample	Compound	RPD	Flag	A or P
LDW20-SC219C	Aroclor-1260	52.2	J (all detects)	A
LDW20-SC212A	Aroclor-1254	47.7	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, MS/MSD %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 20F0233

Sample	Compound	Flag	A or P	Reason
LDW20-IT257 LDW20-IT258 LDW20-IT266 LDW20-SC230B LDW20-SC223A LDW20-SC222B LDW20-SC220A LDW20-SC217A LDW20-SC219C LDW20-SC212A	Aroclor-1260	J (all detects)	A	Initial calibration verification (%D)
LDW20-IT266	Aroclor-1260	J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)
LDW20-IT258 LDW20-IT266 LDW20-SC219C	Aroclor-1260	J (all detects)	A	Compound quantitation (RPD between two columns)
LDW20-SC230B	Aroclor-1254 Aroclor-1260	J (all detects) J (all detects)	A	Compound quantitation (RPD between two columns)
LDW20-SC222B LDW20-SC217A	Aroclor-1248 Aroclor-1260	J (all detects) J (all detects)	A	Compound quantitation (RPD between two columns)
LDW20-SC220A LDW20-SC212A	Aroclor-1254	J (all detects)	A	Compound quantitation (RPD between two columns)

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 20F0233

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 20F0233

No Sample Data Qualified in this SDG

LDC #: 48765C3b
SDG #: 20F0233
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 8/12/20
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	A	Temp @ 6.5-9.5°C - same day
II.	Initial calibration/ICV	A SW	RSDs ≤ 20%. ICV ≤ 20%
III.	Continuing calibration	A	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes / IS	SW	
VII.	Matrix spike/Matrix spike duplicates	SW	
VIII.	Laboratory control samples / SRM	A	LCS
IX.	Field duplicates	N	
X.	Compound quantitation/RL/LOQ/LODs	A 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	LDW20SC230B	20F0233-04	Sediment	06/12/20
2	LDW20-SC223A	20F0233-05	Sediment	06/12/20
3	LDW20-SC222B	20F0233-06	Sediment	06/12/20
4	LDW20-SC220A	20F0233-07	Sediment	06/12/20
5	LDW20-SC217A	20F0233-08	Sediment	06/12/20
6	LDW20-SC219C	20F0233-09	Sediment	06/12/20
7	LDW20-SC212A	20F0233-10	Sediment	06/12/20
8	LDW20-IT266MS	20F0233-03MS	Sediment	06/12/20
9	LDW20-IT266MSD	20F0233-03MSD	Sediment	06/12/20
10	LDW20-IT257	01		
11	LDW20-IT258	02		
12	LDW-20-IT266	03		

Notes:

VALIDATION FINDINGS WORKSHEET

METHOD: Pesticides

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

Notes:_____

LDC #: 48765e2b

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

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

METHOD: √ GC __ HPLC

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
	7/2/20	514005-5041	IC	BB	21.8	All (dets)	√/N/A
							~~Equal 2. AA, BB~~

ICV-qc.wpd

LDC #: 48765c3b

VALIDATION FINDINGS WORKSHEET
Surrogate Recovery

Reviewer: 9
2nd Reviewer: 1

METHOD: / **GC** __ **HPLC**

Are surrogates required by the method? Yes___ or No____.

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

Y (N) N/A Were surrogates spiked into all samples and blanks?

Y N (N/A) Did all surrogate recoveries (%R) meet the QC limits?

#	Sample ID	Detector/ Column	Surrogate Compound	%R (Limits)	Qualifications
	1		surr	out (-)	No Qual (0f>5x1
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
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	Surrogate Compound		Surrogate Compound		Surrogate Compound		Surrogate Compound		Surrogate Compound
A	Chlorobenzene (CBZ)	G	Octacosane	M	Benzo(e)Pyrene	S	1-Chloro-3-Nitrobenzene	Y	Tetrachloro-m- xylene
B	4-Bromofluorobenzene (BFB)	H	Ortho-Terphenyl	N	Terphenyl-D14	T	3,4-Dinitrotoluene	Z	1,2-Dinitrobenzene
C	a,a,a-Trifluorotoluene	I	Fluorobenzene (FBZ)	O	Decachlorobiphenyl (DCB)	U	Tripentyltin		
D	Bromochlorobenene	J	n-Triacontane	P	1-methylnaphthalene	V	Tri-n-propyltin		
E	1,4-Dichlorobutane	K	Hexacosane	Q	Dichlorophenyl Acetic Acid (DCAA)	W	Tributyl Phosphate		
F	1,4-Difluorobenzene (DFB)	L	Bromobenzene	R	4-Nitrophenol	X	Triphenyl Phosphate		

LDC #: 48765C3b

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

Page: 1 of 1
Reviewer: q
2nd Reviewer: q

METHOD: ✓ GC __ HPLC

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

[✓ Y] N N/A Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG?

[✓ Y] N N/A Was an MS/MSD analyzed every 20 samples for each matrix or whenever a sample extraction was performed?

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

#	MS/MSD ID	Compound	MS %R (Limits)	MSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	8/9	BB	142 (58-120)	142 (58-120)	( )	12 (dets)	J dets/A
			( )	( )	( )		
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LDC #: 48165c3b

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Reviewer: CT
2nd Reviewer: CT

METHOD: ✓ GC ___ HPLC

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 relative percent differences of detected compounds between two columns/detectors ≤40%?
If no, please see findings bellow.

#	Compound Name	Sample ID	%RPD Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	BB	~~12~~ 11	~~2~~ 55.8	Det/J
	BB	12	~~54~~.4	
	AA	1	41.2	
	BB		43.1	
	2	3	42.3	
	BB		47.5	
	~~AA~~	4	49.7	
	2	5	46.2	
	BB		48.1	
	BB	6	52.2	
	AA	7	47.7	↓

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 25, 2020

Parameters: Metals

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0233

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT257	20F0233-01	Sediment	06/12/20
LDW20-IT258	20F0233-02	Sediment	06/12/20
LDW20-IT266	20F0233-03	Sediment	06/12/20
LDW20-SC230B	20F0233-04	Sediment	06/12/20
LDW20-SC223A	20F0233-05	Sediment	06/12/20
LDW20-SC222B	20F0233-06	Sediment	06/12/20
LDW20-SC220A	20F0233-07	Sediment	06/12/20
LDW20-SC217A	20F0233-08	Sediment	06/12/20
LDW20-SC219C	20F0233-09	Sediment	06/12/20
LDW20-SC212A	20F0233-10	Sediment	06/12/20
LDW20-IT258MS	20F0233-02MS	Sediment	06/12/20
LDW20-IT258MSD	20F0233-02MSD	Sediment	06/12/20
LDW20-IT258DUP	20F0233-02DUP	Sediment	06/12/20
LDW20SC230BMS	20F0233-04MS	Sediment	06/12/20
LDW20SC230BMSD	20F0233-04MSD	Sediment	06/12/20
LDW20SC230BDUP	20F0233-04DUP	Sediment	06/12/20

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.

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-IT258MS/MSD (LDW20-SC230B LDW20-SC223A LDW20-SC222B LDW20-SC220A LDW20-SC217A LDW20-SC219C LDW20-SC212A LDW20-IT258DUP)	Zinc	55.7 (75-125)	53.7 (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 with the following exceptions:

DUP ID (Associated Samples)	Analyte	RPD (Limits)	Flag	A or P
LDW20-IT258DUP (LDW20-SC230B LDW20-SC223A LDW20-SC222B LDW20-SC220A LDW20-SC217A LDW20-SC219C LDW20-SC212A LDW20-IT258DUP)	Lead Zinc	21.1 (≤20) 34.5 (≤20)	J (all detects) 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 eight samples.

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

Duwamish AOC4
Metals - Data Qualification Summary - SDG 20F0233

Sample	Analyte	Flag	A or P	Reason
LDW20-SC230B LDW20-SC223A LDW20-SC222B LDW20-SC220A LDW20-SC217A LDW20-SC219C LDW20-SC212A LDW20-IT258DUP	Zinc	J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)
LDW20-SC230B LDW20-SC223A LDW20-SC222B LDW20-SC220A LDW20-SC217A LDW20-SC219C LDW20-SC212A LDW20-IT258DUP	Lead Zinc	J (all detects) J (all detects)	A	Duplicate sample analysis (RPD)

Duwamish AOC4
Metals - Laboratory Blank Data Qualification Summary - SDG 20F0233

No Sample Data Qualified in this SDG

Duwamish AOC4
Metals - Field Blank Data Qualification Summary - SDG 20F0233

No Sample Data Qualified in this SDG

LDC #: 48765C4a **VALIDATION COMPLETENESS WORKSHEET** Date: 8/17/20
SDG #: 20F0233 Stage 2B Page: 1 of 2
Laboratory: Analytical Resources, Inc. Reviewer: [illegible]
2nd Reviewer: [illegible]

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	A	
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-IT257	20F0233-01	Sediment	06/12/20
2	LDW20-IT258	20F0233-02	Sediment	06/12/20
3	LDW20-IT266	20F0233-03	Sediment	06/12/20
4	LDW20SC230B	20F0233-04	Sediment	06/12/20
5	LDW20-SC223A	20F0233-05	Sediment	06/12/20
6	LDW20-SC222B	20F0233-06	Sediment	06/12/20
7	LDW20-SC220A	20F0233-07	Sediment	06/12/20
8	LDW20-SC217A	20F0233-08	Sediment	06/12/20
9	LDW20-SC219C	20F0233-09	Sediment	06/12/20
10	LDW20-SC212A	20F0233-10	Sediment	06/12/20
11	LDW20-IT258MS	20F0233-02MS	Sediment	06/12/20
12	LDW20-IT258MSD	20F0233-02MSD	Sediment	06/12/20
13	LDW20-IT258DUP	20F0233-02DUP	Sediment	06/12/20
14	LDW20SC230BMS	20F0233-04MS	Sediment	06/12/20
15	LDW20SC230BMSD	20F0233-04MSD	Sediment	06/12/20

LDC #: 48765C4a **VALIDATION COMPLETENESS WORKSHEET** Date: 8/17/20
SDG #: 20F0233 Stage 2B Page: 2 of 2
Laboratory: Analytical Resources, Inc. Reviewer:
2nd Reviewer:

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

	Client ID	Lab ID	Matrix	Date
16	LDW20SC230BDUP	20F0233-04DUP	Sediment	06/12/20
17				
18				
19				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
4 to 10	As, Cd, Cr, Cu, Pb, Ag, Zn, Hg
1 to 3	As
QC: 11-13	As, Cd, Cr, Cu, Pb, Ag, Zn, Hg
14-16	Hg

Analysis Method

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

VALIDATION FINDINGS WORKSHEETS
Matrix Spike/Matrix Spike Duplicates

Reviewer:CR

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
11, 12	s	Zn	55.7	53.7	75-125			4 to 10, 13	J/UJ/A	Det

Comments:

VALIDATION FINDINGS WORKSHEETS
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
13	s	Pb	21.1	20			4 to 10, 13	J/UJ/A	Det
		Zn	34.5	20			4 to 10, 13	J/UJ/A	Det

Comments:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0233

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT257	20F0233-01	Sediment	06/12/20
LDW20-IT258	20F0233-02	Sediment	06/12/20
LDW20-IT266	20F0233-03	Sediment	06/12/20
LDW20-SC230B	20F0233-04	Sediment	06/12/20
LDW20-SC223A	20F0233-05	Sediment	06/12/20
LDW20-SC222B	20F0233-06	Sediment	06/12/20
LDW20-SC220A	20F0233-07	Sediment	06/12/20
LDW20-SC217A	20F0233-08	Sediment	06/12/20
LDW20-SC219C	20F0233-09	Sediment	06/12/20
LDW20-SC212A	20F0233-10	Sediment	06/12/20
LDW20-IT257MS	20F0233-01MS	Sediment	06/12/20
LDW20-IT257DUP	20F0233-01DUP	Sediment	06/12/20

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 with the following exceptions:

Blank ID	Analyte	Maximum Concentration	Associated Samples
ICB/CCB	Total organic carbon	0.02%	LDW20-IT258 LDW20-IT266 LDW20-SC230B LDW20-SC223A LDW20-SC222B LDW20-SC220A LDW20-SC217A LDW20-SC219C LDW20-SC212A

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.

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

Laboratory control samples (LCS) were analyzed as required by the methods. Percent recoveries (%R) 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 20F0233

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 20F0233

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 20F0233

No Sample Data Qualified in this SDG

LDC #: 48765C6 **VALIDATION COMPLETENESS WORKSHEET** Date: 8/17/20
SDG #: 20F0233 Stage 2B Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer: [signature]
2nd Reviewer: [signature]

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	SW	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	A	
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	A	LCS
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-IT257	20F0233-01	Sediment	06/12/20
2	LDW20-IT258	20F0233-02	Sediment	06/12/20
3	LDW20-IT266	20F0233-03	Sediment	06/12/20
4	LDW20SC230B	20F0233-04	Sediment	06/12/20
5	LDW20-SC223A	20F0233-05	Sediment	06/12/20
6	LDW20-SC222B	20F0233-06	Sediment	06/12/20
7	LDW20-SC220A	20F0233-07	Sediment	06/12/20
8	LDW20-SC217A	20F0233-08	Sediment	06/12/20
9	LDW20-SC219C	20F0233-09	Sediment	06/12/20
10	LDW20-SC212A	20F0233-10	Sediment	06/12/20
11	LDW20-IT257MS	20F0233-01MS	Sediment	06/12/20
12	LDW20-IT257DUP	20F0233-01DUP	Sediment	06/12/20
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, 12	TOC

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

Reviewer:CR

METHOD: Inorganics
Soil preparation factor applied (if applicable):

Sample Concentration, unless otherwise noted: % Associated Samples: 2-10

				Sample Identification								
Analyte	**PB (units)**	**Maximum ICB/CCB (%)**	**Action Level**	No qualifiers								
TOC		0.02	0.2									

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

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Polychlorinated Dioxins/Dibenzofurans

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0233

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT257	20F0233-01	Sediment	06/12/20
LDW20-IT258	20F0233-02	Sediment	06/12/20
LDW20-IT266	20F0233-03	Sediment	06/12/20
LDW20-SC212A	20F0233-10	Sediment	06/12/20

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 were reported between 6.5°C and 9.5°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 Total HpCDD	0.140 ng/Kg 0.0330 ng/Kg 0.535 ng/Kg 1.37 ng/Kg 6.33 ng/Kg 0.284 ng/Kg	All samples in SDG 20F0233

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 20F0233	All compounds reported as estimated maximum possible concentration (EMPC) and greater than the reporting limit.	J (all detects)	A
All samples in SDG 20F0233	All compounds reported as estimated maximum possible concentration (EMPC) and less than the reporting limit.	U (all non-detects)	A
All samples in SDG 20F0233	All results flagged "X" by the laboratory due to chlorinated diphenyl ether (CDPE) interference.	J (all detects)	A

Sample	Compound	Finding	Criteria	Flag	A or P
LDW20-IT257	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, CDPE interference, and results exceeding calibration range, data were qualified as estimated in four 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 20F0233

Sample	Compound	Flag	A or P	Reason
LDW20-IT257 LDW20-IT258 LDW20-IT266 LDW20-SC212A	All compounds reported as estimated maximum possible concentration (EMPC) and greater than the reporting limit.	J (all detects)	A	Compound quantitation (EMPC)
LDW20-IT257 LDW20-IT258 LDW20-IT266 LDW20-SC212A	All compounds reported as estimated maximum possible concentration (EMPC) and less than the reporting limit.	U (all non-detects)	A	Compound quantitation (EMPC)
LDW20-IT257 LDW20-IT258 LDW20-IT266 LDW20-SC212A	All compounds flagged "X" due to chlorinated diphenyl ether (CDPE) interference.	J (all detects)	A	Compound quantitation
LDW20-IT257	OCDD	J (all detects)	P	Compound quantitation (exceeded range)

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG 20F0233

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Field Blank Data Qualification Summary - SDG 20F0233

No Sample Data Qualified in this SDG

LDC #: 48765C21 **VALIDATION COMPLETENESS WORKSHEET** Date: 8/12/20
SDG #: 20F0233 Stage 2B Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer: 1
2nd Reviewer: 1

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	A	Temp @ 6.5 - 9.5°C - same day
II.	HRGC/HRMS Instrument performance check	A	
III.	Initial calibration/ICV	A A	%RSD ≤ 20/25%. 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	CS
VIII.	Laboratory control samples SRM	A	LCS
IX.	Field duplicates	N	
X.	Labeled Compounds	A	
XI.	Compound quantitation RL/LOQ/LODs	A 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-IT257	20F0233-01	Sediment	06/12/20
2	LDW20-IT258	20F0233-02	Sediment	06/12/20
3	LDW20-IT266	20F0233-03	Sediment	06/12/20
4	LDW20-SC212A	20F0233-10	Sediment	06/12/20
5				
6				
7				
8				
9				
10				

Notes:

VALIDATION FINDINGS WORKSHEET

METHOD: HRGC/HRMS Dioxins/Dibenzofurans

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 #: 48765C21

VALIDATION FINDINGS WOR/UHEET
Blanks

Reviewer: PG
2nd Reviewer:

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

Blank extraction date: 7/6/20 **Blank analysis date:** 7/9/20
Conc. units: ng/kg **Associated samples:** All qual U (> RL)

Compound	Blank ID	Sample Identification											
	BIF0803-BLK1	5X											
O	0.140	0.7											
P	0.0330	0.165											
F	0.535	2.675											
Q	1.37	6.85											
G	6.33	31.65											
U	0.284	1.42											

LDC #: 48765C21

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported RLs

Page: 1 of 1
Reviewer: 9
2nd Reviewer: 9

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 > RL		Jdets/A
			↓ < RL		U/A
		All	All results flagged "X" by the lab due to chlorinated		Jdets/A
			diphenyl ether (CDPE) interference		
		1	≤ > edlib range		Jdets/A

Comments: See sample calculation verification worksheet for recalculations

LDC Report# 48765D2a

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 14, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0235

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS253	20F0235-01	Sediment	06/12/20
LDW20-SS248	20F0235-02	Sediment	06/12/20
LDW20-SS272	20F0235-03	Sediment	06/12/20
LDW20-SS151	20F0235-04	Sediment	06/12/20
LDW20-SS151-FD	20F0235-05	Sediment	06/12/20
LDW20-SS150	20F0235-06	Sediment	06/12/20
LDW20-SS155	20F0235-07	Sediment	06/12/20
LDW20-SS156	20F0235-08	Sediment	06/12/20
LDW20-SS162	20F0235-09	Sediment	06/12/20
LDW20-SS166	20F0235-10	Sediment	06/12/20
LDW20-SS166MS	20F0235-10MS	Sediment	06/12/20
LDW20-SS166MSD	20F0235-10MSD	Sediment	06/12/20

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 temperature for samples in this SDG was reported at 7.5°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.

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
BIF0719-SRM1	Acenaphthylene Anthracene Bis(2-ethylhexyl)phthalate	51.4 (52-148) 51.8 (57-143) 61.5 (62-138)	All samples in SDG 20F0235	J (all detects) UJ (all non-detects)	P

X. Field Duplicates

Samples LDW20-SS151 and LDW20-SS151-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-SS151	LDW20-SS151-FD	
Phenol	10.7	19.9U	Not calculable
Naphthalene	6.7	6.1	9
2-Methylnaphthalene	8.6	7.1	19
Dibenzofuran	5.1	4.9	4
Phenanthrene	35.0	49.7	35
Anthracene	7.6	8.6	12
Fluoranthene	91.0	118	26

Compound	Concentration (ug/Kg)		RPD
	LDW20-SS151	LDW20-SS151-FD	
Pyrene	77.3	94.6	20
Butylbenzylphthalate	12.5	10.1	21
Benzo(a)anthracene	32.5	32.7	1
Chrysene	60.4	77.5	25
Bis(2-ethylhexyl)phthalate	86.6	105	19
Benzofluoranthenes, total	94.0	92.0	2
Benzo(a)pyrene	38.5	34.2	12
Indeno(1,2,3-cd)pyrene	25.6	23.7	8
Dibenz(a,h)anthracene	7.8	6.2	23
Benzo(g,h,i)perylene	31.2	25.8	19

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 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 20F0235

Sample	Compound	Flag	A or P	Reason
LDW20-SS253 LDW20-SS248 LDW20-SS272 LDW20-SS151 LDW20-SS151-FD LDW20-SS150 LDW20-SS155 LDW20-SS156 LDW20-SS162 LDW20-SS166	Acenaphthylene Anthracene Bis(2-ethylhexyl)phthalate	J (all detects) UJ (all non-detects)	P	Standard reference materials (%R)

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0235

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0235

No Sample Data Qualified in this SDG

LDC #: 48765D2a
SDG #: 20F0235
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 5/12/21
Page: 1 of 1
Reviewer: ?
2nd Reviewer: A

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	A	Temp @ 7.5°C - same day
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A A	RSD ≤ 20% . r² 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 / SRM	A/SW	LCS
X.	Field duplicates	SW	D=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 1	LDW20-SS253	20F0235-01	Sediment	06/12/20
2 1	LDW20-SS248	20F0235-02	Sediment	06/12/20
3 1	LDW20-SS272	20F0235-03	Sediment	06/12/20
4 1	LDW20-SS151	20F0235-04	Sediment	06/12/20
5 1	LDW20-SS151-FD	20F0235-05	Sediment	06/12/20
6 1	LDW20-SS150	20F0235-06	Sediment	06/12/20
7 2	LDW20-SS155	20F0235-07	Sediment	06/12/20
8 2	LDW20-SS156	20F0235-08	Sediment	06/12/20
9 2	LDW20-SS162	20F0235-09	Sediment	06/12/20
10 2	LDW20-SS166	20F0235-10	Sediment	06/12/20
11 3	LDW20-SS166MS	20F0235-10MS	Sediment	06/12/20
12 3	LDW20-SS166MSD	20F0235-10MSD	Sediment	06/12/20
13				
14				

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: ~~48765~~D2a

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS)

Page: 1 of 1
Reviewer:
2nd Reviewer:

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

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?

#	Date	LCS/LCSD ID	Compound	~~LCS~~ SRM %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		BH0719-SRM1	DD	51.4 (52-148)	( )	( )	All (dets+ND)	J/UJ/P
			VV	51.8 (57-143)	( )	( )		↓
			ZZZ	61.5 (62-138)	( )	( )		↓
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
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				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		

LDC#: 48765D2a

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Page: 1 of 1
Reviewer: JVC
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
	4	5	
A	10.7	19.9U	NC
S	6.7	6.1	9
W	8.6	7.1	19
JJ	5.1	4.9	4
UU	35.0	49.7	35
VV	7.6	8.6	12
YY	91.0	118	26
ZZ	77.3	94.6	20
AAA	12.5	10.1	21
CCC	32.5	32.7	1
DDD	60.4	77.5	25
EEE	86.6	105	19
ZZZZ	94.0	92.0	2
III	38.5	34.2	12
JJJ	25.6	23.7	8
KKK	7.8	6.2	23
LLL	31.2	25.8	19

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 14, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0235

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS253	20F0235-01	Sediment	06/12/20
LDW20-SS248	20F0235-02	Sediment	06/12/20
LDW20-SS272	20F0235-03	Sediment	06/12/20
LDW20-SS151	20F0235-04	Sediment	06/12/20
LDW20-SS151-FD	20F0235-05	Sediment	06/12/20
LDW20-SS150	20F0235-06	Sediment	06/12/20
LDW20-SS155	20F0235-07	Sediment	06/12/20
LDW20-SS156	20F0235-08	Sediment	06/12/20
LDW20-SS162	20F0235-09	Sediment	06/12/20
LDW20-SS166	20F0235-10	Sediment	06/12/20
LDW20-SS166MS	20F0235-10MS	Sediment	06/12/20
LDW20-SS166MSD	20F0235-10MSD	Sediment	06/12/20

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 temperature for samples in this SDG was reported at 7.5°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-SS253 LDW20-SS248 LDW20-SS272 LDW20-SS151 LDW20-SS151-FD LDW20-SS150	J (all detects) UJ (all non-detects)	A
06/26/20 (SIF0393-SCV1)	N-Nitrosodiphenylamine	41.9	LDW20-SS155 LDW20-SS156 LDW20-SS162 LDW20-SS166	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
07/10/20 (NT1420071003S)	Benzoic acid	32.0	LDW20-SS253 LDW20-SS248	J (all detects) UJ (all non-detects)	A
	Pentachlorophenol	50.0	LDW20-SS272 LDW20-SS151 LDW20-SS151-FD LDW20-SS150	J (all detects) UJ (all non-detects)	
07/10/20 (NT1020071003S)	Benzyl alcohol	26.8	LDW20-SS155 LDW20-SS156 LDW20-SS162 LDW20-SS166	J (all detects) UJ (all non-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 with the following exceptions:

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
BIF0719-BLK2	06/26/20	1,4-Dichlorobenzene	0.7 ug/Kg	All samples in SDG 20F0235

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-SS272	1,4-Dichlorobenzene	0.6 ug/Kg	0.6U ug/Kg
LDW20-SS155	1,4-Dichlorobenzene	0.9 ug/Kg	0.9U ug/Kg
LDW20-SS166	1,4-Dichlorobenzene	0.9 ug/Kg	0.9U 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 with the following exceptions:

SRM ID	Compound	%R (Limits)	Associated Samples	Flag	A or P
BIF0719-SRM2	2,4-Dimethylphenol	34.2 (40-160)	All samples in SDG 20F0235	UJ (all non-detects)	P

X. Field Duplicates

Samples LDW20-SS151 and LDW20-SS151-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-SS151	LDW20-SS151-FD	
Benzyl alcohol	33.8	22.0	42
Benzoic acid	85.6	63.8	29
N-Nitrosodiphenylamine	1.9	1.7	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.

Due to ICV %D, continuing calibration %D, and SRM %R, data were qualified as estimated in ten 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
Semivolatiles – Data Qualification Summary - SDG 20F0235

Sample	Compound	Flag	A or P	Reason
LDW20-SS253 LDW20-SS248 LDW20-SS272 LDW20-SS151 LDW20-SS151-FD LDW20-SS150 LDW20-SS155 LDW20-SS156 LDW20-SS162 LDW20-SS166	N-Nitrosodiphenylamine	J (all detects) UJ (all non-detects)	A	Initial calibration verification (%D)
LDW20-SS253 LDW20-SS248 LDW20-SS272 LDW20-SS151 LDW20-SS151-FD LDW20-SS150	Benzoic acid Pentachlorophenol	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	A	Continuing calibration (%D)
LDW20-SS155 LDW20-SS156 LDW20-SS162 LDW20-SS166	Benzyl alcohol	J (all detects) UJ (all non-detects)	A	Continuing calibration (%D)
LDW20-SS253 LDW20-SS248 LDW20-SS272 LDW20-SS151 LDW20-SS151-FD LDW20-SS150 LDW20-SS155 LDW20-SS156 LDW20-SS162 LDW20-SS166	2,4-Dimethylphenol	UJ (all non-detects)	P	Standard reference materials (%R)

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0235

Sample	Compound	Modified Final Concentration	A or P
LDW20-SS272	1,4-Dichlorobenzene	0.6U ug/Kg	A
LDW20-SS155	1,4-Dichlorobenzene	0.9U ug/Kg	A
LDW20-SS166	1,4-Dichlorobenzene	0.9U ug/Kg	A

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0235

No Sample Data Qualified in this SDG

LDC #: 48765D2b

SDG #: 20F0235

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 8/13/20

Page: 1 of 1

Reviewer: 1

2nd Reviewer: A

METHOD: GC/MS ~~Polynuclear Aromatic Hydrocarbons~~ SVOAs (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	A	Temp @ 7.5°C - same day
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A / SW	RSD ≤ 20% . r, ICV ≤ 30%
IV.	Continuing calibration	SW	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 / SRM	A / SW	LCS
X.	Field duplicates	SW	D=1-5
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-SS253	20F0235-01	Sediment	06/12/20
2	LDW20-SS248	20F0235-02	Sediment	06/12/20
3	LDW20-SS272	20F0235-03	Sediment	06/12/20
4 1	LDW20-SS151	20F0235-04	Sediment	06/12/20
5	LDW20-SS151-FD	20F0235-05	Sediment	06/12/20
6	LDW20-SS150	20F0235-06	Sediment	06/12/20
7 2	LDW20-SS155	20F0235-07	Sediment	06/12/20
8 2	LDW20-SS156	20F0235-08	Sediment	06/12/20
9 2	LDW20-SS162	20F0235-09	Sediment	06/12/20
10 2	LDW20-SS166	20F0235-10	Sediment	06/12/20
11	LDW20-SS166MS	20F0235-10MS	Sediment	06/12/20
12	LDW20-SS166MSD	20F0235-10MSD	Sediment	06/12/20
13				
14				

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 48650-b

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

Page: 1 of 1
Reviewer: 9
2nd Reviewer: AK

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

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 ≤30 %D ?

#	Date	Standard ID	Compound	Finding %D (Limit: ≤30.0%)	Associated Samples	Qualifications
	6/26/20	SIF0395-SCV1 (NT4)	QQ	65.7	1-6. MB (det+ND)	J/UJ/A
	6/26/20	SIF0393-SCV1 (NT10)	QQ	41.9	7-10. 11-12 (det+ND)	J/UJ/A

LDC #: 48765D26

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

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

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

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 for each instrument?

Y (N) N/A Were percent differences (%D) ≤20 % and relative response factors (RRF) within the method criteria?

#	Date	Standard ID	Compound	Finding %D (Limit: ≤20.0%)	Finding RRF (Limit)	Associated Samples	Qualifications
	7/10/20	NT1420071003S	PPP	32.0		1-6. MB	J/UJ/A
			TT	50.0		(dets+ND)	
	7/11/20	NT1020071103S	QQQ	21.1		11-12.	J/UJ/A
			TT	28.6			
	7/10/20	NT1020071003S	QQQ	26.8		7-10. (dets+ND)	J/UJ/A

LDC #: 48766D4

VALIDATION FINDINGS WORKSHEET
Blanks

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

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

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: 6/25/20 **Blank analysis date:** 7/10/20
Conc. units: ug/kg Associated Samples: All

Compound	Blank ID	Sample Identification								
BEHP	719-BLK2	3	7	10						
c	0.7	0.6/U	0.9/U	0.9/U						

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:
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 #: 48765D-2b

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS)

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

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

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?

#	Date	LCS/LCSD ID	Compound	~~LCS~~ SRM %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		BHF0719-SRM2	O	34.2 (40-160)	( )	( )	All (ND)	J/UJ/D
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
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				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		

LDC#: 48765D2b

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: PG
2nd Reviewer: M

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
	4	5	
QQQ	33.8	22.0	42
PPP	85.6	63.8	29
QQ	1.9	1.7	11

V:\FIELD DUPLICATES\Field Duplicates\FD_Organics\2020\48765D2b windward duwamish.wpd

LDC Report# 48765D3a

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 14, 2020

Parameters: Hexachlorobenzene

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F235

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS253	20F0235-01	Sediment	06/12/20
LDW20-SS248	20F0235-02	Sediment	06/12/20
LDW20-SS272	20F0235-03	Sediment	06/12/20
LDW20-SS151	20F0235-04	Sediment	06/12/20
LDW20-SS151-FD	20F0235-05	Sediment	06/12/20
LDW20-SS150	20F0235-06	Sediment	06/12/20
LDW20-SS155	20F0235-07	Sediment	06/12/20
LDW20-SS156	20F0235-08	Sediment	06/12/20
LDW20-SS162	20F0235-09	Sediment	06/12/20
LDW20-SS166	20F0235-10	Sediment	06/12/20
LDW20-SS166MS	20F0235-10MS	Sediment	06/12/20
LDW20-SS166MSD	20F0235-10MSD	Sediment	06/12/20

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 temperature for samples in this SDG was reported at 7.5°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-SS151 and LDW20-SS151-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 20F235

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Laboratory Blank Data Qualification Summary - SDG 20F235

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Field Blank Data Qualification Summary - SDG 20F235

No Sample Data Qualified in this SDG

LDC #: 48765D3a
SDG #: 20F0235
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 8/13/20
Page: 1 of 1
Reviewer: Y
2nd Reviewer: A

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	A	Temp @ 7.5°C - Same day
II.	GC Instrument Performance Check	A	
III.	Initial calibration/ICV	A/A	RSD ≤ 20%. ICV ≤ 20%
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/D
X.	Field duplicates	ND	D=1+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-SS253	20F0235-01	Sediment	06/12/20
2	LDW20-SS248	20F0235-02	Sediment	06/12/20
3	LDW20-SS272	20F0235-03	Sediment	06/12/20
4	LDW20-SS151	20F0235-04	Sediment	06/12/20
5	LDW20-SS151-FD	20F0235-05	Sediment	06/12/20
6	LDW20-SS150	20F0235-06	Sediment	06/12/20
7	LDW20-SS155	20F0235-07	Sediment	06/12/20
8	LDW20-SS156	20F0235-08	Sediment	06/12/20
9	LDW20-SS162	20F0235-09	Sediment	06/12/20
10	LDW20-SS166	20F0235-10	Sediment	06/12/20
11	LDW20-SS166MS	20F0235-10MS	Sediment	06/12/20
12	LDW20-SS166MSD	20F0235-10MSD	Sediment	06/12/20
13				
14				
15				

LDC Report# 48765D3b

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 14, 2020

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0235

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS253	20F0235-01	Sediment	06/12/20
LDW20-SS248	20F0235-02	Sediment	06/12/20
LDW20-SS272	20F0235-03	Sediment	06/12/20
LDW20-SS151	20F0235-04	Sediment	06/12/20
LDW20-SS151-FD	20F0235-05	Sediment	06/12/20
LDW20-SS150	20F0235-06	Sediment	06/12/20
LDW20-SS155	20F0235-07	Sediment	06/12/20
LDW20-SS155DL	20F0235-07DL	Sediment	06/12/20
LDW20-SS156	20F0235-08	Sediment	06/12/20
LDW20-SS162	20F0235-09	Sediment	06/12/20
LDW20-SS166	20F0235-10	Sediment	06/12/20

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 temperature for samples in this SDG was reported at 7.5□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 20F0235	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

Samples LDW20-SS151 and LDW20-SS151-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-SS151	LDW20-SS151-FD	
Aroclor-1248	18.6	18.5	1
Aroclor-1254	22.4	23.3	4
Aroclor-1260	29.7	30.9	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-SS248	Aroclor-1248	54.5	J (all detects)	A
LDW20-SS272	Aroclor-1254 Aroclor-1260	41.1 58.5	J (all detects) J (all detects)	A
LDW20-SS151	Aroclor-1260	56	J (all detects)	A
LDW20-SS151-FD	Aroclor-1260	57	J (all detects)	A
LDW20-SS150	Aroclor-1254	46.9	J (all detects)	A

Sample	Compound	RPD	Flag	A or P
LDW20-SS155	Aroclor-1260	52.1	J (all detects)	A
LDW20-SS155DL	Aroclor-1260	46	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-SS155	Aroclor-1260	Results exceeded calibration range.	Not reportable	-
LDW20-SS155DL	All compounds except Aroclor-1260	Results from undiluted analyses were more usable.	Not reportable	-

Due to ICV %D 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 20F0235

Sample	Compound	Flag	A or P	Reason
LDW20-SS253 LDW20-SS248 LDW20-SS272 LDW20-SS151 LDW20-SS151-FD LDW20-SS150 LDW20-SS155DL LDW20-SS156 LDW20-SS162 LDW20-SS166	Aroclor-1260	J (all detects)	A	Initial calibration verification (%D)
LDW20-SS248	Aroclor-1248	J (all detects)	A	Compound quantitation (RPD between two columns)
LDW20-SS272	Aroclor-1254 Aroclor-1260	J (all detects) J (all detects)	A	Compound quantitation (RPD between two columns)
LDW20-SS151 LDW20-SS151-FD LDW20-SS155DL	Aroclor-1260	J (all detects)	A	Compound quantitation (RPD between two columns)
LDW20-SS150	Aroclor-1254	J (all detects)	A	Compound quantitation (RPD between two columns)
LDW20-SS155	Aroclor-1260	Not reportable	-	Overall assessment of data
LDW20-SS155DL	All compounds except Aroclor-1260	Not reportable	-	Overall assessment of data

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 20F0235

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 20F0235

No Sample Data Qualified in this SDG

LDC #: 48765D3b
SDG #: 20F0235
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 7/17/20
Page: 1 of 1
Reviewer: A
2nd Reviewer: M

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	A	Temp @ 7.5°C
II.	Initial calibration/ICV	A/SW	RSD ≤ 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	cc
VIII.	Laboratory control samples /SRM	A/A	LCS
IX.	Field duplicates	SW	D-4+5
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-SS253	20F0235-01	Sediment	06/12/20
2	LDW20-SS248	20F0235-02	Sediment	06/12/20
3	LDW20-SS272	20F0235-03	Sediment	06/12/20
4	LDW20-SS151	20F0235-04	Sediment	06/12/20
5	LDW20-SS151-FD	20F0235-05	Sediment	06/12/20
6	LDW20-SS150	20F0235-06	Sediment	06/12/20
7	LDW20-SS155	20F0235-07	Sediment	06/12/20
8	LDW20-SS156	20F0235-08	Sediment	06/12/20
9	LDW20-SS162	20F0235-09	Sediment	06/12/20
10	LDW20-SS166	20F0235-10	Sediment	06/12/20
11	#7 DL	LOTDL	L	+
12				

Notes:

VALIDATION FINDINGS WORKSHEET

METHOD: Pesticides

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

Notes:_____

LDC #: 48650b6

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

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

METHOD: √ GC __ HPLC

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
	7/6/20	SKF0056ICV11	IC	BB	21.8	All (dofs)	√ UJ / A
							~~+ qual Z. AA. BB~~

LDC#: 48765D3b

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Page: 1 of 1
Reviewer: PG
2nd Reviewer: AC

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
	4	5	
Aroclor 1248	18.6	18.5	1
Aroclor 1254	22.4	23.3	4
Aroclor 1260	29.7	30.9	4

V:\FIELD DUPLICATES\Field Duplicates\FD_Organics\2020\48765D3b windward duwamish.wpd

LDC #: 43765b36

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Reviewer: 9
2nd Reviewer: 9

METHOD: ✓ GC __ HPLC

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 relative percent differences of detected compounds between two columns/detectors ≤40%?
If no, please see findings bellow.

#	Compound Name	Sample ID	%RPD Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	Z	2	54.5	J+ (all detects)/A
	AA	3	41.1	
	BB		58.5	
	BB	4	56.	
	BB	5	57	
	AA	6	46.9	
	BB	7	52.1	
	BB	11	46	

LDC #: 40765036

VALIDATION FINDINGS WORKSHEET
Overall Assessment of Data

Page: 1 of 1
Reviewer: 9
2nd Reviewer: 9

METHOD: ✓ **GC** __ **HPLC**

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 Samples	Qualifications
	7	BB r calib range		NR/A
	8 11	All except BB		✓

Comments: _____

OVRNew.wpd

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Metals

Validation Level: Stage 2B & 4

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0233

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS253	20F0235-01	Sediment	06/12/20
LDW20-SS248	20F0235-02	Sediment	06/12/20
LDW20-SS272	20F0235-03	Sediment	06/12/20
LDW20-SS151	20F0235-04	Sediment	06/12/20
LDW20-SS151-FD	20F0235-05	Sediment	06/12/20
LDW20-SS150	20F0235-06	Sediment	06/12/20
LDW20-SS155	20F0235-07	Sediment	06/12/20
LDW20-SS156	20F0235-08	Sediment	06/12/20
LDW20-SS162	20F0235-09	Sediment	06/12/20
LDW20-SS166	20F0235-10	Sediment	06/12/20
LDW20-SS253MS	20F0235-01MS	Sediment	06/12/20
LDW20-SS253MSD	20F0235-01MSD	Sediment	06/12/20
LDW20-SS253DUP	20F0235-01DUP	Sediment	06/12/20

Mercury underwent Stage 4 validation

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. Samples appended with a double asterisk on the cover page were subjected to Stage 4 data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

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.

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-IT258MS/MSD (All samples in SDG 20F0235)	Zinc	55.7 (75-125)	53.7 (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

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

XI. Field Duplicates

Samples LDW20-SS151 and LDW20-SS151-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-SS151	LDW20-SS151-FD	
Arsenic	10.2	10.6	4
Cadmium	0.13	0.17	27
Chromium	26.8	27.3	2
Copper	47.2	46.6	1
Lead	17.4	17.2	1
Mercury	0.122	0.120	2
Silver	0.17	0.33	64
Zinc	91.7	94.5	3

XII. Internal Standards (ICP-MS)

ICP-MS was not utilized in this SDG.

XIII. Sample Result Verification

All sample result verifications were acceptable for samples which underwent Stage 4 validation. 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 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 20F0233

Sample	Analyte	Flag	A or P	Reason
LDW20-SS253 LDW20-SS248 LDW20-SS272 LDW20-SS151 LDW20-SS151-FD LDW20-SS150 LDW20-SS155 LDW20-SS156 LDW20-SS162 LDW20-SS166	Zinc	J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)

Duwamish AOC4
Metals - Laboratory Blank Data Qualification Summary - SDG 20F0233

No Sample Data Qualified in this SDG

Duwamish AOC4
Metals - Field Blank Data Qualification Summary - SDG 20F0233

No Sample Data Qualified in this SDG

LDC #: 48765D4a
SDG #: 20F0235
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B/4

Date: 8/17/20
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	A	
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
XI.	Field Duplicates	SW	(4,5)
XII.	Internal Standard (ICP-MS)	N	not reviewed
XIII.	Sample Result Verification	A	Not reviewed for 6020A validation.
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:

Mercury underwent Stage 4 validation

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS253	20F0235-01	Sediment	06/12/20
2	LDW20-SS248	20F0235-02	Sediment	06/12/20
3	LDW20-SS272	20F0235-03	Sediment	06/12/20
4	LDW20-SS151	20F0235-04	Sediment	06/12/20
5	LDW20-SS151-FD	20F0235-05	Sediment	06/12/20
6	LDW20-SS150	20F0235-06	Sediment	06/12/20
7	LDW20-SS155	20F0235-07	Sediment	06/12/20
8	LDW20-SS156	20F0235-08	Sediment	06/12/20
9	LDW20-SS162	20F0235-09	Sediment	06/12/20
10	LDW20-SS166	20F0235-10	Sediment	06/12/20
11	LDW20-SS253MS	20F0235-01MS	Sediment	06/12/20
12	LDW20-SS253MSD	20F0235-01MSD	Sediment	06/12/20
13	LDW20-SS253~~MSD~~ DUP	20F0235-01DUP	Sediment	06/12/20
14				

Notes:

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)				
Validation Area	**Yes**	**No**	**NA**	**Comments**
I. Technical holding times				
Were all technical holding times met?	X			
Were all water samples preserved to a pH of <2.			X	
II. ICP-MS Tune				
Were mass resolutions within 0.1 amu for all isotopes in the tuning solution?			X	
Were %RSDs of isoptoes in the tuning solution ≤5%?			X	
III. Calibration				
Were all instuments calibrated daily?	X			
Were the proper standards used?	X			
Were all initial and continuing calibration verifications within the 90-110% (80-120% for mercury) QC limits?	X			
Were the low level standard checks within 70-130%?			X	
Were all initial calibration correlation coefficients within limits as specifed by the method?	X			
IV. Blanks				
Was a method blank associated with every sample in this SDG?	X			
Was there contamination in the method blanks?		X		
Was there contamination in the initial and continuing calibration blanks?		X		
V. Interference Check Sample				
Were the interference check samples performed daily?			X	
Were the AB solution recoveries within 80-120%?			X	
VI. Matrix Spike/Matrix Spike Duplicates/Laboratory Duplicates				
Were MS/MSD recoveries with the QC limits? (If the sample concentration exceeded the spike concentration by a factor of 4, no action was taken.)	X			
Were the MS/MSD or laboratory duplicate relative percent differences (RPDs) within the QC limits?	X			
VII. Laboratory Control Samples				
Was a LCS analyzed for each batch in the SDG?	X			
Were the LCS recoveries and RPDs (if applicable) within QC limits?	X			

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)				
Validation Area	**Yes**	**No**	**NA**	**Comments**
VIII. Internal Standards				
Were all percent recoveries within the 30-120% (60-125% for EPA Method 200.8) QC limits?			X	
If the recoveries were outside the limits, was a reanalysis performed?			X	
IX. Serial Dilution				
Were all percent differences <10%?			X	
Was there evidence of negative interference? If yes, professional judgement will be used to qualify the data.			X	
X. Sample Result Verification				
Were all reporting limits adjusted to reflect sample dilutions?	X			
Were all soil samples dry weight corrected?	X			
XI. Overall Assessment of Data				
Was the overall assessment of the data found to be acceptable?	X			
XII. Field Duplicates				
Were field duplicates identifed in this SDG?	X			
Were target analytes detected in the field duplicates?	X			
XIII. Field Blanks				
Were field blanks identified in this SDG?		X		
Were target analytes detected in the field blanks?			X	

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, 12	Hg

Analysis Method

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

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-IT258MS/MSD	s	Zn	55.7	53.7	75-125			All	J/UJ/A	Det
(SDG: 20F0233)										

Comments:

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Method: Metals

Analyte	Concentration (mg/Kg)		RPD
	4	5	
Arsenic	10.2	10.6	4
Cadmium	0.13	0.17	27
Chromium	26.8	27.3	2
Copper	47.2	46.6	1
Lead	17.4	17.2	1
Mercury	0.122	0.120	2
Silver	0.17	0.33	64
Zinc	91.7	94.5	3

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

An intial calibration verification (ICV), continuing calibration verification (CCV), low level calibration check (LLCC), and interference check sample (ICSAB) percent recovery (%R) was recalculated for each type of analysis using the following formula:

%R = (Found/True) x 100

Found = concentration of each analyte measured in the analysis

True = concentration of each analyte in the source

Standard ID	Type of Analysis	Element	Found (ug/L)	True (ug/L)	Recalcuated %R	Reported %R	Acceptable (Y/N)
ICV	CVAA	Hg	4.0515	4	101.3	101.3	Y
CCV	CVAA	Hg	4.0101	4	100.3	100.3	Y

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

Percent recoveries (%R) for the laboratory control sample (LCS), matrix spike (MS), and post digestion spike (PDS) were recalculated using the following formula:

%R = (Found/True) x 100

Found = concentration of each analyte measured in the analysis. For the MS calculation, Found = SSR (Spiked Sample Result) - SR (Sample Result)

True = concentration of each analyte in the source

The sample and duplicate relative percent difference (RPD) was recalculated using the following formula:

RPD = (Absolute value(S-D)x 200) / (S+D)

S = Original sample concentration

D = Duplicate sample concentration

The serial dilution percent difference (%D) was recalculated using the following formula.

%D = (Absolute value (I - SDR)) x 100 / (I)

I = Initial sample result

SDR = Serial dilution result (with a 5x dilution applied)

Sample ID	Type of Analysis	Element	Found/S/I	True/D/SDR	Recalcuated %R/RPD/%D	Reported %R/RPD/%D	Acceptable (Y/N)
LCS	LCS	Hg	0.499	0.5	99.8	99.8	Y
11	MS	Hg	0.3122	0.265	118	118	Y
13	Duplicate	Hg	0.0258	0.0274	6.0	5.8	Y

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)
Analytes were recalculated and verified using the following equation:
Concentration = (Result from raw data x Final volume x Dilution factor) / (Percent solids x Initial weight)

Sample ID	Analyte	Raw Data (ug/L)	Dilution	Initial Weight (g)	Final Volume (mL)	Percent solids (%)	Reported Result (mg/Kg)	Recalcuated Result (mg/Kg)	Acceptable (Y/N)
1	Hg	0.0986	1	0.264	50	72.33	0.0258	0.0258	Y
2	Hg	0.1397	1	0.223	50	71.43	0.0439	0.0439	Y
3	Hg	0.1925	1	0.206	50	45.23	0.103	0.103	Y
4	Hg	0.1953	1	0.207	50	38.6	0.122	0.122	Y
5	Hg	0.224	1	0.24	50	38.78	0.120	0.120	Y
6	Hg	0.0994	1	0.271	50	73.64	0.0249	0.0249	Y
7	Hg	0.3089	1	0.284	50	62.29	0.0873	0.0873	Y
8	Hg	1.4573	1	0.235	50	67.11	0.462	0.462	Y
9	Hg	0.1157	1	0.208	80	68.09	0.0408	0.0654	Y
10	Hg	0.1907	1	0.241	50	65.53	0.0604	0.0604	Y

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0235

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS253	20F0235-01	Sediment	06/12/20
LDW20-SS248	20F0235-02	Sediment	06/12/20
LDW20-SS272	20F0235-03	Sediment	06/12/20
LDW20-SS151	20F0235-04	Sediment	06/12/20
LDW20-SS151-FD	20F0235-05	Sediment	06/12/20
LDW20-SS150	20F0235-06	Sediment	06/12/20
LDW20-SS155	20F0235-07	Sediment	06/12/20
LDW20-SS156	20F0235-08	Sediment	06/12/20
LDW20-SS162	20F0235-09	Sediment	06/12/20
LDW20-SS166	20F0235-10	Sediment	06/12/20

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 with the following exceptions:

Blank ID	Analyte	Maximum Concentration	Associated Samples
ICB/CCB	Total organic carbon	0.02%	All samples in SDG 20F0235

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.

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

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

IX. Field Duplicates

Samples LDW20-SS151 and LDW20-SS151-FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (%)		RPD
	LDW20-SS151	LDW20-SS151-FD	
Total solids	38.60	38.78	0
Total organic carbon	3.15	3.06	3

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 20F0235

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 20F0235

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 20F0235

No Sample Data Qualified in this SDG

LDC #: 48765D6
SDG #: 20F0235
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 8/17/20
Page: 1 of 1
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	SW	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	A ~~A~~	MS (20F0233)
VII.	Duplicate sample analysis	A	DUP ↓
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	SW	(4,5)
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-SS253	20F0235-01	Sediment	06/12/20
2	LDW20-SS248	20F0235-02	Sediment	06/12/20
3	LDW20-SS272	20F0235-03	Sediment	06/12/20
4	LDW20-SS151	20F0235-04	Sediment	06/12/20
5	LDW20-SS151-FD	20F0235-05	Sediment	06/12/20
6	LDW20-SS150	20F0235-06	Sediment	06/12/20
7	LDW20-SS155	20F0235-07	Sediment	06/12/20
8	LDW20-SS156	20F0235-08	Sediment	06/12/20
9	LDW20-SS162	20F0235-09	Sediment	06/12/20
10	LDW20-SS166	20F0235-10	Sediment	06/12/20
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

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

METHOD: Inorganics
Soil preparation factor applied (if applicable):

Sample Concentration, unless otherwise noted: % Associated Samples: All

				Sample Identification								
Analyte	**PB (units)**	**Maximum ICB/CCB (%)**	**Action Level**	No qualifiers								
TOC		0.02	0.2									

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

VALIDATION FINDINGS WORKSHEET
Field Duplicates

METHOD: Inorganics

Analyte	Concentration (%)		RPD
	4	5	
Total solids	38.60	38.78	0
TOC	3.15	3.06	3

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 14, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0288

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC346	20F0288-03	Sediment	06/15/20
LDW20-SC345	20F0288-04	Sediment	06/15/20
LDW20-SC349	20F0288-05	Sediment	06/15/20
LDW20-SC351	20F0288-08	Sediment	06/15/20
LDW20-SC349FD	20F0288-09	Sediment	06/15/20
LDW20-SC160C	20F0288-10	Sediment	06/15/20
LDW20-SC210B	20F0288-11	Sediment	06/15/20
LDW20-SC204B	20F0288-12	Sediment	06/15/20
LDW20-SC346MS	20F0288-03MS	Sediment	06/15/20
LDW20-SC346MSD	20F0288-03MSD	Sediment	06/15/20

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 7.8°C and 8.6°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.

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
BIF0816-SRM1	Acenaphthene Anthracene	47.3 (52-148) 46.4 (57-143)	All samples in SDG 20F0288	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	P

X. Field Duplicates

Samples LDW20-SC349 and LDW20-SC349FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/Kg)		RPD
	LDW20-SC349	LDW20-SC349FD	
Phenol	14.8	13.6	8
Naphthalene	11.6	11.4	2
2-Methylnaphthalene	11.5	12.7	10
Acenaphthylene	8.0	8.2	2
Dimethylphthalate	7.2	20.0U	Not calculable
Acenaphthene	7.4	6.9	7
Dibenzofuran	14.1	13.1	7

Compound	Concentration (ug/Kg)		RPD
	LDW20-SC349	LDW20-SC349FD	
Fluorene	17.1	14.5	16
Phenanthrene	107	100	7
Anthracene	35.9	35.9	0
Fluoranthene	327	313	4
Pyrene	285	276	3
Butylbenzylphthalate	12.8	21.3	50
Benzo(a)anthracene	117	117	0
Chrysene	182	181	1
Bis(2-ethylhexyl)phthalate	214	199	7
Benzofluroanthenes, total	356	355	0
Benzo(a)pyrene	147	149	1
Indeno(1,2,3-cd)pyrene	94.2	81.9	14
Dibenz(a,h)anthracene	30.9	38.0	21
Benzo(g,h,i)perylene	111	93.8	17

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 eight samples.

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

Duwamish AOC4
Semivolatiles - Data Qualification Summary - SDG 20F0288

Sample	Compound	Flag	A or P	Reason
LDW20-SC346 LDW20-SC345 LDW20-SC349 LDW20-SC351 LDW20-SC349FD LDW20-SC160C LDW20-SC210B LDW20-SC204B	Acenaphthene Anthracene	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	P	Standard reference materials (%R)

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0288

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0288

No Sample Data Qualified in this SDG

LDC #: 48765E2a

SDG #: 20F0288

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 7/13/20

Page: 1 of 1

Reviewer:

2nd Reviewer: AC

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	A	Temp @ 7.8-8.6°C - same day
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A A	RSD ≤ 20%, r² ICV ≤ 30%
IV.	Continuing calibration	A	CCV ≤ 30%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples /SRM	A/SW	LCS
X.	Field duplicates	SW	D=3+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-SC346	20F0288-03	Sediment	06/15/20
2	LDW20-SC345	20F0288-04	Sediment	06/15/20
3	LDW20-SC349 D	20F0288-05	Sediment	06/15/20
4	LDW20-SC351	20F0288-08	Sediment	06/15/20
5	LDW20-SC349FD D	20F0288-09	Sediment	06/15/20
6	LDW20-SC160C	20F0288-10	Sediment	06/15/20
7	LDW20-SC210B	20F0288-11	Sediment	06/15/20
8	LDW20-SC204B	20F0288-12	Sediment	06/15/20
9	LDW20-SC346MS	20F0288-03MS	Sediment	06/15/20
10	LDW20-SC346MSD	20F0288-03MSD	Sediment	06/15/20
11				
12				
13				
14				

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 48765C29

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS)

Page: 1 of 1
Reviewer:
2nd Reviewer:

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

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?

#	Date	LCS/LCSD ID	Compound	~~LCS~~ SRM %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		B4F0876-SRM1	GG	47.3 (52-148)	( )	( )	All (dets+ND)	J/UJ/P
			VV	46.4 (57-143)	( )	( )		↓
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
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				( )	( )	( )		
				( )	( )	( )		

LDC#: 48765E2a

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
	3	5	
A	14.8	13.6	8
S	11.6	11.4	2
W	11.5	12.7	10
DD	8.0	8.2	2
CC	7.2	20.0U	NC
GG	7.4	6.9	7
JJ	14.1	13.1	7
NN	17.1	14.5	16
UU	107	100	7
VV	35.9	35.9	0
YY	327	313	4
ZZ	285	276	3
AAA	12.8	21.3	50
CCC	117	117	0
DDD	182	181	1
EEE	214	199	7
ZZZZ	356	355	0
III	147	149	1
JJJ	94.2	81.9	14
KKK	30.9	38.0	21
LLL	111	93.8	17

LDC Report# 48765E2b

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 14, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0288

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC346	20F0288-03	Sediment	06/15/20
LDW20-SC345	20F0288-04	Sediment	06/15/20
LDW20-SC349	20F0288-05	Sediment	06/15/20
LDW20-SC351	20F0288-08	Sediment	06/15/20
LDW20-SC349FD	20F0288-09	Sediment	06/15/20
LDW20-SC160C	20F0288-10	Sediment	06/15/20
LDW20-SC210B	20F0288-11	Sediment	06/15/20
LDW20-SC204B	20F0288-12	Sediment	06/15/20
LDW20-SC346MS	20F0288-03MS	Sediment	06/15/20
LDW20-SC346MSD	20F0288-03MSD	Sediment	06/15/20

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 7.8°C and 8.6°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	65.7	All samples in SDG 20F0288	J (all 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
07/03/20	Pentachlorophenol	30.9	All samples in SDG 20F0288	J (all detects) UJ (all non-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
BIF0816-SRM2	2,4-Dimethylphenol	35.0 (40-160)	All samples in SDG 20F0288	J (all detects) UJ (all non-detects)	P

X. Field Duplicates

Samples LDW20-SC349 and LDW20-SC349FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/Kg)		RPD
	LDW20-SC349	LDW20-SC349FD	
1,4-Dichlorobenzene	1.4	1.4	0
Benzyl alcohol	51.8	45.6	13
Benzoic acid	71.7	43.5	49
2,4-Dimethylphenol	2.4	2.2	9
N-Nitrosodiphenylamine	3.7	3.3	11
Pentachlorophenol	2.4	2.0U	Not calculable

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 eight samples.

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

Duwamish AOC4
Semivolatiles – Data Qualification Summary - SDG 20F0288

Sample	Compound	Flag	A or P	Reason
LDW20-SC346 LDW20-SC345 LDW20-SC349 LDW20-SC351 LDW20-SC349FD LDW20-SC160C LDW20-SC210B LDW20-SC204B	N-Nitrosodiphenylamine	J (all detects)	A	Initial calibration verification (%D)
LDW20-SC346 LDW20-SC345 LDW20-SC349 LDW20-SC351 LDW20-SC349FD LDW20-SC160C LDW20-SC210B LDW20-SC204B	Pentachlorophenol	J (all detects) UJ (all non-detects)	A	Continuing calibration (%D)
LDW20-SC346 LDW20-SC345 LDW20-SC349 LDW20-SC351 LDW20-SC349FD LDW20-SC160C LDW20-SC210B LDW20-SC204B	2,4-Dimethylphenol	J (all detects) UJ (all non-detects)	P	Standard reference materials (%R)

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0288

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0288

No Sample Data Qualified in this SDG

LDC #: 48765E2b

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 8/13/20

SDG #: 20F0288

Page: 1 of 1

Laboratory: Analytical Resources, Inc.

Reviewer: CF

2nd Reviewer: AC

METHOD: GC/MS ~~Polynuclear Aromatic Hydrocarbons~~ SVOAs (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	A	Temp @ 7.8-8.6°C - same day
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A SW	RSD ≤ 20% or r² ICV ≤ 30%
IV.	Continuing calibration	SW	CCV ≤ ~~30%~~ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples / SRM	A SW	LCS
X.	Field duplicates	SW	D=3+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-SC346	20F0288-03	Sediment	06/15/20
2	LDW20-SC345	20F0288-04	Sediment	06/15/20
3	LDW20-SC349	20F0288-05	Sediment	06/15/20
4	LDW20-SC351	20F0288-08	Sediment	06/15/20
5	LDW20-SC349FD	20F0288-09	Sediment	06/15/20
6	LDW20-SC160C	20F0288-10	Sediment	06/15/20
7	LDW20-SC210B	20F0288-11	Sediment	06/15/20
8	LDW20-SC204B	20F0288-12	Sediment	06/15/20
9	LDW20-SC346MS	20F0288-03MS	Sediment	06/15/20
10	LDW20-SC346MSD	20F0288-03MSD	Sediment	06/15/20
11				
12				
13				
14				

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 48765E2b

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

Reviewer: [illegible]
2nd Reviewer: [illegible]

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

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 ≤30 %D ?

#	Date	Standard ID	Compound	Finding %D (Limit: ≤30.0%)	Associated Samples	Qualifications
	6/26/20	51F0395-SCV1	QQ	65.7	All (dets)	J/UJ/A

LDC #: 48765E26

Page: 1 of 1

Reviewer: [illegible]

2nd Reviewer: [illegible]

VALIDATION FINDINGS WORKSHEET

Continuing Calibration

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

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 for each instrument?

Y (N) N/A Were percent differences (%D) ≤20 % and relative response factors (RRF) within the method criteria?

#	Date	Standard ID	Compound	Finding %D (Limit: ≤20.0%)	Finding RRF (Limit)	Associated Samples	Qualifications
	7/3/20	NT4200703045	TT	30.9		All (dets + ND)	J/UJ/A

LDC #: 48765B2b

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS)

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

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

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?

#	Date	LCS/LCSD ID	Compound	~~LCS~~ SRM %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		B1F0816-SRM2	O	35 (40-160)	( )	( )	All (dets+ND)	J/UJ/P
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
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				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		

LDC#: 48765E2b

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: PG
2nd Reviewer: [illegible]

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
	3	5	
E	1.4	1.4	0
QQQ	51.8	45.6	13
PPP	71.7	43.5	49
O	2.4	2.2	9
QQ	3.7	3.3	11
TT	2.4	20.0U	NC

V:\FIELD DUPLICATES\Field Duplicates\FD_Organics\2020\48765E2b windward duwamish.wpd

LDC Report# 48765E3a

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 14, 2020

Parameters: Hexachlorobenzene

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0288

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC346	20F0288-03	Sediment	06/15/20
LDW20-SC345	20F0288-04	Sediment	06/15/20
LDW20-SC349	20F0288-05	Sediment	06/15/20
LDW20-SC351	20F0288-08	Sediment	06/15/20
LDW20-SC349FD	20F0288-09	Sediment	06/15/20
LDW20-SC160C	20F0288-10	Sediment	06/15/20
LDW20-SC210B	20F0288-11	Sediment	06/15/20
LDW20-SC204B	20F0288-12	Sediment	06/15/20
LDW20-SC345MS	20F0288-04MS	Sediment	06/15/20
LDW20-SC345MSD	20F0288-04MSD	Sediment	06/15/20

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 7.8°C and 8.6°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-SC349 and LDW20-SC349FD 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 20F0288

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Laboratory Blank Data Qualification Summary - SDG 20F0288

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Field Blank Data Qualification Summary - SDG 20F0288

No Sample Data Qualified in this SDG

LDC #: 48765E3a
SDG #: 20F0288
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 8/13/20
Page: 1 of 1
Reviewer: [illegible]
2nd Reviewer: M

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	A	Temp @ 7.8-8.6°C - same day
II.	GC Instrument Performance Check	A	
III.	Initial calibration/ICV	A/A	RSD ≤ 20%. ICV ≤ 20%
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
X.	Field duplicates	ND	D=3+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-SC346	20F0288-03	Sediment	06/15/20
2	LDW20-SC345	20F0288-04	Sediment	06/15/20
3	LDW20-SC349 D	20F0288-05	Sediment	06/15/20
4	LDW20-SC351	20F0288-08	Sediment	06/15/20
5	LDW20-SC349FD D	20F0288-09	Sediment	06/15/20
6	LDW20-SC160C	20F0288-10	Sediment	06/15/20
7	LDW20-SC210B	20F0288-11	Sediment	06/15/20
8	LDW20-SC204B	20F0288-12	Sediment	06/15/20
9	LDW20-SC345MS	20F0288-04MS	Sediment	06/15/20
10	LDW20-SC345MSD	20F0288-04MSD	Sediment	06/15/20
11				

Notes:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 14, 2020

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0288

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC340	20F0288-01	Sediment	06/15/20
LDW20-SC342	20F0288-02	Sediment	06/15/20
LDW20-SC346	20F0288-03	Sediment	06/15/20
LDW20-SC345	20F0288-04	Sediment	06/15/20
LDW20-SC349	20F0288-05	Sediment	06/15/20
LDW20-SC348	20F0288-06	Sediment	06/15/20
LDW20-SC353	20F0288-07	Sediment	06/15/20
LDW20-SC351	20F0288-08	Sediment	06/15/20
LDW20-SC349FD	20F0288-09	Sediment	06/15/20
LDW20-SC160C	20F0288-10	Sediment	06/15/20
LDW20-SC210B	20F0288-11	Sediment	06/15/20
LDW20-SC204B	20F0288-12	Sediment	06/15/20
LDW20-SC340MS	20F0288-01MS	Sediment	06/15/20
LDW20-SC340MSD	20F0288-01MSD	Sediment	06/15/20

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 7.8°C and 8.6°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 20F0288	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-SC349 and LDW20-SC349FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/Kg)		RPD
	LDW20-SC349	LDW20-SC349FD	
Aroclor-1248	33.4	36.4	9
Aroclor-1254	42.7	50.1	16
Aroclor-1260	52.2	56.6	8

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-SC340	Aroclor-1260	43.8	J (all detects)	A
LDW20-SC342	Aroclor-1260	45.5	J (all detects)	A
LDW20-SC346	Aroclor-1260	48.1	J (all detects)	A
LDW20-SC345	Aroclor-1248 Aroclor-1260	41.3 46.5	J (all detects) J (all detects)	A
LDW20-SC349	Aroclor-1260	50.1	J (all detects)	A

Sample	Compound	RPD	Flag	A or P
LDW20-SC348	Aroclor-1260	48.2	J (all detects)	A
LDW20-SC353	Aroclor-1260	47.1	J (all detects)	A
LDW20-SC351	Aroclor-1248 Aroclor-1260	42.8 45.7	J (all detects) J (all detects)	A
LDW20-SC349FD	Aroclor-1248 Aroclor-1260	43.9 48.5	J (all detects) J (all detects)	A
LDW20-SC160C	Aroclor-1248 Aroclor-1260	46 44.1	J (all detects) J (all detects)	A
LDW20-SC204B	Aroclor-1254	40.3	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 and RPD between two columns, 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
Polychlorinated Biphenyls - Data Qualification Summary - SDG 20F0288

Sample	Compound	Flag	A or P	Reason
LDW20-SC340 LDW20-SC342 LDW20-SC346 LDW20-SC345 LDW20-SC349 LDW20-SC348 LDW20-SC353 LDW20-SC351 LDW20-SC349FD LDW20-SC160C LDW20-SC210B LDW20-SC204B	Aroclor-1260	J (all detects)	A	Initial calibration verification (%D)
LDW20-SC340 LDW20-SC342 LDW20-SC346 LDW20-SC349 LDW20-SC348 LDW20-SC353	Aroclor-1260	J (all detects)	A	Compound quantitation (RPD between two columns)
LDW20-SC345 LDW20-SC351 LDW20-SC349FD LDW20-SC160C	Aroclor-1248 Aroclor-1260	J (all detects) J (all detects)	A	Compound quantitation (RPD between two columns)
LDW20-SC204B	Aroclor-1254	J (all detects)	A	Compound quantitation (RPD between two columns)

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 20F0288

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 20F0288

No Sample Data Qualified in this SDG

LDC #: 48765E3b
SDG #: 20F0288
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 8/13/20
Page: 1 of 1
Reviewer: [illegible]
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	A	Temp @ 7.8 - 8.6 oc - same day
II.	Initial calibration/ICV	A/SW	RSD ≤ 20%. ICV ≤ 20%
III.	Continuing calibration	A	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes / IS	A/A	~~IS out on 2C - No results updated.~~
VII.	Matrix spike/Matrix spike duplicates	A	
VIII.	Laboratory control samples / SRM	A/A	LCS/D
IX.	Field duplicates	SW/	D=5+9
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-SC340	20F0288-01	Sediment	06/15/20
2	LDW20-SC342	20F0288-02	Sediment	06/15/20
3	LDW20-SC346	20F0288-03	Sediment	06/15/20
4	LDW20-SC345	20F0288-04	Sediment	06/15/20
5	LDW20-SC349 D	20F0288-05	Sediment	06/15/20
6	LDW20-SC348	20F0288-06	Sediment	06/15/20
7	LDW20-SC353	20F0288-07	Sediment	06/15/20
8	LDW20-SC351	20F0288-08	Sediment	06/15/20
9	LDW20-SC349FD D	20F0288-09	Sediment	06/15/20
10	LDW20-SC160C	20F0288-10	Sediment	06/15/20
11	LDW20-SC210B	20F0288-11	Sediment	06/15/20
12	LDW20-SC204B	20F0288-12	Sediment	06/15/20
13	LDW20-SC340MS	20F0288-01MS	Sediment	06/15/20
14	LDW20-SC340MSD	20F0288-01MSD	Sediment	06/15/20
15				
16				
17				

VALIDATION FINDINGS WORKSHEET

METHOD: Pesticides

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

Notes:_____

_____

LDC #: 48765236

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

Page: 1 of 1
Reviewer: 9
2nd Reviewer: 9

METHOD: √ GC __ HPLC

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
	7/6/20	1400568 SQ1	1C	BB	21.8	All (dets)	J (all sp) / UJ (all nd) / A
							~~J (all sp) / UJ (all nd) / AA, FB~~

ICV-qc.wpd

LDC#: 48765E3b

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: PG
2nd Reviewer: M

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
	5	9	
Aroclor 1248	33.4	36.4	9
Aroclor 1254	42.7	50.1	16
Aroclor 1260	52.2	56.6	8

V:\FIELD DUPLICATES\Field Duplicates\FD_Organics\2020\48765E3b windward duwamish.wpd

LDC #: 48765236

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Page: 1 of 1
Reviewer: 9
2nd Reviewer: DC

METHOD: ✓ GC __ HPLC

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 relative percent differences of detected compounds between two columns/detectors ≤40%?
If no, please see findings bellow.

#	Compound Name	Sample ID	%RPD Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	BB	1	13.8	J+ (3) / UJ (5)
	BB	2	45.5	
	BB	3	48.1	
	Z	4	41.3	
	BB		46.5	
	BB	5	50.1	
	BB	6	48.2	
	BB	7	47.1	
	Z	8	42.8	
	BB		45.7	
	Z	9	43.9	
	BB		48.5	

LDC #: 48765236

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: ✓ GC __ HPLC

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 relative percent differences of detected compounds between two columns/detectors ≤40%?
If no, please see findings bellow.

#	Compound Name	Sample ID	%RPD Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	Z	10	46	J dets/A
	BB		44.1	↓
	AA	12	40.3	↓

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 25, 2020

Parameters: Metals

Validation Level: Stage 4

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0288

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC346	20F0288-03	Sediment	06/15/20
LDW20-SC345	20F0288-04	Sediment	06/15/20
LDW20-SC349	20F0288-05	Sediment	06/15/20
LDW20-SC351	20F0288-08	Sediment	06/15/20
LDW20-SC349FD	20F0288-09	Sediment	06/15/20
LDW20-SC160C	20F0288-10	Sediment	06/15/20
LDW20-SC210B	20F0288-11	Sediment	06/15/20
LDW20-SC204B	20F0288-12	Sediment	06/15/20
LDW20-SC346MS	20F0288-03MS	Sediment	06/15/20
LDW20-SC346MSD	20F0288-03MSD	Sediment	06/15/20
LDW20-SC346DUP	20F0288-03DUP	Sediment	06/15/20

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 4 data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

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)	Chromium	0.17 mg/Kg	All samples in SDG 20F0212
ICB/CCB	Silver	0.026 ug/L	LDW20-SC345

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-SC345	Silver	0.27 mg/Kg	0.27U 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 with the following exceptions:

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW20-SC346MS/MSD (All samples in SDG 20F0235)	Silver	55.7 (75-125)	51.1 (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 with the following exceptions:

DUP ID (Associated Samples)	Analyte	RPD (Limits)	Flag	A or P
LDW20-SC346DUP (All samples in SDG 20F0235)	Arsenic	32.7 (≤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

Samples LDW20-SC349 and LDW20-SC349FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (mg/Kg)		RPD
	LDW20-SC349	LDW20-SC349FD	
Arsenic	19.3	20.0	4
Cadmium	0.33	0.43	26

Analyte	Concentration (mg/Kg)		RPD
	LDW20-SC349	LDW20-SC349FD	
Chromium	31.8	33.7	6
Copper	72.1	72.2	0
Lead	26.1	26.6	2
Mercury	0.165	0.171	4
Silver	0.25	0.27	8
Zinc	120	121	1

XII. Internal Standards (ICP-MS)

Raw data were not reviewed for Stage 4 validation.

XIII. Sample Result Verification

All sample result verifications were acceptable.

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 nine 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
Metals - Data Qualification Summary - SDG 20F0288

Sample	Analyte	Flag	A or P	Reason
LDW20-SC346 LDW20-SC345 LDW20-SC349 LDW20-SC351 LDW20-SC349FD LDW20-SC160C LDW20-SC210B LDW20-SC204B LDW20-SC346DUP	Silver	J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)
LDW20-SC346 LDW20-SC345 LDW20-SC349 LDW20-SC351 LDW20-SC349FD LDW20-SC160C LDW20-SC210B LDW20-SC204B LDW20-SC346DUP	Arsenic	J (all detects)	A	Duplicate sample analysis (RPD)

Duwamish AOC4
Metals - Laboratory Blank Data Qualification Summary - SDG 20F0288

Sample	Analyte	Modified Final Concentration	A or P
LDW20-SC345	Silver	0.27U mg/Kg	A

Duwamish AOC4
Metals - Field Blank Data Qualification Summary - SDG 20F0288

No Sample Data Qualified in this SDG

LDC #: 48765E4a

SDG #: 20F0288

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 4

Date: 8/17/20

Page: 1 of 1

Reviewer: CF

2nd Reviewer: CF

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	SW	(3,5)
XII.	Internal Standard (ICP-MS)	A	
XIII.	Sample Result Verification	A	
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-SC346	20F0288-03	Sediment	06/15/20
2	LDW20-SC345	20F0288-04	Sediment	06/15/20
3	LDW20-SC349	20F0288-05	Sediment	06/15/20
4	LDW20-SC351	20F0288-08	Sediment	06/15/20
5	LDW20-SC349FD	20F0288-09	Sediment	06/15/20
6	LDW20-SC160C	20F0288-10	Sediment	06/15/20
7	LDW20-SC210B	20F0288-11	Sediment	06/15/20
8	LDW20-SC204B	20F0288-12	Sediment	06/15/20
9	LDW20-SC346MS	20F0288-03MS	Sediment	06/15/20
10	LDW20-SC346MSD	20F0288-03MSD	Sediment	06/15/20
11	LDW20-SC346DUP	20F0288-03DUP	Sediment	06/15/20
12				
13				
14				

Notes:

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)				
Validation Area	**Yes**	**No**	**NA**	**Comments**
I. Technical holding times				
Were all technical holding times met?	X			
Were all water samples preserved to a pH of <2.			X	
II. ICP-MS Tune				
Were mass resolutions within 0.1 amu for all isotopes in the tuning solution?	X			
Were %RSDs of isoptoes in the tuning solution ≤5%?	X			
III. Calibration				
Were all instuments calibrated daily?	X			
Were the proper standards used?	X			
Were all initial and continuing calibration verifications within the 90-110% (80-120% for mercury) QC limits?	X			
Were the low level standard checks within 70-130%?			X	
Were all initial calibration correlation coefficients within limits as specifed by the method?	X			
IV. Blanks				
Was a method blank associated with every sample in this SDG?	X			
Was there contamination in the method blanks?	X			
Was there contamination in the initial and continuing calibration blanks?	X			
V. Interference Check Sample				
Were the interference check samples performed daily?	X			
Were the AB solution recoveries within 80-120%?	X			
VI. Matrix Spike/Matrix Spike Duplicates/Laboratory Duplicates				
Were MS/MSD recoveries with the QC limits? (If the sample concentration exceeded the spike concentration by a factor of 4, no action was taken.)		X		
Were the MS/MSD or laboratory duplicate relative percent differences (RPDs) within the QC limits?		X		
VII. Laboratory Control Samples				
Was a LCS analyzed for each batch in the SDG?	X			
Were the LCS recoveries and RPDs (if applicable) within QC limits?	X			

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)				
Validation Area	**Yes**	**No**	**NA**	**Comments**
VIII. Internal Standards				
Were all percent recoveries within the 30-120% (60-125% for EPA Method 200.8) QC limits?	X			
If the recoveries were outside the limits, was a reanalysis performed?			X	
IX. Serial Dilution				
Were all percent differences <10%?			X	
Was there evidence of negative interference? If yes, professional judgement will be used to qualify the data.			X	
X. Sample Result Verification				
Were all reporting limits adjusted to reflect sample dilutions?	X			
Were all soil samples dry weight corrected?	X			
XI. Overall Assessment of Data				
Was the overall assessment of the data found to be acceptable?	X			
XII. Field Duplicates				
Were field duplicates identifed in this SDG?	X			
Were target analytes detected in the field duplicates?	X			
XIII. Field Blanks				
Were field blanks identified in this SDG?		X		
Were target analytes detected in the field blanks?			x	

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1 to 8	As, Cd, Cr, Cu, Pb, Ag, Zn, Hg
QC: 9-11	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							
Cr	0.17										

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

				Sample Identification							
Analyte	**PB (mg/Kg)**	**Maximum ICB/CCB (ug/L)**	**Action Level**	2							
Ag		0.026		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
9, 10	s	Ag	55.7	51.1				All	J/UJ/A	Det

Comments:

VALIDATION FINDINGS WORKSHEETS
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
11	s	As	32.7	20			All	J/UJ/A	Det

Comments:

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer:CR

Method: Metals

Analyte	Concentration (mg/Kg)		RPD
	3	5	
Arsenic	19.3	20.0	4
Cadmium	0.33	0.43	26
Chromium	31.8	33.7	6
Copper	72.1	72.2	0
Lead	26.1	26.6	2
Mercury	0.165	0.171	4
Silver	0.25	0.27	8
Zinc	120	121	1

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

An intial calibration verification (ICV), continuing calibration verification (CCV), low level calibration check (LLCC), and interference check sample (ICSAB) percent recovery (%R) was recalculated for each type of analysis using the following formula:

%R = (Found/True) x 100

Found = concentration of each analyte measured in the analysis

True = concentration of each analyte in the source

Standard ID	Type of Analysis	Element	Found (ug/L)	True (ug/L)	Recalcuated %R	Reported %R	Acceptable (Y/N)
ICV	ICP-MS	Ag	51.5	50	103	103	Y
CCVB	ICP-MS	Cr	50.7	50	101	101	Y
ICSAB	ICP-MS	Cd	19.29	20	96.5	96.5	Y
ICV	CVAA	Hg	4.0515	4	101.3	101.3	Y
CCV	CVAA	Hg	3.9381	4	98.5	98.5	Y

VALIDATION FINDINGS CHECKLIST

Quality Control Sample Recalculations

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

Percent recoveries (%R) for the laboratory control sample (LCS), matrix spike (MS), and post digestion spike (PDS) were recalculated using the following formula:

%R = (Found/True) x 100

Found = concentration of each analyte measured in the analysis. For the MS calculation, Found = SSR (Spiked Sample Result) - SR (Sample Result)

True = concentration of each analyte in the source

The sample and duplicate relative percent difference (RPD) was recalculated using the following formula:

RPD = (Absolute value(S-D)x 200) / (S+D)

S = Original sample concentration

D = Duplicate sample concentration

The serial dilution percent difference (%D) was recalculated using the following formula.

%D = (Absolute value (I - SDR)) x 100 / (I)

I = Initial sample result

SDR = Serial dilution result (with a 5x dilution applied)

Sample ID	Type of Analysis	Element	Found/S/I	True/D/SDR	Recalcuated %R/RPD/%D	Reported %R/RPD/%D	Acceptable (Y/N)
LCS	LCS	Hg	0.499	0.5	99.8	99.8	Y
9	MS	Ag	32.95	59.1	55.8	55.7	Y
11	Duplicate	Cr	30.5	30.8	0.98	1.17	Y
	PDS						
	Serial dilution						

VALIDATION FINDINGS CHECKLIST
Sample Calculation Verification

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)
Analytes were recalculated and verified using the following equation:
Concentration = (Result from raw data x Final volume x Dilution factor) / (Percent solids x Initial weight)

Sample ID	Analyte	Raw Data (ug/L)	Dilution	Initial Weight (g)	Final Volume (mL)	Percent solids (%)	Reported Result (mg/Kg)	Recalcuated Result (mg/Kg)	Acceptable (Y/N)
1	Cr	12.873	20	1.017	50	41.54	30.5	30.5	Y
2	Pb	8.575	20	1.073	50	37.29	21.4	21.4	Y
3	Ag	0.109	20	1.086	50	40.38	0.25	0.25	Y
4	As	8.6	20	1.047	50	40.22	20.4	20.4	Y
5	Cd	0.173	20	1.012	50	39.39	0.43	0.43	Y
6	Zn	49.574	20	1.063	50	60.29	77.4	77.4	Y
7	Hg	0.3359	1	0.29	50	63.2	0.0916	0.0916	Y
8	Hg	0.2047	1	0.209	50	63.72	0.0769	0.0769	Y

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0288

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC340	20F0288-01	Sediment	06/15/20
LDW20-SC342	20F0288-02	Sediment	06/15/20
LDW20-SC346	20F0288-03	Sediment	06/15/20
LDW20-SC345	20F0288-04	Sediment	06/15/20
LDW20-SC349	20F0288-05	Sediment	06/15/20
LDW20-SC348	20F0288-06	Sediment	06/15/20
LDW20-SC353	20F0288-07	Sediment	06/15/20
LDW20-SC351	20F0288-08	Sediment	06/15/20
LDW20-SC349FD	20F0288-09	Sediment	06/15/20
LDW20-SC160C	20F0288-10	Sediment	06/15/20
LDW20-SC210B	20F0288-11	Sediment	06/15/20
LDW20-SC204B	20F0288-12	Sediment	06/15/20
LDW20-SC340MS	20F0288-01MS	Sediment	06/15/20
LDW20-SC340DUP	20F0288-01DUP	Sediment	06/15/20

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 with the following exceptions:

Blank ID	Analyte	Maximum Concentration	Associated Samples
ICB/CCB	Total organic carbon	0.02%	All samples in SDG 20F0288

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.

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

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

IX. Field Duplicates

Samples LDW20-SC349 and LDW20-SC349FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (%)		RPD
	LDW20-SC349	LDW20-SC349FD	
Total solids	40.38	39.39	2
Total organic carbon	3.82	3.70	3

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 20F0288

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 20F0288

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 20F0288

No Sample Data Qualified in this SDG

LDC #: 48765E6 **VALIDATION COMPLETENESS WORKSHEET** Date: 8/17/26
SDG #: 20F0288 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	SW	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	A	
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	SW	(5,9)
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-SC340	20F0288-01	Sediment	06/15/20
2	LDW20-SC342	20F0288-02	Sediment	06/15/20
3	LDW20-SC346	20F0288-03	Sediment	06/15/20
4	LDW20-SC345	20F0288-04	Sediment	06/15/20
5	LDW20-SC349	20F0288-05	Sediment	06/15/20
6	LDW20-SC348	20F0288-06	Sediment	06/15/20
7	LDW20-SC353	20F0288-07	Sediment	06/15/20
8	LDW20-SC351	20F0288-08	Sediment	06/15/20
9	LDW20-SC349FD	20F0288-09	Sediment	06/15/20
10	LDW20-SC160C	20F0288-10	Sediment	06/15/20
11	LDW20-SC210B	20F0288-11	Sediment	06/15/20
12	LDW20-SC204B	20F0288-12	Sediment	06/15/20
13	LDW20-SC340MS	20F0288-01MS	Sediment	06/15/20
14	LDW20-SC340DUP	20F0288-01DUP	Sediment	06/15/20
15				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1 to ~~10~~ 12	Total solids
~~1-6, 8-12~~ 1 – 12	TOC
QC: 13, 14	TOC

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

METHOD: Inorganics
Soil preparation factor applied (if applicable):

Sample Concentration, unless otherwise noted: % Associated Samples: All

				Sample Identification								
Analyte	**PB (units)**	**Maximum ICB/CCB (%)**	**Action Level**	No qualifiers								
TOC		0.02	0.2									

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

VALIDATION FINDINGS WORKSHEET
Field Duplicates

METHOD: Inorganics

Analyte	Concentration (%)		RPD
	5	9	
Total solids	40.38	39.39	2
TOC	3.82	3.70	3

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Polychlorinated Dioxins/Dibenzofurans

Validation Level: Stage 4

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0288

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC349	20F0288-05	Sediment	06/15/20
LDW20-SC351	20F0288-08	Sediment	06/15/20
LDW20-SC349FD	20F0288-09	Sediment	06/15/20
LDW20-SC210B	20F0288-11	Sediment	06/15/20

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 4 data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

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 7.8°C and 8.6°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 minimum S/N ratio was greater than or equal to 10 for each unlabeled compound and labeled compound.

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.

The minimum S/N ratio was greater than or equal to 10 for each unlabeled compound and labeled compound.

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
BIF0780-BLK1	06/29/20	1,2,3,4,6,7,8-HpCDF 1,2,3,4,6,7,8-HpCDD OCDF OCDD	0.0726 ng/Kg 0.220 ng/Kg 0.477 ng/Kg 1.66 ng/Kg	All samples in SDG 20F0288

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

Samples LDW20-SC349 and LDW20-SC349FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ng/Kg)		RPD
	LDW20-SC349	LDW20-SC349FD	
2,3,7,8-TCDF	0.942	0.844	11
2,3,7,8-TCDD	0.997U	0.619	Not calculable
1,2,3,7,8-PeCDF	0.619	0.585	6

Compound	Concentration (ng/Kg)		RPD
	LDW20-SC349	LDW20-SC349FD	
2,3,4,7,8-PeCDF	1.17	1.15	2
1,2,3,7,8-PeCDD	1.35	1.14	17
1,2,3,4,7,8-HxCDF	3.44	3.62	5
1,2,3,6,7,8-HxCDF	1.34	1.28	5
2,3,4,6,7,8-HxCDF	1.76	1.82	3
1,2,3,7,8,9-HxCDF	0.760	0.699	8
1,2,3,4,7,8-HxCDD	2.00	1.62	21
1,2,3,6,7,8-HxCDD	6.09	5.64	8
1,2,3,7,8,9-HxCDD	5.18	3.65	35
1,2,3,4,6,7,8-HpCDF	32.9	32.4	2
1,2,3,4,7,8,9-HpCDF	2.34	2.61	11
1,2,3,4,6,7,8-HpCDD	224	234	4
OCDF	128	116	10
OCDD	2010	1930	4
Total TCDF	11.9	3.04	119
Total TCDD	1.43	1.04	32
Total PeCDF	10.5	9.93	6
Total PeCDD	3.46	0.676	135
Total HxCDF	45.3	44.5	2
Total HxCDD	62.0	63.1	2
Total HpCDF	124	125	1
Total HpCDD	697	850	20

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 20F0288	All compounds reported as estimated maximum possible concentration (EMPC) and greater than the reporting limit.	J (all detects)	A
All samples in SDG 20F0288	All compounds reported as estimated maximum possible concentration (EMPC) and less than the reporting limit.	U (all non-detects)	A
LDW20-SC349FD	All results flagged "X" by the laboratory due to chlorinated diphenyl ether (CDPE) interference.	J (all detects)	A

XII. Target Compound Identifications

All target compound identifications met validation criteria.

XIII. System Performance

The system performance was acceptable.

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 in four 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 20F0288

Sample	Compound	Flag	A or P	Reason
LDW20-SC349 LDW20-SC351 LDW20-SC349FD LDW20-SC210B	All compounds reported as estimated maximum possible concentration (EMPC) and greater than the reporting limit.	J (all detects)	A	Compound quantitation (EMPC)
LDW20-SC349 LDW20-SC351 LDW20-SC349FD LDW20-SC210B	All compounds reported as estimated maximum possible concentration (EMPC) and less than the reporting limit.	U (all non-detects)	A	Compound quantitation (EMPC)
LDW20-SC349FD	All results flagged "X" by the laboratory 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 20F0288

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Field Blank Data Qualification Summary - SDG 20F0288

No Sample Data Qualified in this SDG

LDC #: 48765E21 **VALIDATION COMPLETENESS WORKSHEET** Date: 8/14/20
SDG #: 20F0288 Stage 4 Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer: CR
2nd Reviewer: A

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	A	Temp @ 7.8 - 8.6°C - same day
II.	HRGC/HRMS Instrument performance check	A	
III.	Initial calibration/ICV	A A	RSD ≤ 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	MS
VIII.	Laboratory control samples /SRM	A	LCS
IX.	Field duplicates	SW	D=1+3
X.	Labeled Compounds	A	
XI.	Compound quantitation RL/LOQ/LODs	SW	
XII.	Target compound identification	A	
XIII.	System performance	A	
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-SC349	20F0288-05	Sediment	06/15/20
2	LDW20-SC351	20F0288-08	Sediment	06/15/20
3	LDW20-SC349FD	20F0288-09	Sediment	06/15/20
4	LDW20-SC210B	20F0288-11	Sediment	06/15/20
5				
6				
7				
8				
9				
10				

Notes:

LDC #: 48765221

VALIDATION FINDINGS CHECKLIST

Page: 1 of 2
Reviewer: 9
2nd Reviewer: N

Method: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 1613B)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
Cooler temperature criteria was met.	✓			
II. GC/MS Instrument performance check				
Was PFK exact mass 380.9760 verified?	✓			
Were the retention time windows established for all homologues?	✓			
Was the chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomers ≤ 25% ?	✓			
Is the static resolving power at least 10,000 (10% valley definition)?	✓			
Was the mass resolution adequately check with PFK?	✓			
Was the presence of 1,2,8,9-TCDD and 1,3,4,6,8-PeCDF verified?	✓			
IIIa. Initial calibration				
Was the initial calibration performed at 5 concentration levels?	✓			
Were all percent relative standard deviations (%RSD) ≤ 20% for unlabeled compounds and ≤ 35% for unlabeled compounds?	✓			
Did all calibration standards meet the Ion Abundance Ratio criteria?	✓			
Was the signal to noise ratio for each target compound and labeled compound ≥ 10?	✓			
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all concentrations for the unlabeled compounds and for labeled compounds within QC limits?	✓			
IV. Continuing calibration				
Was a continuing calibration performed at the beginning of each 12 hour period?	✓			
Were all concentrations for the unlabeled compounds and for labeled compounds within QC limits (Method 1613B, Table 6)?	✓			
Did all continuing calibration standards meet the Ion Abundance Ratio criteria?	✓			
V. Blanks				
Was a method blank associated with every sample in this SDG?	✓			
Was a method blank performed for each matrix and whenever a sample extraction was performed?	✓			
Was there contamination in the method blanks?	✓			
VI. Field blanks				
Were field blanks identified in this SDG?		✓		
Were target compounds detected in the field blanks?			✓	
VII. Matrix spike/Matrix spike duplicates				
Were matrix spike (MS) and matrix spike duplicate (MSD) analyzed in this SDG?		✓		
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			✓	

Validation Area	Yes	No	NA	Findings/Comments
VIII. Laboratory control samples				
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
IX. Field duplicates				
Were field duplicate pairs identified in this SDG?	✓	✓		
Were target compounds detected in the field duplicates?	✓			
X. Labeled Compounds				
Were labeled compounds within QC limits (Method 1613B, Table 7)?	✓			
Was the minimum S/N ratio of all labeled compound peaks ≥ 10?	✓			
XI. Compound quantitation				
Did the laboratory LOQs/RLs meet the QAPP LOQs/RLs?	✓			
Were the correct labeled compound, quantitation ion and relative response factor (RRF) used to quantitate the compound?	✓			
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XII. Target compound identification				
For 2,3,7,8 substituted congeners with associated labeled standards, were the retention times of the two quantitation peaks within -1 to 3 sec. of the RT of the labeled standard?	✓			
For 2,3,7,8 substituted congeners without associated labeled standards, were the relative retention times of the two quantitation peaks within 0.005 time units of the RRT measured in the routine calibration?	✓			
For non-2,3,7,8 substituted congeners, were the retention times of the two quantitation peaks within RT established in the performance check solution?	✓			
Did compound spectra contain all characteristic ions listed in the table attached?	✓	✓		
Was the Ion Abundance Ratio for the two quantitation ions within criteria?	✓			
Was the signal to noise ratio for each target compound ≥2.5 and ≥10 for the labeled compound?	✓			
Does the maximum intensity of each specified characteristic ion coincide within ± 2 seconds (includes labeled standards)?	✓			
For PCDF identification, was any signal (S/N ≥ 2.5, at ± seconds RT) detected in the corresponding PCDPE channel?	✓			
Was an acceptable lock mass recorded and monitored?	✓			
XIII. System performance				
System performance was found to be acceptable.	✓			
XIV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

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 #: 48765E21

VALIDATION FINDINGS WOR/UHEET
Blanks

Reviewer: PG
2nd Reviewer:

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

Blank extraction date: 6/29/20 **Blank analysis date:** 7/2/20
Conc. units: ng/kg **Associated samples:** All qual U

Compound	Blank ID	Sample Identification											
	BIF0780-BLK1	5X											
O	0.0726	0.363											
F	0.220	1.1											
Q	0.477	2.385											
G	1.66	8.3											

LDC#: 48765E21

VALIDATION FINDINGS WORKSHEET
Field Duplicates

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

METHOD: HRGC/HRMS Polychlorinated Dioxins/Dibenzofurans (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
	1	3	
H	0.942	0.844	11
A	0.997U	0.619	NC
I	0.619	0.585	6
J	1.17	1.15	2
B	1.35	1.14	17
K	3.44	3.62	5
L	1.34	1.28	5
M	1.76	1.82	3
N	0.760	0.699	8
C	2.00	1.62	21
D	6.09	5.64	8
E	5.18	3.65	35
O	32.9	32.4	2
P	2.34	2.61	11
F	224	234	4
Q	128	116	10
G	2010	1930	4
V	11.9	3.04	119
R	1.43	1.04	32
W	10.5	9.93	6
S	3.46	0.676	135
X	45.3	44.5	2
T	62.0	63.1	2
Y	124	125	1
U	697	850	20

LDC #: 48765C21

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported RLs

Page: 1 of 1
Reviewer: 9
2nd Reviewer: 1

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 >RL		Jdets/A
			↓ <RL		N/A
		#3	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 #: 48765E21

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: PG
2nd Reviewer:

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

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

$RRF = (A_x)(C_{is})/(A_{is})(C_x)$
average RRF = sum of the RRFs/number of standards
%RSD = 100 * (S/X)

A_x = Area of compound,
C_x = Concentration of compound,
S = Standard deviation of the RRFs,

A_{is} = Area of associated internal standard
C_{is} = Concentration of internal standard
X = Mean of the RRFs

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Reported Average RRF (initial)	Recalculated Average RRF (initial)	Reported RRF (10 std)	Recalculated RRF (10 std)	Reported %RSD	Recalculated %RSD
1	ICAL	7/1/20	2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)	0.822	0.8223	0.8117684	0.8117	6.7	6.7
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)	1.231	1.2310	1.212577	1.2125	11.4	11.4
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)	0.958	0.9576	1.02541	1.0254	10.8	10.8
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)	1.125	1.1246	1.193104	1.1930	12.3	12.3
			OCDF (^{13}C-OCDF)	1.392	1.3922	1.362751	1.3628	8.0	8.0
2			2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)						
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)						
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)						
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)						
			OCDF (^{13}C-OCDF)						
3			2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)						
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)						
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)						
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)						
			OCDF (^{13}C-OCDF)						

Comments: Refer to Initial Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 48765E21

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Reviewer: PG
2nd Reviewer:

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

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF
RRF = $(A_x)(C_{is})/(A_{is})(C_x)$

Where: ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
A_x = Area of compound, A_{is} = Area of associated internal standard
C_x = Concentration of compound, C_{is} = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Average RRF (initial)	Reported Conc (CC)	Recalculated Conc (CC)	Reported %D	Recalculated %D
1	20070202	7/2/20	2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)	0.822	0.7756249	0.7756	5.7	5.7
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)	1.231	1.2109160	1.2109	1.6	1.7
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)	0.958	0.9764576	0.9764	2.0	2.0
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)	1.125	1.1701800	1.1701	4.1	4.0
			OCDF (^{13}C-OCDF)	1.392	1.3030900	1.3030	6.4	6.4
2	20070215	7/2/20	2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)	0.822	0.8055136	0.8055	2.0	2.0
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)	1.231	1.2570670	1.2570	2.1	2.2
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)	0.958	0.9913691	0.9913	3.5	3.5
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)	1.125	1.1863840	1.1864	5.5	5.5
			OCDF (^{13}C-OCDF)	1.392	1.2640570	1.2644	9.2	9.2
3			2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)					
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)					
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)					
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)					
			OCDF (^{13}C-OCDF)					

Comments: Refer to Routine Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 48765E21

VALIDATION FINDINGS WORKSHEET
Laboratory Control Sample Results Verification

Reviewer: PG
2nd Reviewer:

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

The percent recoveries (%R) and Relative Percent Difference (RPD) of the laboratoy control sample and laboratory control sample duplicate (if applicable) were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * SSC/SA Where: SSC = Spiked sample concentration
SA = Spike added

RPD = I LCS - LCSD I * 2/(LCS + LCSD) LCS = Laboraotry control sample percent recovery LCSD = Laboratory control sample duplicate percent recovery

LCS ID: BIF0780-BS1

Compound	Spike Added (ng/kg)		Spiked Sample Concentration (ng/kg)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc	Reported	Recalc	Reported	Recalculated
2,3,7,8-TCDD	20.0	NA	19.97	NA	99.9	99.9				
1,2,3,7,8-PeCDD	100		101.79		102	102				
1,2,3,4,7,8-HxCDD	100		99.30		99.3	99.3				
1,2,3,4,7,8,9-HpCDF	100		105.44		105	105				
OCDF	200		182.39		91.2	91.2				

Comments: Refer to Laboratory Control Sample findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 48765221

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

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

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

Y N N/A Were all reported results recalculated and verified for all level IV samples?
Y N N/A Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

Concentration = $\frac{(A_x)(I_s)(DF)}{(A_{is})(RRF)(V_o)(\%S)}$

A_x	=	Area of the characteristic ion (EICP) for the compound to be measured
A_{is}	=	Area of the characteristic ion (EICP) for the specific internal standard
I_s	=	Amount of internal standard added in nanograms (ng)
V_o	=	Volume or weight of sample extract in milliliters (ml) or grams (g).
RRF	=	Relative Response Factor (average) from the initial calibration
Df	=	Dilution Factor.
%S	=	Percent solids, applicable to soil and solid matrices only.

Example:

Sample I.D. 1, F:

Conc. = $\frac{(6709)(2000)(1)}{(5319)(1.125)(25.11)(0.3994)}$

= 223.6 ng/kg

#	Sample ID	Compound	Reported Concentration (ng/kg)	Calculated Concentration ( )	Qualification
	1	F	224		

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0293

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS215	20F0293-01	Sediment	06/15/20
LDW20-SS214	20F0293-02	Sediment	06/15/20
LDW20-SS212	20F0293-03	Sediment	06/15/20
LDW20-SS202	20F0293-04	Sediment	06/15/20
LDW20-SS203	20F0293-05	Sediment	06/15/20
LDW20-SS341	20F0293-06	Sediment	06/15/20
LDW20-SS347	20F0293-07	Sediment	06/15/20
LDW20-SS350	20F0293-08	Sediment	06/15/20
LDW20-SS352	20F0293-09	Sediment	06/15/20
LDW20-SS217	20F0293-10	Sediment	06/15/20
LDW20-SS219	20F0293-11	Sediment	06/15/20
LDW20-SS220	20F0293-12	Sediment	06/15/20
LDW20-SS215MS	20F0293-01MS	Sediment	06/15/20
LDW20-SS215MSD	20F0293-01MSD	Sediment	06/15/20

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 all samples in this SDG were reported between 7.3°C and 9.6°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.

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 20F0293

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0293

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0293

No Sample Data Qualified in this SDG

LDC #: 48765F2a

SDG #: 20F0293

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 8/14/20

Page: 1 of 1

Reviewer: 9

2nd Reviewer: M

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	A	Temp @ 7.3-9.6°C - same day
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	RSD≤20%. r² 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 / SRM	A/A	LCS
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-SS215	20F0293-01	Sediment	06/15/20
2	LDW20-SS214	20F0293-02	Sediment	06/15/20
3	LDW20-SS212	20F0293-03	Sediment	06/15/20
4	LDW20-SS202	20F0293-04	Sediment	06/15/20
5	LDW20-SS203	20F0293-05	Sediment	06/15/20
6	LDW20-SS341	20F0293-06	Sediment	06/15/20
7	LDW20-SS347	20F0293-07	Sediment	06/15/20
8	LDW20-SS350	20F0293-08	Sediment	06/15/20
9	LDW20-SS352	20F0293-09	Sediment	06/15/20
10	LDW20-SS217	20F0293-10	Sediment	06/15/20
11	LDW20-SS219	20F0293-11	Sediment	06/15/20
12	LDW20-SS220	20F0293-12	Sediment	06/15/20
13	LDW20-SS215MS	20F0293-01MS	Sediment	06/15/20
14	LDW20-SS215MSD	20F0293-01MSD	Sediment	06/15/20

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0293

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS215	20F0293-01	Sediment	06/15/20
LDW20-SS214	20F0293-02	Sediment	06/15/20
LDW20-SS212	20F0293-03	Sediment	06/15/20
LDW20-SS202	20F0293-04	Sediment	06/15/20
LDW20-SS203	20F0293-05	Sediment	06/15/20
LDW20-SS341	20F0293-06	Sediment	06/15/20
LDW20-SS347	20F0293-07	Sediment	06/15/20
LDW20-SS350	20F0293-08	Sediment	06/15/20
LDW20-SS352	20F0293-09	Sediment	06/15/20
LDW20-SS217	20F0293-10	Sediment	06/15/20
LDW20-SS219	20F0293-11	Sediment	06/15/20
LDW20-SS220	20F0293-12	Sediment	06/15/20
LDW20-SS215MS	20F0293-01MS	Sediment	06/15/20
LDW20-SS215MSD	20F0293-01MSD	Sediment	06/15/20

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 temperature for samples in this SDG were reported between 7.3°C and 9.6°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 20F0293	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.

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
BIF0847-BLK2	06/29/20	Benzoic acid	17.3 ug/Kg	All samples in SDG 20F0293

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-SS215	Benzoic acid	50.6 ug/Kg	50.6U ug/Kg
LDW20-SS212	Benzoic acid	70.0 ug/Kg	70.0U ug/Kg
LDW20-SS202	Benzoic acid	28.5 ug/Kg	28.5U ug/Kg
LDW20-SS341	Benzoic acid	48.6 ug/Kg	48.6U ug/Kg
LDW20-SS217	Benzoic acid	21.4 ug/Kg	21.4U ug/Kg
LDW20-SS219	Benzoic acid	32.9 ug/Kg	32.9U ug/Kg
LDW20-SS220	Benzoic acid	24.4 ug/Kg	24.4U 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.

Due to ICV %D, data were qualified as estimated in twelve samples.

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

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

Duwamish AOC4
Semivolatiles – Data Qualification Summary - SDG 20F0293

Sample	Compound	Flag	A or P	Reason
LDW20-SS215 LDW20-SS214 LDW20-SS212 LDW20-SS202 LDW20-SS203 LDW20-SS341 LDW20-SS347 LDW20-SS350 LDW20-SS352 LDW20-SS217 LDW20-SS219 LDW20-SS220	N-Nitrosodiphenylamine	J (all detects) UJ (all non-detects)	A	Initial calibration verification (%D)

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0293

Sample	Compound	Modified Final Concentration	A or P
LDW20-SS215	Benzoic acid	50.6U ug/Kg	A
LDW20-SS212	Benzoic acid	70.0U ug/Kg	A
LDW20-SS202	Benzoic acid	28.5U ug/Kg	A
LDW20-SS341	Benzoic acid	48.6U ug/Kg	A
LDW20-SS217	Benzoic acid	21.4U ug/Kg	A
LDW20-SS219	Benzoic acid	32.9U ug/Kg	A
LDW20-SS220	Benzoic acid	24.4U ug/Kg	A

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0293

No Sample Data Qualified in this SDG

LDC #: 48765F2b

SDG #: 20F0293

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 8/4/20

Page: 1 of 1

Reviewer: 1

2nd Reviewer: M

METHOD: GC/MS Polynuclear Aromatic Hydrocarbons (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	A	Temp @ 7.3, 8.9, 7.6°C - same day
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A SW	RSD ≤ 20%. r^2 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 / SRM	A/A	LCS
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-SS215	20F0293-01	Sediment	06/15/20
2	LDW20-SS214	20F0293-02	Sediment	06/15/20
3	LDW20-SS212	20F0293-03	Sediment	06/15/20
4	LDW20-SS202	20F0293-04	Sediment	06/15/20
5	LDW20-SS203	20F0293-05	Sediment	06/15/20
6	LDW20-SS341	20F0293-06	Sediment	06/15/20
7	LDW20-SS347	20F0293-07	Sediment	06/15/20
8	LDW20-SS350	20F0293-08	Sediment	06/15/20
9	LDW20-SS352	20F0293-09	Sediment	06/15/20
10	LDW20-SS217	20F0293-10	Sediment	06/15/20
11	LDW20-SS219	20F0293-11	Sediment	06/15/20
12	LDW20-SS220	20F0293-12	Sediment	06/15/20
13	LDW20-SS215MS	20F0293-01MS	Sediment	06/15/20
14	LDW20-SS215MSD	20F0293-01MSD	Sediment	06/15/20

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

A. Phenol	CC. Dimethylphthalate	EEE. Bis(2-ethylhexyl)phthalate	GGGG. C30-Hopane	I1. Methyl methanesulfonate
B. Bis (2-chloroethyl) ether	DD. Acenaphthylene	FFF. Di-n-octylphthalate	HHHH. 1-Methylphenanthrene	J1. Ethyl methanesulfonate
C. 2-Chlorophenol	EE. 2,6-Dinitrotoluene	GGG. Benzo(b)fluoranthene	IIII. 1,4-Dioxane	K1. o,o',o''-Triethylphosphorothioate
D. 1,3-Dichlorobenzene	FF. 3-Nitroaniline	HHH. Benzo(k)fluoranthene	JJJJ. Acetophenone	L1. n-Phenylene diamine
E. 1,4-Dichlorobenzene	GG. Acenaphthene	III. Benzo(a)pyrene	KKKK. Atrazine	M1. 1,4-Naphthoquinone
F. 1,2-Dichlorobenzene	HH. 2,4-Dinitrophenol	JJJ. Indeno(1,2,3-cd)pyrene	LLLL. Benzaldehyde	N1. N-Nitro-o-toluidine
G. 2-Methylphenol	II. 4-Nitrophenol	KKK. Dibenz(a,h)anthracene	MMMM. Caprolactam	O1. 1,3,5-Trinitrobenzene
H. 2,2'-Oxybis(1-chloropropane)	JJ. Dibenzofuran	LLL. Benzo(g,h,i)perylene	NNNN. 2,6-Dichlorophenol	P1. Pentachlorobenzene
I. 4-Methylphenol	KK. 2,4-Dinitrotoluene	MMM. Bis(2-Chloroisopropyl)ether	OOOO. 1,2-Diphenylhydrazine	Q1. 4-Aminobiphenyl
J. N-Nitroso-di-n-propylamine	LL. Diethylphthalate	NNN. Aniline	PPPP. 3-Methylphenol	R1. 2-Naphthylamine
K. Hexachloroethane	MM. 4-Chlorophenyl-phenyl ether	OOO. N-Nitrosodimethylamine	QQQQ. 3&4-Methylphenol	S1. Triphenylene
L. Nitrobenzene	NN. Fluorene	PPP. Benzoic Acid	RRRR. 4-Dimethyldibenzothiophene (4MDT)	T1. Octachlorostyrene
M. Isophorone	OO. 4-Nitroaniline	QQQ. Benzyl alcohol	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	U1. Famphur
N. 2-Nitrophenol	PP. 4,6-Dinitro-2-methylphenol	RRR. Pyridine	TTTT. 1-Methyldibenzothiophene (1MDT)	V1. 1,4-phenylenediamine
O. 2,4-Dimethylphenol	QQ. N-Nitrosodiphenylamine	SSS. Benzidine	UUUU.. 2,3,4,6-Tetrachlorophenol	W1. Methapyrilene
P. Bis(2-chloroethoxy)methane	RR. 4-Bromophenyl-phenylether	TTT. 1-Methylnaphthalene	VVVV. 1,2,4,5-Tetrachlorobenzene	X1. Pentachloroethane
Q. 2,4-Dichlorophenol	SS. Hexachlorobenzene	UUU.Benzo(b)thiophene	WWWW.. 2-Picoline	Y1. 3,3'-Dimethylbenzidine
R. 1,2,4-Trichlorobenzene	TT. Pentachlorophenol	VVV.Benzonaphthothiophene	XXXX. 3-Methylcholanthrene	Z1. o-Toluidine
S. Naphthalene	UU. Phenanthrene	WWW.Benzo(e)pyrene	YYYY. a,a-Dimethylphenethylamine	A2. 1-Naphthylamine
T. 4-Chloroaniline	VV. Anthracene	XXX. 2,6-Dimethylnaphthalene	ZZZZ. Hexachloropropene	B2. 4-Aminobiphenyl
U. Hexachlorobutadiene	WW. Carbazole	YYY. 2,3,5-Trimethylnaphthalene	A1. N-Nitrosodiethylamine	C2. 4-Nitroquinoline-1-oxide
V. 4-Chloro-3-methylphenol	XX. Di-n-butylphthalate	ZZZ. Perylene	B1. N-Nitrosodi-n-butylamine	D2. Hexachloropene
W. 2-Methylnaphthalene	YY. Fluoranthene	AAAA. Dibenzothiophene	C1. N-Nitrosomethylethylamine	E2. Bis (2-chloro-1-methylethyl) ether
X. Hexachlorocyclopentadiene	ZZ. Pyrene	BBBB. Benzo(a)fluoranthene	D1. N-Nitrosomorpholine	F2. Bifenthrin
Y. 2,4,6-Trichlorophenol	AAA. Butylbenzylphthalate	CCCC. Benzo(b)fluorene	E1. N-Nitrosopyrrolidine	G2. Cyfluthrin
Z. 2,4,5-Trichlorophenol	BBB. 3,3'-Dichlorobenzidine	DDDD. cis/trans-Decalin	F1. Phenacetin	H2. Cypermethrin
AA. 2-Chloronaphthalene	CCC. Benzo(a)anthracene	EEEE. 1,1'-Biphenyl	G1. 2-Acetylaminofluorene	I2. Permethrin (cis/trans)
BB. 2-Nitroaniline	DDD. Chrysene	FFFF. Retene	H1. Pronamide	J2. 5-Nitro-o-toluidine

LDC #: 48765F2b

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

Reviewer: [illegible]
2nd Reviewer: [illegible]

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 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 %D ?

#	Date	Standard ID	Compound	Finding %D (Limit: ≤20.0%)	Associated Samples	Qualifications
	6/26/20	5F0393-SCV1	QQ	41.9	All (Dets+ND)	J/UJ/A

LDC #: 48765F3b

VALIDATION FINDINGS WORKSHEET
Blanks

Page: 1 of 1
Reviewer: 2
2nd Reviewer: SK

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

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: 6/30/20 **Blank analysis date:** 7/7/20
Conc. units: µg/Kg Associated Samples: All

Compound	Blank ID	Sample Identification								
BFB	84C-BLK2		1	3	4	6	10	11	12	
Bis(2-ethylhexyl)phthalate										
DDD	17.3		50.6 U	70.0 U	28.5 U	48.5 U	21.4 U	32.9 U	21.4 U	

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:
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".

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Hexachlorobenzene

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0293

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS215	20F0293-01	Sediment	06/15/20
LDW20-SS214	20F0293-02	Sediment	06/15/20
LDW20-SS212	20F0293-03	Sediment	06/15/20
LDW20-SS202	20F0293-04	Sediment	06/15/20
LDW20-SS203	20F0293-05	Sediment	06/15/20
LDW20-SS341	20F0293-06	Sediment	06/15/20
LDW20-SS347	20F0293-07	Sediment	06/15/20
LDW20-SS350	20F0293-08	Sediment	06/15/20
LDW20-SS352	20F0293-09	Sediment	06/15/20
LDW20-SS217	20F0293-10	Sediment	06/15/20
LDW20-SS219	20F0293-11	Sediment	06/15/20
LDW20-SS220	20F0293-12	Sediment	06/15/20
LDW20-SS214MS	20F0293-02MS	Sediment	06/15/20
LDW20-SS214MSD	20F0293-02MSD	Sediment	06/15/20

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 temperature for samples in this SDG were reported between 7.3°C and 9.6°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 with the following exceptions:

Sample	Column	Surrogate	%R (Limits)	Affected Compound	Flag	A or P
LDW20-SS217	1C	Decachlorobiphenyl	164 (30-160)	Hexachlorobenzene	NA	-

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 20F0293

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Laboratory Blank Data Qualification Summary - SDG 20F0293

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Field Blank Data Qualification Summary - SDG 20F0293

No Sample Data Qualified in this SDG

LDC #: 48765F3a
SDG #: 20F0293
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 8/14/20
Page: 1 of 1
Reviewer: T
2nd Reviewer: T

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	A	Temp @ 7.3-9.6°C - same day
II.	GC Instrument Performance Check	A	
III.	Initial calibration/ICV	A/A	RSD ≤ 20%. ICV ≤ 20%
IV.	Continuing calibration	A	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes / IS	N/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-SS215	20F0293-01	Sediment	06/15/20
2	LDW20-SS214	20F0293-02	Sediment	06/15/20
3	LDW20-SS212	20F0293-03	Sediment	06/15/20
4	LDW20-SS202	20F0293-04	Sediment	06/15/20
5	LDW20-SS203	20F0293-05	Sediment	06/15/20
6	LDW20-SS341	20F0293-06	Sediment	06/15/20
7	LDW20-SS347	20F0293-07	Sediment	06/15/20
8	LDW20-SS350	20F0293-08	Sediment	06/15/20
9	LDW20-SS352	20F0293-09	Sediment	06/15/20
10	LDW20-SS217	20F0293-10	Sediment	06/15/20
11	LDW20-SS219	20F0293-11	Sediment	06/15/20
12	LDW20-SS220	20F0293-12	Sediment	06/15/20
13	LDW20-SS214MS	20F0293-02MS	Sediment	06/15/20
14	LDW20-SS214MSD	20F0293-02MSD	Sediment	06/15/20
15				

LDC #: 48765F2A

VALIDATION FINDINGS WORKSHEET
Surrogate Recovery

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

METHOD: / GC __ HPLC

Are surrogates required by the method? Yes___ or No____.

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

Y N N/A Were surrogates spiked into all samples and blanks?

Y N N/A Did all surrogate recoveries (%R) meet the QC limits?

#	Sample ID	Detector/ Column	Surrogate Compound	%R (Limits)	Qualifications
	10 (NB)	1C	O	164 (30-160)	J+ (3,5)
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
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				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	

	Surrogate Compound		Surrogate Compound		Surrogate Compound		Surrogate Compound		Surrogate Compound
A	Chlorobenzene (CBZ)	G	Octacosane	M	Benzo(e)Pyrene	S	1-Chloro-3-Nitrobenzene	Y	Tetrachloro-m- xylene
B	4-Bromofluorobenzene (BFB)	H	Ortho-Terphenyl	N	Terphenyl-D14	T	3,4-Dinitrotoluene	Z	1,2-Dinitrobenzene
C	a,a,a-Trifluorotoluene	I	Fluorobenzene (FBZ)	O	Decachlorobiphenyl (DCB)	U	Tripentyltin		
D	Bromochlorobenene	J	n-Triacontane	P	1-methylnaphthalene	V	Tri-n-propyltin		
E	1,4-Dichlorobutane	K	Hexacosane	Q	Dichlorophenyl Acetic Acid (DCAA)	W	Tributyl Phosphate		
F	1,4-Difluorobenzene (DFB)	L	Bromobenzene	R	4-Nitrophenol	X	Triphenyl Phosphate		

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0293

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS215	20F0293-01	Sediment	06/15/20
LDW20-SS214	20F0293-02	Sediment	06/15/20
LDW20-SS212	20F0293-03	Sediment	06/15/20
LDW20-SS202	20F0293-04	Sediment	06/15/20
LDW20-SS203	20F0293-05	Sediment	06/15/20
LDW20-SS341	20F0293-06	Sediment	06/15/20
LDW20-SS347	20F0293-07	Sediment	06/15/20
LDW20-SS350	20F0293-08	Sediment	06/15/20
LDW20-SS352	20F0293-09	Sediment	06/15/20
LDW20-SS217	20F0293-10	Sediment	06/15/20
LDW20-SS219	20F0293-11	Sediment	06/15/20
LDW20-SS220	20F0293-12	Sediment	06/15/20
LDW20-SS214MS	20F0293-02MS	Sediment	06/15/20
LDW20-SS214MSD	20F0293-02MSD	Sediment	06/15/20

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 7.3°C and 9.6°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 20F0293	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 with the following exceptions:

Date	Standard	Column	Compound	%D	Associated Samples	Flag	A or P
07/04/20	20070427ECD7	2C	Aroclor-1254	21.8	LDW20-SS352 LDW20-SS217 LDW20-SS219 LDW20-SS220	J (all detects)	A

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

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

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-SS215	Aroclor-1260	45.8	J (all detects)	A
LDW20-SS214	Aroclor-1248 Aroclor-1254 Aroclor-1260	41.9 47 43.4	J (all detects) J (all detects) J (all detects)	A
LDW20-SS341	Aroclor-1248 Aroclor-1254 Aroclor-1260	43.9 43.6 47.6	J (all detects) J (all detects) J (all detects)	A
LDW20-SS347	Aroclor-1248 Aroclor-1254 Aroclor-1260	42.5 49.6 53.2	J (all detects) J (all detects) J (all detects)	A
LDW20-SS350	Aroclor-1248 Aroclor-1254 Aroclor-1260	42.7 49.9 58.8	J (all detects) J (all detects) J (all detects)	A

Sample	Compound	RPD	Flag	A or P
LDW20-SS352	Aroclor-1248 Aroclor-1254 Aroclor-1260	46.3 49.4 44.2	J (all detects) J (all detects) J (all detects)	A
LDW20-SS219	Aroclor-1254	41.8	J (all detects)	A
LDW20-SS220	Aroclor-1254	41.3	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, continuing calibration %D, and RPD between two columns, 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
Polychlorinated Biphenyls - Data Qualification Summary - SDG 20F0293

Sample	Compound	Flag	A or P	Reason
LDW20-SS215 LDW20-SS214 LDW20-SS212 LDW20-SS202 LDW20-SS203 LDW20-SS341 LDW20-SS347 LDW20-SS350 LDW20-SS352 LDW20-SS217 LDW20-SS219 LDW20-SS220	Aroclor-1260	J (all detects)	A	Initial calibration verification (%D)
LDW20-SS352 LDW20-SS217 LDW20-SS219 LDW20-SS220	Aroclor-1254	J (all detects)	A	Continuing calibration (%D)
LDW20-SS215	Aroclor-1260	J (all detects)	A	Compound quantitation (RPD between two columns)
LDW20-SS214 LDW20-SS341 LDW20-SS347 LDW20-SS350 LDW20-SS352	Aroclor-1248 Aroclor-1254 Aroclor-1260	J (all detects) J (all detects) J (all detects)	A	Compound quantitation (RPD between two columns)
LDW20-SS219 LDW20-SS220	Aroclor-1254	J (all detects)	A	Compound quantitation (RPD between two columns)

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 20F0293

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 20F0293

No Sample Data Qualified in this SDG

LDC #: 48765F3b
SDG #: 20F0293
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 8/14/20
Page: 1 of 1
Reviewer: [illegible]
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	A	Temp @ 7.3-9.6°C - same day
II.	Initial calibration/ICV	A / TW	RSD ≤ 20%. ICV ≤ 20%
III.	Continuing calibration	TW	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 / SRM	A / A	LCS/D
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-SS215	20F0293-01	Sediment	06/15/20
2	LDW20-SS214	20F0293-02	Sediment	06/15/20
3	LDW20-SS212	20F0293-03	Sediment	06/15/20
4	LDW20-SS202	20F0293-04	Sediment	06/15/20
5	LDW20-SS203	20F0293-05	Sediment	06/15/20
6	LDW20-SS341	20F0293-06	Sediment	06/15/20
7	LDW20-SS347	20F0293-07	Sediment	06/15/20
8	LDW20-SS350	20F0293-08	Sediment	06/15/20
9	LDW20-SS352	20F0293-09	Sediment	06/15/20
10	LDW20-SS217	20F0293-10	Sediment	06/15/20
11	LDW20-SS219	20F0293-11	Sediment	06/15/20
12	LDW20-SS220	20F0293-12	Sediment	06/15/20
13	LDW20-SS214MS	20F0293-02MS	Sediment	06/15/20
14	LDW20-SS214MSD	20F0293-02MSD	Sediment	06/15/20
15				
16				
17				

VALIDATION FINDINGS WORKSHEET

METHOD: Pesticides

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

Notes:_____

LDC #: 48765F36

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

Reviewer: 9
2nd Reviewer: M

METHOD: / **GC** __ **HPLC**

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
	7/5/20	SIF0056-SCN	IC	21.8		All (dot3)	V(N)/A

ICV-gc.wpd

LDC #: 48765F36

VALIDATION FINDINGS WORKSHEET

Continuing Calibration

Page: 1 of 1

Reviewer:

2nd Reviewer:

METHOD: ✓ **GC** __ **HPLC**

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

[✓ Y] N N/A Were continuing calibration standards analyzed at the required frequencies?

Y [✓ N] N/A Did the continuing calibration standards meet the %D validation criteria of <20.0%?

Level IV Only

Y N [✓ N/A] Were the retention times for all calibrated compounds within their respective acceptance windows?

#	Date	Standard ID	Detector/ Column	Compound	%D (Limit)	RT (limit)	Associated Samples	Qualifications
	7/4/20	2007042ECD7	2C	AA	21.8	( )	9-12 (det)	J/UJ/A
						( )		
						( )		
						( )		
						( )		
						( )		
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LDC #: 48165F2b

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Reviewer: 9
2nd Reviewer: 9

METHOD: / GC __ HPLC

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 relative percent differences of detected compounds between two columns/detectors ≤40%?
If no, please see findings bellow.

#	Compound Name	Sample ID	%RPD Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	BB	1	45.8	J+ (all detects)/A
	2	2	41.9	
	AA		47	
	BB		43.4	
	2	6	43.9	
	AA		43.6	
	BB		47.6	
	2	7	42.5	
	AA		49.6	
	BB		53.2	
	2	8	42.7	
	AA		49.9	
	BB		58.8	

LDC #: 48665B

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Reviewer: 9
2nd Reviewer: AK

METHOD: ✓ GC __ HPLC

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 relative percent differences of detected compounds between two columns/detectors ≤40%?
If no, please see findings bellow.

#	Compound Name	Sample ID	%RPD Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	Z	9	46.3	bdb/A
	~~AA~~		~~49.4~~	
	BB		44.2	
	~~AA~~	11	41.8	
	~~AA~~	12	41.3	

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Metals

Validation Level: Stage 2B & 4

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0293

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS215	20F0293-01	Sediment	06/15/20
LDW20-SS214	20F0293-02	Sediment	06/15/20
LDW20-SS212	20F0293-03	Sediment	06/15/20
LDW20-SS202	20F0293-04	Sediment	06/15/20
LDW20-SS203	20F0293-05	Sediment	06/15/20
LDW20-SS341	20F0293-06	Sediment	06/15/20
LDW20-SS347	20F0293-07	Sediment	06/15/20
LDW20-SS350	20F0293-08	Sediment	06/15/20
LDW20-SS352	20F0293-09	Sediment	06/15/20
LDW20-SS217	20F0293-10	Sediment	06/15/20
LDW20-SS219	20F0293-11	Sediment	06/15/20
LDW20-SS220	20F0293-12	Sediment	06/15/20

All metals by method 6020A underwent Stage 4 validation

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. Samples appended with a double asterisk on the cover page were subjected to Stage 4 data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

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)	Chromium	0.17 mg/Kg	All samples in SDG 20F0212
ICB/CCB	Silver	0.047 ug/L	LDW20-SS215 LDW20-SS214 LDW20-SS212 LDW20-SS202

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-SS215	Silver	0.13 mg/Kg	0.13U mg/Kg
LDW20-SS214	Silver	0.2 mg/Kg	0.2U mg/Kg

Sample	Analyte	Reported Concentration	Modified Final Concentration
LDW20-SS212	Silver	0.08 mg/Kg	0.08U mg/Kg
LDW20-SS202	Silver	0.05 mg/Kg	0.05U 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 with the following exceptions:

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW20-SC346MS/MSD (All samples in SDG 20F0235)	Zinc	55.7 (75-125)	51.1 (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 with the following exceptions:

DUP ID (Associated Samples)	Analyte	RPD (Limits)	Flag	A or P
LDW20-SC346DUP (All samples in SDG 20F0235)	Arsenic	32.7 (≤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)

ICP-MS was not utilized in this SDG.

XIII. Sample Result Verification

All sample result verifications were acceptable for samples which underwent Stage 4 validation. 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 twelve samples.

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 20F0293

Sample	Analyte	Flag	A or P	Reason
LDW20-SS215 LDW20-SS214 LDW20-SS212 LDW20-SS202 LDW20-SS203 LDW20-SS341 LDW20-SS347 LDW20-SS350 LDW20-SS352 LDW20-SS217 LDW20-SS219 LDW20-SS220	Zinc	J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)
LDW20-SS215 LDW20-SS214 LDW20-SS212 LDW20-SS202 LDW20-SS203 LDW20-SS341 LDW20-SS347 LDW20-SS350 LDW20-SS352 LDW20-SS217 LDW20-SS219 LDW20-SS220	Arsenic	J (all detects)	A	Duplicate sample analysis (RPD)

Duwamish AOC4
Metals - Laboratory Blank Data Qualification Summary - SDG 20F0293

Sample	Analyte	Modified Final Concentration	A or P
LDW20-SS215	Silver	0.13U mg/Kg	A
LDW20-SS214	Silver	0.2U mg/Kg	A
LDW20-SS212	Silver	0.08U mg/Kg	A
LDW20-SS202	Silver	0.05U mg/Kg	A

Duwamish AOC4
Metals - Field Blank Data Qualification Summary - SDG 20F0293

No Sample Data Qualified in this SDG

LDC #: 48765F4a
SDG #: 20F0293
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B/4

Date: 8/15/20
Page: 1 of 1
Reviewer: AV
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	SW	
IX.	Serial Dilution	N	
X.	Laboratory control samples	A	LCS
XI.	Field Duplicates	N	
XII.	Internal Standard (ICP-MS)	A	
XIII.	Sample Result Verification	A	Not reviewed for 7471B validation.
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:

Method 6020A undwewent Stage 4 review

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS215	20F0293-01	Sediment	06/15/20
2	LDW20-SS214	20F0293-02	Sediment	06/15/20
3	LDW20-SS212	20F0293-03	Sediment	06/15/20
4	LDW20-SS202	20F0293-04	Sediment	06/15/20
5	LDW20-SS203	20F0293-05	Sediment	06/15/20
6	LDW20-SS341	20F0293-06	Sediment	06/15/20
7	LDW20-SS347	20F0293-07	Sediment	06/15/20
8	LDW20-SS350	20F0293-08	Sediment	06/15/20
9	LDW20-SS352	20F0293-09	Sediment	06/15/20
10	LDW20-SS217	20F0293-10	Sediment	06/15/20
11	LDW20-SS219	20F0293-11	Sediment	06/15/20
12	LDW20-SS220	20F0293-12	Sediment	06/15/20
13				
14				

Notes:

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)				
Validation Area	**Yes**	**No**	**NA**	**Comments**
I. Technical holding times				
Were all technical holding times met?	X			
Were all water samples preserved to a pH of <2.			X	
II. ICP-MS Tune				
Were mass resolutions within 0.1 amu for all isotopes in the tuning solution?	X			
Were %RSDs of isoptoes in the tuning solution ≤5%?	X			
III. Calibration				
Were all instuments calibrated daily?	X			
Were the proper standards used?	X			
Were all initial and continuing calibration verifications within the 90-110% (80-120% for mercury) QC limits?	X			
Were the low level standard checks within 70-130%?			X	
Were all initial calibration correlation coefficients within limits as specifed by the method?	X			
IV. Blanks				
Was a method blank associated with every sample in this SDG?	X			
Was there contamination in the method blanks?	X			
Was there contamination in the initial and continuing calibration blanks?	X			
V. Interference Check Sample				
Were the interference check samples performed daily?	X			
Were the AB solution recoveries within 80-120%?	X			
VI. Matrix Spike/Matrix Spike Duplicates/Laboratory Duplicates				
Were MS/MSD recoveries with the QC limits? (If the sample concentration exceeded the spike concentration by a factor of 4, no action was taken.)		X		
Were the MS/MSD or laboratory duplicate relative percent differences (RPDs) within the QC limits?		X		
VII. Laboratory Control Samples				
Was a LCS analyzed for each batch in the SDG?	X			
Were the LCS recoveries and RPDs (if applicable) within QC limits?	X			

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)				
Validation Area	**Yes**	**No**	**NA**	**Comments**
VIII. Internal Standards				
Were all percent recoveries within the 30-120% (60-125% for EPA Method 200.8) QC limits?	X			
If the recoveries were outside the limits, was a reanalysis performed?			X	
IX. Serial Dilution				
Were all percent differences <10%?			X	
Was there evidence of negative interference? If yes, professional judgement will be used to qualify the data.			X	
X. Sample Result Verification				
Were all reporting limits adjusted to reflect sample dilutions?	X			
Were all soil samples dry weight corrected?	X			
XI. Overall Assessment of Data				
Was the overall assessment of the data found to be acceptable?	X			
XII. Field Duplicates				
Were field duplicates identifed in this SDG?		X		
Were target analytes detected in the field duplicates?			X	
XIII. Field Blanks				
Were field blanks identified in this SDG?		X		
Were target analytes detected in the field blanks?			x	

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1 to 12	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								
Cr	0.17											

Sample Concentration, unless otherwise noted: mg/Kg Associated Samples: 1-4

				Sample Identification								
Analyte	**PB (mg/Kg)**	**Maximum ICB/CCB (ug/L)**	**Action Level**	1	2	3	4					
Ag		0.047		0.13	0.2	0.08	0.05					

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-SC346MS/MSD	s	Ag	55.7	51.1				All	J/UJ/A	Det
(SDG: 20F0288)										

Comments:

VALIDATION FINDINGS WORKSHEETS
Laboratory Duplicates

Reviewer: CR

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-SC346DUP	s	As	32.7	20			All	J/UJ/A	Det
(SDG: 20F0288)									

Comments:

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

An intial calibration verification (ICV), continuing calibration verification (CCV), low level calibration check (LLCC), and interference check sample (ICSAB) percent recovery (%R) was recalculated for each type of analysis using the following formula:

%R = (Found/True) x 100

Found = concentration of each analyte measured in the analysis

True = concentration of each analyte in the source

Standard ID	Type of Analysis	Element	Found (ug/L)	True (ug/L)	Recalcuated %R	Reported %R	Acceptable (Y/N)
ICV	ICP-MS	Cr	50.5	50	101	101	Y
CCV3	ICP-MS	As	50.8	50	102	102	Y
ICSAB	ICP-MS	Zn	18.634	20	93.2	93.2	Y

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

Percent recoveries (%R) for the laboratory control sample (LCS), matrix spike (MS), and post digestion spike (PDS) were recalculated using the following formula:

%R = (Found/True) x 100

Found = concentration of each analyte measured in the analysis. For the MS calculation, Found = SSR (Spiked Sample Result) - SR (Sample Result)

True = concentration of each analyte in the source

The sample and duplicate relative percent difference (RPD) was recalculated using the following formula:

RPD = (Absolute value(S-D)x 200) / (S+D)

S = Original sample concentration

D = Duplicate sample concentration

The serial dilution percent difference (%D) was recalculated using the following formula.

%D = (Absolute value (I - SDR)) x 100 / (I)

I = Initial sample result

SDR = Serial dilution result (with a 5x dilution applied)

Sample ID	Type of Analysis	Element	Found/S/I	True/D/SDR	Recalcuated %R/RPD/%D	Reported %R/RPD/%D	Acceptable (Y/N)
LCS	LCS	Ag	23.2	25	92.8	92.7	Y
	MS						
	Duplicate						
	PDS						
	Serial dilution						

Sample Calculation Verification Reviewer:CR

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

Analytes were recalculated and verified using the following equation:

Concentration = (Result from raw data x Final volume x Dilution factor) / (Percent solids x Initial weight)

Sample ID	Analyte	Raw Data (ug/L)	Dilution	Initial Weight (g)	Final Volume (mL)	Percent solids (%)	Reported Result (mg/Kg)	Recalcuated Result (mg/Kg)	Acceptable (Y/N)
1	Cr	3.222	50	1.028	50	68.09	11.5	11.5	Y
2	Pb	9.952	20	1.054	50	49.38	19.1	19.1	Y
3	Ag	0.055	20	1.039	50	64.34	0.08	0.08	Y
4	As	4.345	20	1.078	50	82.09	4.91	4.91	Y
5	Cd	0.033	20	1.014	50	79.2	0.04	0.04	Y
6	Cu	20.392	20	1.012	50	38.5	52.3	52.3	Y
7	Zn	38.04	20	1.016	50	31.78	118	118	Y
8	Hg	0.2602	1	0.249	50	32.53	0.161	0.161	Y
9	Hg	0.2736	1	0.233	50	33.37	0.176	0.176	Y
10	As	1.612	50	1.039	50	59.5	6.52	6.52	Y
11	Hg	0.2095	1	0.204	50	53.06	0.0968	0.0968	Y
12	Hg	0.2006	1	0.216	50	57.03	0.0814	0.0814	Y

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)
Analytes were recalculated and verified using the following equation:
Concentration = (Result from raw data x Final volume x Dilution factor) / (Percent solids x Initial weight)

Sample ID	Analyte	Raw Data (ug/L)	Dilution	Initial Weight (g)	Final Volume (mL)	Percent solids (%)	Reported Result (mg/Kg)	Recalcuated Result (mg/Kg)	Acceptable (Y/N)
1	Cr	3.222	50	1.028	50	68.09	11.5	11.5	Y
2	Pb	9.952	20	1.054	50	49.38	19.1	19.1	Y
3	Ag	0.055	20	1.039	50	64.34	0.08	0.08	Y
4	As	4.345	20	1.078	50	82.09	4.91	4.91	Y
5	Cd	0.033	20	1.014	50	79.2	0.04	0.04	Y
6	Cu	20.392	20	1.012	50	38.5	52.3	52.3	Y
7	Zn	38.04	20	1.016	50	31.78	118	118	Y
8	Cr	10.454	20	1.029	50	32.53	31.2	31.2	Y
9	Cd	0.138	20	1.051	50	33.37	0.39	0.39	Y
10	As	1.612	50	1.039	50	59.5	6.52	6.52	Y
11	Ag	0.081	20	1.006	50	53.06	0.15	0.15	Y
12	Zn	46.044	20	1.027	50	57.03	78.6	78.6	Y

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0293

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS215	20F0293-01	Sediment	06/15/20
LDW20-SS214	20F0293-02	Sediment	06/15/20
LDW20-SS212	20F0293-03	Sediment	06/15/20
LDW20-SS202	20F0293-04	Sediment	06/15/20
LDW20-SS203	20F0293-05	Sediment	06/15/20
LDW20-SS341	20F0293-06	Sediment	06/15/20
LDW20-SS347	20F0293-07	Sediment	06/15/20
LDW20-SS350	20F0293-08	Sediment	06/15/20
LDW20-SS352	20F0293-09	Sediment	06/15/20
LDW20-SS217	20F0293-10	Sediment	06/15/20
LDW20-SS219	20F0293-11	Sediment	06/15/20
LDW20-SS220	20F0293-12	Sediment	06/15/20
LDW20-SS215MS	20F0293-01MS	Sediment	06/15/20
LDW20-SS215DUP	20F0293-01DUP	Sediment	06/15/20

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 with the following exceptions:

Blank ID	Analyte	Maximum Concentration	Associated Samples
ICB/CCB	Total organic carbon	0.02%	LDW20-SS215 LDW20-SS214 LDW20-SS212 LDW20-SS202 LDW20-SS203 LDW20-SS341 LDW20-SS347 LDW20-SS350 LDW20-SS352 LDW20-SS217 LDW20-SS219

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.

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

Laboratory control samples (LCS) were analyzed as required by the methods. Percent recoveries (%R) 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 20F0293

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 20F0293

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 20F0293

No Sample Data Qualified in this SDG

LDC #: 48765F6
SDG #: 20F0293
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 8/17/20
Page: 1 of 1
Reviewer: A
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	SW	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	A	
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	A	LCS
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-SS215	20F0293-01	Sediment	06/15/20
2	LDW20-SS214	20F0293-02	Sediment	06/15/20
3	LDW20-SS212	20F0293-03	Sediment	06/15/20
4	LDW20-SS202	20F0293-04	Sediment	06/15/20
5	LDW20-SS203	20F0293-05	Sediment	06/15/20
6	LDW20-SS341	20F0293-06	Sediment	06/15/20
7	LDW20-SS347	20F0293-07	Sediment	06/15/20
8	LDW20-SS350	20F0293-08	Sediment	06/15/20
9	LDW20-SS352	20F0293-09	Sediment	06/15/20
10	LDW20-SS217	20F0293-10	Sediment	06/15/20
11	LDW20-SS219	20F0293-11	Sediment	06/15/20
12	LDW20-SS220	20F0293-12	Sediment	06/15/20
13	LDW20-SS215MS	20F0293-01MS	Sediment	06/15/20
14	LDW20-SS215DUP	20F0293-01DUP	Sediment	06/15/20
15				

Notes:

Sample Specific Element Reference

All elements are applicable to each sample as noted below.

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

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

METHOD: Inorganics
Soil preparation factor applied (if applicable):

Sample Concentration, unless otherwise noted: % Associated Samples: 1-11

				Sample Identification								
Analyte	**PB (units)**	**Maximum ICB/CCB (%)**	**Action Level**	No qualifiers								
TOC		0.02	0.2									

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

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Polychlorinated Dioxins/Dibenzofurans

Validation Level: Stage 4

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0293

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS215	20F0293-01	Sediment	06/15/20
LDW20-SS212	20F0293-03	Sediment	06/15/20
LDW20-SS352	20F0293-09	Sediment	06/15/20

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 4 data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

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 8.0°C and 9.6°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 minimum S/N ratio was greater than or equal to 10 for each unlabeled compound and labeled compound.

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.

The minimum S/N ratio was greater than or equal to 10 for each unlabeled compound and labeled compound.

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
BIF0780-BLK1	06/29/20	1,2,3,4,6,7,8-HpCDF 1,2,3,4,6,7,8-HpCDD OCDF OCDD	0.0726 ng/Kg 0.220 ng/Kg 0.477 ng/Kg 1.66 ng/Kg	All samples in SDG 20F0293

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 20F0293	All compounds reported as estimated maximum possible concentration (EMPC) and greater than the reporting limit.	J (all detects)	A
All samples in SDG 20F0293	All compounds reported as estimated maximum possible concentration (EMPC) and less than the reporting limit.	U (all non-detects)	A
LDW20-SS352	All compounds flagged "X" due to chlorinated diphenyl ether (CDPE) interference.	J (all detects)	A

XII. Target Compound Identifications

All target compound identifications met validation criteria.

XIII. System Performance

The system performance was acceptable.

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 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 20F0293

Sample	Compound	Flag	A or P	Reason
LDW20-SS215 LDW20-SS212 LDW20-SS352	All compounds reported as estimated maximum possible concentration (EMPC) and greater than the reporting limit.	J (all detects)	A	Compound quantitation (EMPC)
LDW20-SS215 LDW20-SS212 LDW20-SS352	All compounds reported as estimated maximum possible concentration (EMPC) and less than the reporting limit.	U (all non-detects)	A	Compound quantitation (EMPC)
LDW20-SS352	All results flagged "X" by the laboratory 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 20F0293

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Field Blank Data Qualification Summary - SDG 20F0293

No Sample Data Qualified in this SDG

LDC #: 48765F21 **VALIDATION COMPLETENESS WORKSHEET** Date: 8/4/20
SDG #: 20F0293 Stage 4 Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer: 9
2nd Reviewer: D

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	A	Temp @ 8.0 - 9.6°C - same day
II.	HRGC/HRMS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	RSD ≤ 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	CS
VIII.	Laboratory control samples / SRM	A	LCS
IX.	Field duplicates	N	
X.	Labeled Compounds	A	
XI.	Compound quantitation RL/LOQ/LODs	SW	
XII.	Target compound identification	A	
XIII.	System performance	A	
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-SS215	20F0293-01	Sediment	06/15/20
2	LDW20-SS212	20F0293-03	Sediment	06/15/20
3	LDW20-SS352	20F0293-09	Sediment	06/15/20
4				
5				
6				
7				
8				
9				
10				

Notes:

LDC #: 48765F31

VALIDATION FINDINGS CHECKLIST

Reviewer: 9
2nd Reviewer: AC

Method: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 1613B)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
Cooler temperature criteria was met.	✓			
II. GC/MS Instrument performance check				
Was PFK exact mass 380.9760 verified?	✓			
Were the retention time windows established for all homologues?	✓			
Was the chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomers ≤ 25% ?	✓			
Is the static resolving power at least 10,000 (10% valley definition)?	✓			
Was the mass resolution adequately check with PFK?	✓			
Was the presence of 1,2,8,9-TCDD and 1,3,4,6,8-PeCDF verified?	✓			
IIIa. Initial calibration				
Was the initial calibration performed at 5 concentration levels?	✓			
Were all percent relative standard deviations (%RSD) ≤ 20% for unlabeled compounds and ≤ 35% for unlabeled compounds?	✓			
Did all calibration standards meet the Ion Abundance Ratio criteria?	✓			
Was the signal to noise ratio for each target compound and labeled compound ≥ 10?	✓			
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all concentrations for the unlabeled compounds and for labeled compounds within QC limits?	✓			
IV. Continuing calibration				
Was a continuing calibration performed at the beginning of each 12 hour period?	✓			
Were all concentrations for the unlabeled compounds and for labeled compounds within QC limits (Method 1613B, Table 6)?	✓			
Did all continuing calibration standards meet the Ion Abundance Ratio criteria?	✓			
V. Blanks				
Was a method blank associated with every sample in this SDG?	✓			
Was a method blank performed for each matrix and whenever a sample extraction was performed?	✓			
Was there contamination in the method blanks?	✓			
VI. Field blanks				
Were field blanks identified in this SDG?		✓		
Were target compounds detected in the field blanks?			✓	
VII. Matrix spike/Matrix spike duplicates				
Were matrix spike (MS) and matrix spike duplicate (MSD) analyzed in this SDG?		✓		
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			✓	

Validation Area	Yes	No	NA	Findings/Comments
VIII. Laboratory control samples				
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
IX. Field duplicates				
Were field duplicate pairs identified in this SDG?		✓		
Were target compounds detected in the field duplicates?			✓	
X. Labeled Compounds				
Were labeled compounds within QC limits (Method 1613B, Table 7)?	✓			
Was the minimum S/N ratio of all labeled compound peaks ≥ 10?	✓			
XI. Compound quantitation				
Did the laboratory LOQs/RLs meet the QAPP LOQs/RLs?	✓			
Were the correct labeled compound, quantitation ion and relative response factor (RRF) used to quantitate the compound?	✓			
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XII. Target compound identification				
For 2,3,7,8 substituted congeners with associated labeled standards, were the retention times of the two quantitation peaks within -1 to 3 sec. of the RT of the labeled standard?	✓			
For 2,3,7,8 substituted congeners without associated labeled standards, were the relative retention times of the two quantitation peaks within 0.005 time units of the RRT measured in the routine calibration?	✓			
For non-2,3,7,8 substituted congeners, were the retention times of the two quantitation peaks within RT established in the performance check solution?	✓			
Did compound spectra contain all characteristic ions listed in the table attached?	✓			
Was the Ion Abundance Ratio for the two quantitation ions within criteria?		✓		
Was the signal to noise ratio for each target compound ≥2.5 and ≥10 for the labeled compound?	✓			
Does the maximum intensity of each specified characteristic ion coincide within ± 2 seconds (includes labeled standards)?	✓			
For PCDF identification, was any signal (S/N ≥ 2.5, at ± seconds RT) detected in the corresponding PCDPE channel?	✓			
Was an acceptable lock mass recorded and monitored?	✓			
XIII. System performance				
System performance was found to be acceptable.	✓			
XIV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

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 #: 48765F21

VALIDATION FINDINGS WOR/UHEET
Blanks

Reviewer: PG
2nd Reviewer: AC

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

Blank extraction date: 6/29/20 **Blank analysis date:** 7/2/20
Conc. units: ng/kg **Associated samples:** All qual U

Compound	Blank ID	Sample Identification											
	BIF0780-BLK1	5X											
O	0.0726	0.363											
F	0.220	1.1											
Q	0.477	2.385											
G	1.66	8.3											

LDC #: 48765J1

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported RLs

Reviewer: 9
2nd Reviewer: 1

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 >RL		Jdets/A
			↓ <RL		U/A
		3	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 #: 48765F21

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: PG
2nd Reviewer:

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

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

$RRF = (A_x)(C_{is})/(A_{is})(C_x)$
average RRF = sum of the RRFs/number of standards
$\%RSD = 100 * (S/X)$

A_x = Area of compound,
C_x = Concentration of compound,
S = Standard deviation of the RRFs,

A_{is} = Area of associated internal standard
C_{is} = Concentration of internal standard
X = Mean of the RRFs

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Reported Average RRF (initial)	Recalculated Average RRF (initial)	Reported RRF (10 std)	Recalculated RRF (10 std)	Reported %RSD	Recalculated %RSD
1	ICAL	7/1/20	2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)	0.822	0.8223	0.8117684	0.8117	6.7	6.7
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)	1.231	1.2310	1.212577	1.2125	11.4	11.4
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)	0.958	0.9576	1.02541	1.0254	10.8	10.8
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)	1.125	1.1246	1.193104	1.1930	12.3	12.3
			OCDF (^{13}C-OCDF)	1.392	1.3922	1.362751	1.3628	8.0	8.0
2			2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)						
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)						
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)						
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)						
			OCDF (^{13}C-OCDF)						
3			2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)						
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)						
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)						
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)						
			OCDF (^{13}C-OCDF)						

Comments: Refer to Initial Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 48765F21

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Reviewer: PG
2nd Reviewer:

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

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF
$RRF = (A_x)(C_{is})/(A_{is})(C_x)$

Where: ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
A_x = Area of compound, A_{is} = Area of associated internal standard
C_x = Concentration of compound, C_{is} = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Average RRF (initial)	Reported Conc (CC)	Recalculated Conc (CC)	Reported %D	Recalculated %D
1	20070202	7/2/20	2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)	0.822	0.7756249	0.7756	5.7	5.7
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)	1.231	1.2109160	1.2109	1.6	1.7
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)	0.958	0.9764576	0.9764	2.0	2.0
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)	1.125	1.1701800	1.1701	4.1	4.0
			OCDF (^{13}C-OCDF)	1.392	1.3030900	1.3030	6.4	6.4
2	20070215	7/2/20	2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)	0.822	0.8055136	0.8055	2.0	2.0
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)	1.231	1.2570670	1.2570	2.1	2.2
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)	0.958	0.9913691	0.9913	3.5	3.5
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)	1.125	1.1863840	1.1864	5.5	5.5
			OCDF (^{13}C-OCDF)	1.392	1.2640570	1.2644	9.2	9.2
3			2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)					
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)					
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)					
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)					
			OCDF (^{13}C-OCDF)					

Comments: Refer to Routine Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 48765F21

VALIDATION FINDINGS WORKSHEET
Laboratory Control Sample Results Verification

Reviewer: PG
2nd Reviewer:

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

The percent recoveries (%R) and Relative Percent Difference (RPD) of the laboratoy control sample and laboratory control sample duplicate (if applicable) were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * SSC/SA Where: SSC = Spiked sample concentration
SA = Spike added

RPD = | LCS - LCSD | * 2/(LCS + LCSD) LCS = Laboraotry control sample percent recovery LCSD = Laboratory control sample duplicate percent recovery

LCS ID: BIF0780-BS1

Compound	Spike Added (ng/kg)		Spiked Sample Concentration (ng/kg)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc	Reported	Recalc	Reported	Recalculated
2,3,7,8-TCDD	20.0	NA	19.97	NA	99.9	99.9				
1,2,3,7,8-PeCDD	100		101.79		102	102				
1,2,3,4,7,8-HxCDD	100		99.30		99.3	99.3				
1,2,3,4,7,8,9-HpCDF	100		105.44		105	105				
OCDF	200		182.39		91.2	91.2				

Comments: Refer to Laboratory Control Sample findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 48765F21

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Page: 1 of 1
Reviewer: 9
2nd reviewer: R

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

(Y) N N/A Were all reported results recalculated and verified for all level IV samples?
(Y) N N/A Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

Concentration = $\frac{(A_x)(I_s)(DF)}{(A_{is})(RRF)(V_o)(\%S)}$

A_x = Area of the characteristic ion (EICP) for the compound to be measured

A_{is} = Area of the characteristic ion (EICP) for the specific internal standard

I_s = Amount of internal standard added in nanograms (ng)

V_o = Volume or weight of sample extract in milliliters (ml) or grams (g).

RRF = Relative Response Factor (average) from the initial calibration

Df = Dilution Factor.

%S = Percent solids, applicable to soil and solid matrices only.

Example:

Sample I.D. 1, H:

Conc. = $\frac{(6.90402+7.80802)(100)(20)(1)}{(6.89185+8.65465)(43.5)(0.7446)}$

= 0.22918/kg

#	Sample ID	Compound	Reported Concentration (ng/kg)	Calculated Concentration ( )	Qualification
	1	H	0.229		

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0295

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC368	20F0295-05	Sediment	06/16/20
LDW20-IT388	20F0295-11	Sediment	06/16/20
LDW20-SC368MS	20F0295-05MS	Sediment	06/16/20
LDW20-SC368MSD	20F0295-05MSD	Sediment	06/16/20

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 all samples in this SDG were reported between 12.2°C and 16.4°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.

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	Indeno(1,2,3-cd)pyrene	20.1	All samples in SDG 20F0295	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.

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, 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
Semivolatiles - Data Qualification Summary - SDG 20F0295

Sample	Compound	Flag	A or P	Reason
LDW20-SC368 LDW20-IT388	Indeno(1,2,3-cd)pyrene	J (all detects)	A	Continuing calibration (%D)

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0295

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0295

No Sample Data Qualified in this SDG

LDC #: 48765G2a

SDG #: 20F0295

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 8/14/20

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	A	Temp @ 12.2-16.4°C - same day
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A A	RSD ≤ 20% r² ICV ≤ 30%
IV.	Continuing calibration	A/N	CCV ≤ 30%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples /SRM	A/A	LCS
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-SC368	20F0295-05	Sediment	06/16/20
2	LDW20-IT388	20F0295-11	Sediment	06/16/20
3	LDW20-SC368MS	20F0295-05MS	Sediment	06/16/20
4	LDW20-SC368MSD	20F0295-05MSD	Sediment	06/16/20
5				
6				
7				
8				
9				

Notes:

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

A. Phenol	CC. Dimethylphthalate	EEE. Bis(2-ethylhexyl)phthalate	GGGG. C30-Hopane	I1. Methyl methanesulfonate
B. Bis (2-chloroethyl) ether	DD. Acenaphthylene	FFF. Di-n-octylphthalate	HHHH. 1-Methylphenanthrene	J1. Ethyl methanesulfonate
C. 2-Chlorophenol	EE. 2,6-Dinitrotoluene	GGG. Benzo(b)fluoranthene	IIII. 1,4-Dioxane	K1. o,o',o"-Triethylphosphorothioate
D. 1,3-Dichlorobenzene	FF. 3-Nitroaniline	HHH. Benzo(k)fluoranthene	JJJJ. Acetophenone	L1. n-Phenylene diamine
E. 1,4-Dichlorobenzene	GG. Acenaphthene	III. Benzo(a)pyrene	KKKK. Atrazine	M1. 1,4-Naphthoquinone
F. 1,2-Dichlorobenzene	HH. 2,4-Dinitrophenol	JJJ. Indeno(1,2,3-cd)pyrene	LLLL. Benzaldehyde	N1. N-Nitro-o-toluidine
G. 2-Methylphenol	II. 4-Nitrophenol	KKK. Dibenz(a,h)anthracene	MMMM. Caprolactam	O1. 1,3,5-Trinitrobenzene
H. 2,2'-Oxybis(1-chloropropane)	JJ. Dibenzofuran	LLL. Benzo(g,h,i)perylene	NNNN. 2,6-Dichlorophenol	P1. Pentachlorobenzene
I. 4-Methylphenol	KK. 2,4-Dinitrotoluene	MMM. Bis(2-Chloroisopropyl)ether	OOOO. 1,2-Diphenylhydrazine	Q1. 4-Aminobiphenyl
J. N-Nitroso-di-n-propylamine	LL. Diethylphthalate	NNN. Aniline	PPPP. 3-Methylphenol	R1. 2-Naphthylamine
K. Hexachloroethane	MM. 4-Chlorophenyl-phenyl ether	OOO. N-Nitrosodimethylamine	QQQQ. 3&4-Methylphenol	S1. Triphenylene
L. Nitrobenzene	NN. Fluorene	PPP. Benzoic Acid	RRRR. 4-Dimethyldibenzothiophene (4MDT)	T1. Octachlorostyrene
M. Isophorone	OO. 4-Nitroaniline	QQQ. Benzyl alcohol	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	U1. Famphur
N. 2-Nitrophenol	PP. 4,6-Dinitro-2-methylphenol	RRR. Pyridine	TTTT. 1-Methyldibenzothiophene (1MDT)	V1. 1,4-phenylenediamine
O. 2,4-Dimethylphenol	QQ. N-Nitrosodiphenylamine	SSS. Benzidine	UUUU.. 2,3,4,6-Tetrachlorophenol	W1. Methapyrilene
P. Bis(2-chloroethoxy)methane	RR. 4-Bromophenyl-phenylether	TTT. 1-Methylnaphthalene	VVVV. 1,2,4,5-Tetrachlorobenzene	X1. Pentachloroethane
Q. 2,4-Dichlorophenol	SS. Hexachlorobenzene	UUU.Benzo(b)thiophene	WWWW.. 2-Picoline	Y1. 3,3'-Dimethylbenzidine
R. 1,2,4-Trichlorobenzene	TT. Pentachlorophenol	VVV.Benzonaphthothiophene	XXXX. 3-Methylcholanthrene	Z1. o-Toluidine
S. Naphthalene	UU. Phenanthrene	WWW.Benzo(e)pyrene	YYYY. a,a-Dimethylphenethylamine	A2. 1-Naphthylamine
T. 4-Chloroaniline	VV. Anthracene	XXX. 2,6-Dimethylnaphthalene	ZZZZ. Hexachloropropene	B2. 4-Aminobiphenyl
U. Hexachlorobutadiene	WW. Carbazole	YYY. 2,3,5-Trimethylnaphthalene	A1. N-Nitrosodiethylamine	C2. 4-Nitroquinoline-1-oxide
V. 4-Chloro-3-methylphenol	XX. Di-n-butylphthalate	ZZZ. Perylene	B1. N-Nitrosodi-n-butylamine	D2. Hexachloropene
W. 2-Methylnaphthalene	YY. Fluoranthene	AAAA. Dibenzothiophene	C1. N-Nitrosomethylethylamine	E2. Bis (2-chloro-1-methylethyl) ether
X. Hexachlorocyclopentadiene	ZZ. Pyrene	BBBB. Benzo(a)fluoranthene	D1. N-Nitrosomorpholine	F2. Bifenthrin
Y. 2,4,6-Trichlorophenol	AAA. Butylbenzylphthalate	CCCC. Benzo(b)fluorene	E1. N-Nitrosopyrrolidine	G2. Cyfluthrin
Z. 2,4,5-Trichlorophenol	BBB. 3,3'-Dichlorobenzidine	DDDD. cis/trans-Decalin	F1. Phenacetin	H2. Cypermethrin
AA. 2-Chloronaphthalene	CCC. Benzo(a)anthracene	EEEE. 1,1'-Biphenyl	G1. 2-Acetylaminofluorene	I2. Permethrin (cis/trans)
BB. 2-Nitroaniline	DDD. Chrysene	FFFF. Retene	H1. Pronamide	J2. 5-Nitro-o-toluidine

LDC #: 48765 4-2a

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

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

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

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 for each instrument?

Y (N) N/A Were percent differences (%D) ≤20 % and relative response factors (RRF) within the method criteria?

#	Date	Standard ID	Compound	Finding %D (Limit: ≤20.0%)	Finding RRF (Limit)	Associated Samples	Qualifications
	7/8/20	NTK2007080 4	NN	20.1		All (dets)	J/UJ/A

CONCAL 2SD

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Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0295

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC368	20F0295-05	Sediment	06/16/20
LDW20-IT421	20F0295-06	Sediment	06/16/20
LDW20-IT409	20F0295-07	Sediment	06/16/20
LDW20-IT388	20F0295-11	Sediment	06/16/20
LDW20-IT390	20F0295-12	Sediment	06/16/20
LDW20-IT389	20F0295-13	Sediment	06/16/20
LDW20-SC368MS	20F0295-05MS	Sediment	06/16/20
LDW20-SC368MSD	20F0295-05MSD	Sediment	06/16/20
LDW20-IT421MS	20F0295-06MS	Sediment	06/16/20
LDW20-IT421MSD	20F0295-06MSD	Sediment	06/16/20

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 temperature for samples in this SDG were reported between 12.2°C and 16.4°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	65.7	LDW20-SC368 LDW20-IT388	J (all 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 Pentachlorophenol	39.2 39.2	LDW20-SC368 LDW20-IT388	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 with the following exceptions:

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
BIF0862-BLK2	06/30/20	1,4-Dichlorobenzene	0.7 ug/Kg	LDW20-SC368 LDW20-IT388

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-SC368	1,4-Dichlorobenzene	1.6 ug/Kg	1.6U 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.

Due to ICV %D and continuing calibration %D, data were qualified as estimated in two 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
Semivolatiles – Data Qualification Summary - SDG 20F0295

Sample	Compound	Flag	A or P	Reason
LDW20-SC368 LDW20-IT388	N-Nitrosodiphenylamine	J (all detects)	A	Initial calibration verification (%D)
LDW20-SC368 LDW20-IT388	Benzoic acid Pentachlorophenol	J (all detects) J (all detects)	A	Continuing calibration (%D)

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0295

Sample	Compound	Modified Final Concentration	A or P
LDW20-SC368	1,4-Dichlorobenzene	1.6U ug/Kg	A

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0295

No Sample Data Qualified in this SDG

LDC #: 48765G2b

VALIDATION COMPLETENESS WORKSHEET

SDG #: 20F0295

Stage 2B

Laboratory: Analytical Resources, Inc.

Date: 8/14/20

Page: 1 of 1

Reviewer: [illegible]

2nd Reviewer: [illegible]

METHOD: GC/MS Polynuclear Aromatic Hydrocarbons (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	A	Temp @ 12.2-16.4°C - Same day
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/SW	RSD ≤ 20%. r² ICV ≤ 30%
IV.	Continuing calibration	SW	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/SRM	A/A	LCS
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 1	LDW20-SC368	20F0295-05	Sediment	06/16/20
2 2	LDW20-IT421	20F0295-06	Sediment	06/16/20
3 2	LDW20-IT409	20F0295-07	Sediment	06/16/20
4 1	LDW20-IT388	20F0295-11	Sediment	06/16/20
5 2	LDW20-IT390	20F0295-12	Sediment	06/16/20
6 2	LDW20-IT389	20F0295-13	Sediment	06/16/20
7 1	LDW20-SC368MS	20F0295-05MS	Sediment	06/16/20
8 1	LDW20-SC368MSD	20F0295-05MSD	Sediment	06/16/20
9 2	LDW20-IT421MS	20F0295-06MS	Sediment	06/16/20
10 2	LDW20-IT421MSD	20F0295-06MSD	Sediment	06/16/20
11				
12	BFF0862-BK2			
13	BFF086T-BK1			
14				

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

A. Phenol	CC. Dimethylphthalate	EEE. Bis(2-ethylhexyl)phthalate	GGGG. C30-Hopane	I1. Methyl methanesulfonate
B. Bis (2-chloroethyl) ether	DD. Acenaphthylene	FFF. Di-n-octylphthalate	HHHH. 1-Methylphenanthrene	J1. Ethyl methanesulfonate
C. 2-Chlorophenol	EE. 2,6-Dinitrotoluene	GGG. Benzo(b)fluoranthene	IIII. 1,4-Dioxane	K1. o,o',o''-Triethylphosphorothioate
D. 1,3-Dichlorobenzene	FF. 3-Nitroaniline	HHH. Benzo(k)fluoranthene	JJJJ. Acetophenone	L1. n-Phenylene diamine
E. 1,4-Dichlorobenzene	GG. Acenaphthene	III. Benzo(a)pyrene	KKKK. Atrazine	M1. 1,4-Naphthoquinone
F. 1,2-Dichlorobenzene	HH. 2,4-Dinitrophenol	JJJ. Indeno(1,2,3-cd)pyrene	LLLL. Benzaldehyde	N1. N-Nitro-o-toluidine
G. 2-Methylphenol	II. 4-Nitrophenol	KKK. Dibenz(a,h)anthracene	MMMM. Caprolactam	O1. 1,3,5-Trinitrobenzene
H. 2,2'-Oxybis(1-chloropropane)	JJ. Dibenzofuran	LLL. Benzo(g,h,i)perylene	NNNN. 2,6-Dichlorophenol	P1. Pentachlorobenzene
I. 4-Methylphenol	KK. 2,4-Dinitrotoluene	MMM. Bis(2-Chloroisopropyl)ether	OOOO. 1,2-Diphenylhydrazine	Q1. 4-Aminobiphenyl
J. N-Nitroso-di-n-propylamine	LL. Diethylphthalate	NNN. Aniline	PPPP. 3-Methylphenol	R1. 2-Naphthylamine
K. Hexachloroethane	MM. 4-Chlorophenyl-phenyl ether	OOO. N-Nitrosodimethylamine	QQQQ. 3&4-Methylphenol	S1. Triphenylene
L. Nitrobenzene	NN. Fluorene	PPP. Benzoic Acid	RRRR. 4-Dimethyldibenzothiophene (4MDT)	T1. Octachlorostyrene
M. Isophorone	OO. 4-Nitroaniline	QQQ. Benzyl alcohol	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	U1. Famphur
N. 2-Nitrophenol	PP. 4,6-Dinitro-2-methylphenol	RRR. Pyridine	TTTT. 1-Methyldibenzothiophene (1MDT)	V1. 1,4-phenylenediamine
O. 2,4-Dimethylphenol	QQ. N-Nitrosodiphenylamine	SSS. Benzidine	UUUU.. 2,3,4,6-Tetrachlorophenol	W1. Methapyrilene
P. Bis(2-chloroethoxy)methane	RR. 4-Bromophenyl-phenylether	TTT. 1-Methylnaphthalene	VVVV. 1,2,4,5-Tetrachlorobenzene	X1. Pentachloroethane
Q. 2,4-Dichlorophenol	SS. Hexachlorobenzene	UUU.Benzo(b)thiophene	WWWW.. 2-Picoline	Y1. 3,3'-Dimethylbenzidine
R. 1,2,4-Trichlorobenzene	TT. Pentachlorophenol	VVV.Benzonaphthothiophene	XXXX. 3-Methylcholanthrene	Z1. o-Toluidine
S. Naphthalene	UU. Phenanthrene	WWW.Benzo(e)pyrene	YYYY. a,a-Dimethylphenethylamine	A2. 1-Naphthylamine
T. 4-Chloroaniline	VV. Anthracene	XXX. 2,6-Dimethylnaphthalene	ZZZZ. Hexachloropropene	B2. 4-Aminobiphenyl
U. Hexachlorobutadiene	WW. Carbazole	YYY. 2,3,5-Trimethylnaphthalene	A1. N-Nitrosodiethylamine	C2. 4-Nitroquinoline-1-oxide
V. 4-Chloro-3-methylphenol	XX. Di-n-butylphthalate	ZZZ. Perylene	B1. N-Nitrosodi-n-butylamine	D2. Hexachloropene
W. 2-Methylnaphthalene	YY. Fluoranthene	AAAA. Dibenzothiophene	C1. N-Nitrosomethylethylamine	E2. Bis (2-chloro-1-methylethyl) ether
X. Hexachlorocyclopentadiene	ZZ. Pyrene	BBBB. Benzo(a)fluoranthene	D1. N-Nitrosomorpholine	F2. Bifenthrin
Y. 2,4,6-Trichlorophenol	AAA. Butylbenzylphthalate	CCCC. Benzo(b)fluorene	E1. N-Nitrosopyrrolidine	G2. Cyfluthrin
Z. 2,4,5-Trichlorophenol	BBB. 3,3'-Dichlorobenzidine	DDDD. cis/trans-Decalin	F1. Phenacetin	H2. Cypermethrin
AA. 2-Chloronaphthalene	CCC. Benzo(a)anthracene	EEEE. 1,1'-Biphenyl	G1. 2-Acetylaminofluorene	I2. Permethrin (cis/trans)
BB. 2-Nitroaniline	DDD. Chrysene	FFFF. Retene	H1. Pronamide	J2. 5-Nitro-o-toluidine

LDC #: 48165326

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

Reviewer: [illegible]
2nd Reviewer: [illegible]

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 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 %D ?

#	Date	Standard ID	Compound	Finding %D (Limit: ≤20.0%)	Associated Samples	Qualifications
	6/26/20	S1F0395-SCV1	R	65.7	1,4,7-8, MB (dets)	J/UJ/A

LDC #: 48765E36

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

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

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

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 for each instrument?

Y (N) N/A Were percent differences (%D) ≤20 % and relative response factors (RRF) within the method criteria?

#	Date	Standard ID	Compound	Finding %D (Limit: ≤20.0%)	Finding RRF (Limit)	Associated Samples	Qualifications
	7/8/20	NTH2008055	PP	39.2		1.4.7-8. MB	J/UJ/A
			TT	39.2		(dets)	

LDC #: 48665-26

VALIDATION FINDINGS WORKSHEET
Blanks

Page: 1 of 1
Reviewer: 9
2nd Reviewer: AK

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

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: 6/30/20 **Blank analysis date:** 7/8/20
Conc. units: ug/kg Associated Samples: 1, 4

Compound	Blank ID	Sample Identification								
BIF0862-BLK2		1								
E	0.7		1.4/U							

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:
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".

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Hexachlorobenzene

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0295

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC368	20F0295-05	Sediment	06/16/20
LDW20-IT388	20F0295-11	Sediment	06/16/20
LDW20-SC368MS	20F0295-05MS	Sediment	06/16/20
LDW20-SC368MSD	20F0295-05MSD	Sediment	06/16/20

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 temperature for samples in this SDG were reported between 12.2°C and 16.4°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 20F0295

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Laboratory Blank Data Qualification Summary - SDG 20F0295

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Field Blank Data Qualification Summary - SDG 20F0295

No Sample Data Qualified in this SDG

LDC #: 48765G3a
SDG #: 20F0295
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 8/14/20
Page: 1 of 1
Reviewer: 9
2nd Reviewer: M

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	A	Temp @ 12.2 - 16.4 °C - same day
II.	GC Instrument Performance Check	A	
III.	Initial calibration/ICV	A/A	RSD ≤ 20%. RF ≥ 20%
IV.	Continuing calibration	A	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes / DS	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-SC368	20F0295-05	Sediment	06/16/20
2	LDW20-IT388	20F0295-11	Sediment	06/16/20
3	LDW20-SC368MS	20F0295-05MS	Sediment	06/16/20
4	LDW20-SC368MSD	20F0295-05MSD	Sediment	06/16/20
5				
6				
7				
8				
9				
10				
11				

Notes:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0295

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC324	20F0295-01	Sediment	06/16/20
LDW20-SC327	20F0295-02	Sediment	06/16/20
LDW20-SC326	20F0295-03	Sediment	06/16/20
LDW20-IT332	20F0295-04	Sediment	06/16/20
LDW20-SC368	20F0295-05	Sediment	06/16/20
LDW20-IT421	20F0295-06	Sediment	06/16/20
LDW20-IT409	20F0295-07	Sediment	06/16/20
LDW20-SC381	20F0295-08	Sediment	06/16/20
LDW20-IT330	20F0295-09	Sediment	06/16/20
LDW20-IT331	20F0295-10	Sediment	06/16/20
LDW20-IT388	20F0295-11	Sediment	06/16/20
LDW20-IT390	20F0295-12	Sediment	06/16/20
LDW20-IT389	20F0295-13	Sediment	06/16/20
LDW20-IT332MS	20F0295-04MS	Sediment	06/16/20
LDW20-IT332MSD	20F0295-04MSD	Sediment	06/16/20

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 8.2°C and 16.4°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 20F0295	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 with the following exceptions:

Date	Standard	Column	Compound	%D	Associated Samples	Flag	A or P
07/04/20	20070427ECD7	2C	Aroclor-1254	21.8	LDW20-SC324 LDW20-SC327 LDW20-SC326 LDW20-IT332 LDW20-SC368 LDW20-IT421	J (all detects)	A

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

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) 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-SC327	Aroclor-1260	41.1	J (all detects)	A
LDW20-IT421	Aroclor-1248 Aroclor-1254 Aroclor-1260	61.3 42 44.9	J (all detects) J (all detects) J (all detects)	A
LDW20-IT409	Aroclor-1248	54.5	J (all detects)	A
LDW20-IT330	Aroclor-1248 Aroclor-1254	76.9 81.6	J (all detects) J (all detects)	A
LDW20-IT331	Aroclor-1248	48.5	J (all detects)	A
LDW20-IT389	Aroclor-1254	41.5	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, continuing calibration %D, and RPD between two columns, 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 20F0295

Sample	Compound	Flag	A or P	Reason
LDW20-SC324 LDW20-SC327 LDW20-SC326 LDW20-IT332 LDW20-SC368 LDW20-IT421 LDW20-IT409 LDW20-SC381 LDW20-IT330 LDW20-IT331 LDW20-IT388 LDW20-IT390 LDW20-IT389	Aroclor-1260	J (all detects) UJ (all non-detects)	A	Initial calibration verification (%D)
LDW20-SC324 LDW20-SC327 LDW20-SC326 LDW20-IT332 LDW20-SC368 LDW20-IT421	Aroclor-1254	J (all detects)	A	Continuing calibration (%D)
LDW20-SC327	Aroclor-1260	J (all detects)	A	Compound quantitation (RPD between two columns)
LDW20-IT421	Aroclor-1248 Aroclor-1254 Aroclor-1260	J (all detects) J (all detects) J (all detects)	A	Compound quantitation (RPD between two columns)
LDW20-IT409 LDW20-IT331	Aroclor-1248	J (all detects)	A	Compound quantitation (RPD between two columns)
LDW20-IT330	Aroclor-1248 Aroclor-1254	J (all detects) J (all detects)	A	Compound quantitation (RPD between two columns)
LDW20-IT389	Aroclor-1254	J (all detects)	A	Compound quantitation (RPD between two columns)

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 20F0295

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 20F0295

No Sample Data Qualified in this SDG

LDC #: 48765G3b
SDG #: 20F0295
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 7/14/20
Page: 1 of 1
Reviewer: 1
2nd Reviewer: 1

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	A	Temp @ 8.2 - 16.4°C - same day
II.	Initial calibration/ICV	A/TW	RSD ≤ 20%. ICV ≤ 20%
III.	Continuing calibration	TW	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 / SRM	A/A	LCS
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-SC324	20F0295-01	Sediment	06/16/20
2	LDW20-SC327	20F0295-02	Sediment	06/16/20
3	LDW20-SC326	20F0295-03	Sediment	06/16/20
4	LDW20-IT332	20F0295-04	Sediment	06/16/20
5	LDW20-SC368	20F0295-05	Sediment	06/16/20
6	LDW20-IT421	20F0295-06	Sediment	06/16/20
7	LDW20-IT409	20F0295-07	Sediment	06/16/20
8	LDW20-SC381	20F0295-08	Sediment	06/16/20
9	LDW20-IT330	20F0295-09	Sediment	06/16/20
10	LDW20-IT331	20F0295-10	Sediment	06/16/20
11	LDW20-IT388	20F0295-11	Sediment	06/16/20
12	LDW20-IT390	20F0295-12	Sediment	06/16/20
13	LDW20-IT389	20F0295-13	Sediment	06/16/20
14	LDW20-IT332MS	20F0295-04MS	Sediment	06/16/20
15	LDW20-IT332MSD	20F0295-04MSD	Sediment	06/16/20
16				
17				

VALIDATION FINDINGS WORKSHEET

METHOD: Pesticides

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

Notes:_____

LDC #: 18765f36

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

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

METHOD: / GC __ HPLC

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
	~~[illegible]~~						
	7/2/20	SIG00565-CCV1	1C	BB	9.3	All (dets+ND)	√ U √ A

ICV-gc.wpd

LDC #: 48765G36

VALIDATION FINDINGS WORKSHEET

Continuing Calibration

Page: 1 of 1

Reviewer:

2nd Reviewer:

METHOD: ✓ **GC** ___ **HPLC**

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

[✓ Y] N N/A Were continuing calibration standards analyzed at the required frequencies?

Y [✓ N] N/A Did the continuing calibration standards meet the %D validation criteria of ≤20.0%?

Level IV Only

Y N [✓ N/A] Were the retention times for all calibrated compounds within their respective acceptance windows?

#	Date	Standard ID	Detector/ Column	Compound	%D (Limit)	RT (limit)	Associated Samples	Qualifications
	7/4/20	20070427EC07	2C	AA	21.8	( )	1-6.14-15.MB	J/UJ/A
						( )	(det3)	
						( )		
						( )		
						( )		
						( )		
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LDC #: ~~40765F3b~~

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Page: 1 of 1
Reviewer: a
2nd Reviewer: a

METHOD: √ GC __ HPLC

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 relative percent differences of detected compounds between two columns/detectors ≤40%?
If no, please see findings bellow.

#	Compound Name	Sample ID	%RPD Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	~~BB~~	2	41.1	~~J (all detects) A~~
	2	6	61.3	
	~~AA~~		~~42~~	
	~~BB~~		44.9	
	2	7	~~54.5~~	
	2	9	76.9	
	~~AA~~		~~81.6~~	
	~~BB~~			
	2	10	48.5	
	~~AA~~	13	41.5	√

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Metals

Validation Level: Stage 2B & 4

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0295

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT332	20F0295-04	Sediment	06/16/20
LDW20-SC368	20F0295-05	Sediment	06/16/20
LDW20-IT421	20F0295-06	Sediment	06/16/20
LDW20-IT409	20F0295-07	Sediment	06/16/20
LDW20-IT330	20F0295-09	Sediment	06/16/20
LDW20-IT331	20F0295-10	Sediment	06/16/20
LDW20-IT388	20F0295-11	Sediment	06/16/20
LDW20-IT390	20F0295-12	Sediment	06/16/20
LDW20-IT389	20F0295-13	Sediment	06/16/20
LDW20-IT332MS	20F0295-04MS	Sediment	06/16/20
LDW20-IT332MSD	20F0295-04MSD	Sediment	06/16/20
LDW20-IT332DUP	20F0295-04DUP	Sediment	06/16/20

Mercury underwent Stage 4 validation

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. Samples appended with a double asterisk on the cover page were subjected to Stage 4 data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

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.

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)

ICP-MS was not utilized in this SDG.

XIII. Sample Result Verification

All sample result verifications were acceptable for samples which underwent Stage 4 validation. 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 20F0295

No Sample Data Qualified in this SDG

Duwamish AOC4
Metals - Laboratory Blank Data Qualification Summary - SDG 20F0295

No Sample Data Qualified in this SDG

Duwamish AOC4
Metals - Field Blank Data Qualification Summary - SDG 20F0295

No Sample Data Qualified in this SDG

LDC #: 48765G4a
SDG #: 20F0295
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B/4

Date: 8/17/20
Page: 1 of 1
Reviewer: CG
2nd Reviewer: CF

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	A	
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	A	Not reviewed for 6020A validation.
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:

Mercury underwent Stage 4 validation

	Client ID	Lab ID	Matrix	Date
1	LDW20-IT332	20F0295-04	Sediment	06/16/20
2	LDW20-SC368	20F0295-05	Sediment	06/16/20
3	LDW20-IT421	20F0295-06	Sediment	06/16/20
4	LDW20-IT409	20F0295-07	Sediment	06/16/20
5	LDW20-IT330	20F0295-09	Sediment	06/16/20
6	LDW20-IT331	20F0295-10	Sediment	06/16/20
7	LDW20-IT388	20F0295-11	Sediment	06/16/20
8	LDW20-IT390	20F0295-12	Sediment	06/16/20
9	LDW20-IT389	20F0295-13	Sediment	06/16/20
10	LDW20-IT332MS	20F0295-04MS	Sediment	06/16/20
11	LDW20-IT332MSD	20F0295-04MSD	Sediment	06/16/20
12	LDW20-IT332DUP	20F0295-04DUP	Sediment	06/16/20
13				
14				

Notes:

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)				
Validation Area	**Yes**	**No**	**NA**	**Comments**
I. Technical holding times				
Were all technical holding times met?	X			
Were all water samples preserved to a pH of <2.			X	
II. ICP-MS Tune				
Were mass resolutions within 0.1 amu for all isotopes in the tuning solution?			X	
Were %RSDs of isoptoes in the tuning solution ≤5%?			X	
III. Calibration				
Were all instuments calibrated daily?	X			
Were the proper standards used?	X			
Were all initial and continuing calibration verifications within the 90-110% (80-120% for mercury) QC limits?	X			
Were the low level standard checks within 70-130%?			X	
Were all initial calibration correlation coefficients within limits as specifed by the method?	X			
IV. Blanks				
Was a method blank associated with every sample in this SDG?	X			
Was there contamination in the method blanks?		X		
Was there contamination in the initial and continuing calibration blanks?		X		
V. Interference Check Sample				
Were the interference check samples performed daily?			X	
Were the AB solution recoveries within 80-120%?			X	
VI. Matrix Spike/Matrix Spike Duplicates/Laboratory Duplicates				
Were MS/MSD recoveries with the QC limits? (If the sample concentration exceeded the spike concentration by a factor of 4, no action was taken.)			X	
Were the MS/MSD or laboratory duplicate relative percent differences (RPDs) within the QC limits?			X	
VII. Laboratory Control Samples				
Was a LCS analyzed for each batch in the SDG?	X			
Were the LCS recoveries and RPDs (if applicable) within QC limits?	X			

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)				
Validation Area	**Yes**	**No**	**NA**	**Comments**
VIII. Internal Standards				
Were all percent recoveries within the 30-120% (60-125% for EPA Method 200.8) QC limits?			X	
If the recoveries were outside the limits, was a reanalysis performed?			X	
IX. Serial Dilution				
Were all percent differences <10%?			X	
Was there evidence of negative interference? If yes, professional judgement will be used to qualify the data.			X	
X. Sample Result Verification				
Were all reporting limits adjusted to reflect sample dilutions?	X			
Were all soil samples dry weight corrected?	X			
XI. Overall Assessment of Data				
Was the overall assessment of the data found to be acceptable?	X			
XII. Field Duplicates				
Were field duplicates identifed in this SDG?		X		
Were target analytes detected in the field duplicates?			X	
XIII. Field Blanks				
Were field blanks identified in this SDG?		X		
Were target analytes detected in the field blanks?			X	

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
2, 7	As, Cd, Cr, Cu, Pb, Ag, Zn, Hg
1, 3-6, 8, 9	As
QC: 11, 12	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)

An intial calibration verification (ICV), continuing calibration verification (CCV), low level calibration check (LLCC), and interference check sample (ICSAB) percent recovery (%R) was recalculated for each type of analysis using the following formula:

%R = (Found/True) x 100

Found = concentration of each analyte measured in the analysis

True = concentration of each analyte in the source

Standard ID	Type of Analysis	Element	Found (ug/L)	True (ug/L)	Recalcuated %R	Reported %R	Acceptable (Y/N)
ICV	CVAA	Hg	4.0515	4	101.3	101.3	Y
CCV	CVAA	Hg	3.9381	4	98.5	98.5	Y

Quality Control Sample Recalculations

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

Percent recoveries (%R) for the laboratory control sample (LCS), matrix spike (MS), and post digestion spike (PDS) were recalculated using the following formula:

%R = (Found/True) x 100

Found = concentration of each analyte measured in the analysis. For the MS calculation, Found = SSR (Spiked Sample Result) - SR (Sample Result)

True = concentration of each analyte in the source

The sample and duplicate relative percent difference (RPD) was recalculated using the following formula:

RPD = (Absolute value(S-D)x 200) / (S+D)

S = Original sample concentration

D = Duplicate sample concentration

The serial dilution percent difference (%D) was recalculated using the following formula.

%D = (Absolute value (I - SDR)) x 100 / (I)

I = Initial sample result

SDR = Serial dilution result (with a 5x dilution applied)

Sample ID	Type of Analysis	Element	Found/S/I	True/D/SDR	Recalcuated %R/RPD/%D	Reported %R/RPD/%D	Acceptable (Y/N)
LCS	LCS	Hg	0.499	0.5	99.8	99.8	Y
	MS	Hg					
	Duplicate	Hg					

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)
Analytes were recalculated and verified using the following equation:
Concentration = (Result from raw data x Final volume x Dilution factor) / (Percent solids x Initial weight)

Sample ID	Analyte	Raw Data (ug/L)	Dilution	Initial Weight (g)	Final Volume (mL)	Percent solids (%)	Reported Result (mg/Kg)	Recalcuated Result (mg/Kg)	Acceptable (Y/N)
2	Hg	0.1766	1	0.282	50	75.98	0.0412	0.0412	Y
7	Hg	0.1454	1	0.206	50	69.99	0.0504	0.0504	Y

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0295

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC324	20F0295-01	Sediment	06/16/20
LDW20-SC327	20F0295-02	Sediment	06/16/20
LDW20-SC326	20F0295-03	Sediment	06/16/20
LDW20-IT332	20F0295-04	Sediment	06/16/20
LDW20-SC368	20F0295-05	Sediment	06/16/20
LDW20-IT421	20F0295-06	Sediment	06/16/20
LDW20-IT409	20F0295-07	Sediment	06/16/20
LDW20-SC381	20F0295-08	Sediment	06/16/20
LDW20-IT330	20F0295-09	Sediment	06/16/20
LDW20-IT331	20F0295-10	Sediment	06/16/20
LDW20-IT388	20F0295-11	Sediment	06/16/20
LDW20-IT390	20F0295-12	Sediment	06/16/20
LDW20-IT389	20F0295-13	Sediment	06/16/20
LDW20-SC324DUP	20F0295-01DUP	Sediment	06/16/20
LDW20-IT330MS	20F0295-09MS	Sediment	06/16/20
LDW20-IT330DUP	20F0295-09DUP	Sediment	06/16/20

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

Laboratory control samples (LCS) were analyzed as required by the methods. Percent recoveries (%R) 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 20F0295

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 20F0295

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 20F0295

No Sample Data Qualified in this SDG

LDC #: 48765G6
SDG #: 20F0295
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 8/17/20
Page: 1 of 1
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	A	
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	A	LCS
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-SC324	20F0295-01	Sediment	06/16/20
2	LDW20-SC327	20F0295-02	Sediment	06/16/20
3	LDW20-SC326	20F0295-03	Sediment	06/16/20
4	LDW20-IT332	20F0295-04	Sediment	06/16/20
5	LDW20-SC368	20F0295-05	Sediment	06/16/20
6	LDW20-IT421	20F0295-06	Sediment	06/16/20
7	LDW20-IT409	20F0295-07	Sediment	06/16/20
8	LDW20-SC381	20F0295-08	Sediment	06/16/20
9	LDW20-IT330	20F0295-09	Sediment	06/16/20
10	LDW20-IT331	20F0295-10	Sediment	06/16/20
11	LDW20-IT388	20F0295-11	Sediment	06/16/20
12	LDW20-IT390	20F0295-12	Sediment	06/16/20
13	LDW20-IT389	20F0295-13	Sediment	06/16/20
14	LDW20-SC324DUP	20F0295-01DUP	Sediment	06/16/20
15	LDW20-IT330MS	20F0295-09MS	Sediment	06/16/20
16	LDW20-IT330DUP	20F0295-09DUP	Sediment	06/16/20
17				

Notes:

Sample Specific Element Reference

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1 to 13	Total solids, TOC
QC: 14	TS
15, 16	TOC

LDC Report# 48765G21

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Polychlorinated Dioxins/Dibenzofurans

Validation Level: Stage 4

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0295

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT332	20F0295-04	Sediment	06/16/20
LDW20-IT330	20F0295-09	Sediment	06/16/20
LDW20-IT389	20F0295-13	Sediment	06/16/20

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 4 data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

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 8.2°C and 16.4°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. 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 minimum S/N ratio was greater than or equal to 10 for each unlabeled compound and labeled compound.

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.

The minimum S/N ratio was greater than or equal to 10 for each unlabeled compound and labeled compound.

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
BIF0780-BLK1	06/29/20	1,2,3,4,6,7,8-HpCDF 1,2,3,4,6,7,8-HpCDD OCDF OCDD	0.0726 ng/Kg 0.220 ng/Kg 0.477 ng/Kg 1.66 ng/Kg	All samples in SDG 20F0295

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-IT389	1,2,3,4,6,7,8-HpCDF OCDF	0.589 ng/Kg 1.89 ng/Kg	0.589U ng/Kg 1.89U 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 20F0295	All compounds reported as estimated maximum possible concentration (EMPC) and greater than the reporting limit.	J (all detects)	A
All samples in SDG 20F0295	All compounds reported as estimated maximum possible concentration (EMPC) and less than the reporting limit.	U (all non-detects)	A

XII. Target Compound Identifications

All target compound identifications met validation criteria.

XIII. System Performance

The system performance was acceptable.

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 in three 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 20F0295

Sample	Compound	Flag	A or P	Reason
LDW20-IT332 LDW20-IT330 LDW20-IT389	All compounds reported as estimated maximum possible concentration (EMPC) and greater than the reporting limit.	J (all detects)	A	Compound quantitation (EMPC)
LDW20-IT332 LDW20-IT330 LDW20-IT389	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 20F0295

Sample	Compound	Modified Final Concentration	A or P
LDW20-IT389	1,2,3,4,6,7,8-HpCDF OCDF	0.589U ng/Kg 1.89U ng/Kg	A

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Field Blank Data Qualification Summary - SDG 20F0295

No Sample Data Qualified in this SDG

LDC #: 48765G21 **VALIDATION COMPLETENESS WORKSHEET** Date: 8/4/20
SDG #: 20F0295 Stage 4 Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer:
2nd Reviewer: AL

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	A	Temp @ 5.2-16.4°C. - same day
II.	HRGC/HRMS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	RSD ≤ 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	CS
VIII.	Laboratory control samples /SRM	A	LCS
IX.	Field duplicates	N	
X.	Labeled Compounds	A	
XI.	Compound quantitation RL/LOQ/LODs	SW	
XII.	Target compound identification	A	
XIII.	System performance	A	
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-IT332	20F0295-04	Sediment	06/16/20
2	LDW20-IT330	20F0295-09	Sediment	06/16/20
3	LDW20-IT389	20F0295-13	Sediment	06/16/20
4				
5				
6				
7				
8				
9				
10				

Notes:

LDC #: 48765G21

VALIDATION FINDINGS CHECKLIST

Reviewer: 9
2nd Reviewer: MB

Method: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 1613B)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
Cooler temperature criteria was met.	✓			
II. GC/MS Instrument performance check				
Was PFK exact mass 380.9760 verified?	✓			
Were the retention time windows established for all homologues?	✓			
Was the chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomers ≤ 25% ?	✓			
Is the static resolving power at least 10,000 (10% valley definition)?	✓			
Was the mass resolution adequately check with PFK?	✓			
Was the presence of 1,2,8,9-TCDD and 1,3,4,6,8-PeCDF verified?	✓			
IIIa. Initial calibration				
Was the initial calibration performed at 5 concentration levels?	✓			
Were all percent relative standard deviations (%RSD) ≤ 20% for unlabeled compounds and ≤ 35% for unlabeled compounds?	✓			
Did all calibration standards meet the Ion Abundance Ratio criteria?	✓			
Was the signal to noise ratio for each target compound and labeled compound ≥ 10?	✓			
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all concentrations for the unlabeled compounds and for labeled compounds within QC limits?	✓			
IV. Continuing calibration				
Was a continuing calibration performed at the beginning of each 12 hour period?	✓			
Were all concentrations for the unlabeled compounds and for labeled compounds within QC limits (Method 1613B, Table 6)?	✓			
Did all continuing calibration standards meet the Ion Abundance Ratio criteria?	✓			
V. Blanks				
Was a method blank associated with every sample in this SDG?	✓			
Was a method blank performed for each matrix and whenever a sample extraction was performed?	✓			
Was there contamination in the method blanks?	✓			
VI. Field blanks				
Were field blanks identified in this SDG?		✓		
Were target compounds detected in the field blanks?			✓	
VII. Matrix spike/Matrix spike duplicates				
Were matrix spike (MS) and matrix spike duplicate (MSD) analyzed in this SDG?		✓		
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			✓	

Validation Area	Yes	No	NA	Findings/Comments
VIII. Laboratory control samples				
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
IX. Field duplicates				
Were field duplicate pairs identified in this SDG?		✓		
Were target compounds detected in the field duplicates?			✓	
X. Labeled Compounds				
Were labeled compounds within QC limits (Method 1613B, Table 7)?	✓			
Was the minimum S/N ratio of all labeled compound peaks ≥ 10?	✓			
XI. Compound quantitation				
Did the laboratory LOQs/RLs meet the QAPP LOQs/RLs?	✓			
Were the correct labeled compound, quantitation ion and relative response factor (RRF) used to quantitate the compound?	✓			
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XII. Target compound identification				
For 2,3,7,8 substituted congeners with associated labeled standards, were the retention times of the two quantitation peaks within -1 to 3 sec. of the RT of the labeled standard?	✓			
For 2,3,7,8 substituted congeners without associated labeled standards, were the relative retention times of the two quantitation peaks within 0.005 time units of the RRT measured in the routine calibration?	✓			
For non-2,3,7,8 substituted congeners, were the retention times of the two quantitation peaks within RT established in the performance check solution?	✓			
Did compound spectra contain all characteristic ions listed in the table attached?	✓			
Was the Ion Abundance Ratio for the two quantitation ions within criteria?		✓		
Was the signal to noise ratio for each target compound ≥2.5 and ≥10 for the labeled compound?	✓			
Does the maximum intensity of each specified characteristic ion coincide within ± 2 seconds (includes labeled standards)?	✓			
For PCDF identification, was any signal (S/N ≥ 2.5, at ± seconds RT) detected in the corresponding PCDPE channel?	✓	✓		
Was an acceptable lock mass recorded and monitored?	✓			
XIII. System performance				
System performance was found to be acceptable.	✓			
XIV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

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 #: 48765G21

VALIDATION FINDINGS WOR/UHEET
Blanks

Reviewer: PG
2nd Reviewer:

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

Blank extraction date: 6/29/20 **Blank analysis date:** 7/2/20
Conc. units: ng/kg **Associated samples:** All qual U

Compound	Blank ID	Sample Identification											
	BIF0780-BLK1	5X	3										
O	0.0726	0.363	0.589										
F	0.220	1.1											
Q	0.477	2.385	1.89										
G	1.66	8.3											

LDC #: 48764-1

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported RLs

Page: 1 of 1
Reviewer: 9
2nd Reviewer: 9

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 > RL		Jdets/A
			↓ < RL		U/A
			~~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 #: 48765G21

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: PG
2nd Reviewer:

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

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

$RRF = (A_x)(C_{is})/(A_{is})(C_x)$
average RRF = sum of the RRFs/number of standards
%RSD = 100 * (S/X)

A_x = Area of compound,
C_x = Concentration of compound,
S = Standard deviation of the RRFs,

A_{is} = Area of associated internal standard
C_{is} = Concentration of internal standard
X = Mean of the RRFs

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Reported Average RRF (initial)	Recalculated Average RRF (initial)	Reported RRF (10 std)	Recalculated RRF (10 std)	Reported %RSD	Recalculated %RSD
1	ICAL	7/1/20	2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)	0.822	0.8223	0.8117684	0.8117	6.7	6.7
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)	1.231	1.2310	1.212577	1.2125	11.4	11.4
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)	0.958	0.9576	1.02541	1.0254	10.8	10.8
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)	1.125	1.1246	1.193104	1.1930	12.3	12.3
			OCDF (^{13}C-OCDF)	1.392	1.3922	1.362751	1.3628	8.0	8.0
2			2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)						
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)						
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)						
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)						
			OCDF (^{13}C-OCDF)						
3			2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)						
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)						
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)						
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)						
			OCDF (^{13}C-OCDF)						

Comments: Refer to Initial Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 48765G21

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Reviewer: PG
2nd Reviewer: DX

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

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF
$RRF = (A_x)(C_{is})/(A_{is})(C_x)$

Where: ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
A_x = Area of compound, A_{is} = Area of associated internal standard
C_x = Concentration of compound, C_{is} = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Average RRF (initial)	Reported Conc (CC)	Recalculated Conc (CC)	Reported %D	Recalculated %D
1	20070202	7/2/20	2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)	0.822	0.7756249	0.7756	5.7	5.7
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)	1.231	1.2109160	1.2109	1.6	1.7
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)	0.958	0.9764576	0.9764	2.0	2.0
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)	1.125	1.1701800	1.1701	4.1	4.0
			OCDF (^{13}C-OCDF)	1.392	1.3030900	1.3030	6.4	6.4
2	20070215	7/2/20	2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)	0.822	0.8055136	0.8055	2.0	2.0
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)	1.231	1.2570670	1.2570	2.1	2.2
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)	0.958	0.9913691	0.9913	3.5	3.5
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)	1.125	1.1863840	1.1864	5.5	5.5
			OCDF (^{13}C-OCDF)	1.392	1.2640570	1.2644	9.2	9.2
3			2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)					
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)					
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)					
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)					
			OCDF (^{13}C-OCDF)					

Comments: Refer to Routine Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 48765G21

VALIDATION FINDINGS WORKSHEET
Laboratory Control Sample Results Verification

Reviewer: PG
2nd Reviewer:

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

The percent recoveries (%R) and Relative Percent Difference (RPD) of the laboratoy control sample and laboratory control sample duplicate (if applicable) were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * SSC/SA Where: SSC = Spiked sample concentration
SA = Spike added

RPD = I LCS - LCSD I * 2/(LCS + LCSD) LCS = Laboraotry control sample percent recovery LCSD = Laboratory control sample duplicate percent recovery

LCS ID: BIF0780-BS1

Compound	Spike Added (ng/kg)		Spiked Sample Concentration (ng/kg)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc	Reported	Recalc	Reported	Recalculated
2,3,7,8-TCDD	20.0	NA	19.97	NA	99.9	99.9				
1,2,3,7,8-PeCDD	100		101.79		102	102				
1,2,3,4,7,8-HxCDD	100		99.30		99.3	99.3				
1,2,3,4,7,8,9-HpCDF	100		105.44		105	105				
OCDF	200		182.39		91.2	91.2				

Comments: Refer to Laboratory Control Sample findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 48765F1

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Page: 1 of 1
Reviewer: A
2nd reviewer: A

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

Y N N/A Were all reported results recalculated and verified for all level IV samples?
Y N N/A Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

Concentration = $\frac{(A_x)(I_s)(DF)}{(A_{is})(RRF)(V_o)(\%S)}$

A_x = Area of the characteristic ion (EICP) for the compound to be measured

A_{is} = Area of the characteristic ion (EICP) for the specific internal standard

I_s = Amount of internal standard added in nanograms (ng)

V_o = Volume or weight of sample extract in milliliters (ml) or grams (g).

RRF = Relative Response Factor (average) from the initial calibration

Df = Dilution Factor.

%S = Percent solids, applicable to soil and solid matrices only.

Example:

Sample I.D. 2, D:

Conc. = $\frac{(2.44604+2.0604)(100)(20)(1)}{(5.56765+4.3624e5)(0.9575877)(13.38767)}$

= 9.32 ng/kg

#	Sample ID	Compound	Reported Concentration ng/kg	Calculated Concentration ( )	Qualification
	2	D	9.32		

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0300

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS340	20F0300-01	Sediment	06/16/20
LDW20-SS353	20F0300-02	Sediment	06/16/20
LDW20-SS345	20F0300-03	Sediment	06/16/20
LDW20-SS342	20F0300-04	Sediment	06/16/20
LDW20-SS351	20F0300-05	Sediment	06/16/20
LDW20-SS348	20F0300-06	Sediment	06/16/20
LDW20-SS349	20F0300-07	Sediment	06/16/20
LDW20-SS346	20F0300-08	Sediment	06/16/20
LDW20-SS160	20F0300-09	Sediment	06/16/20
LDW20-SS204	20F0300-10	Sediment	06/16/20
LDW20-SS210	20F0300-11	Sediment	06/16/20
LDW20-SS340MS	20F0300-01MS	Sediment	06/16/20
LDW20-SS340MSD	20F0300-01MSD	Sediment	06/16/20

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 all samples in this SDG were reported between 6.5°C and 7.9°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.

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
BIF0688-SRM1	Phenol Naphthalene Acenaphthylene Acenaphthene Anthracene	39.5 (42-158) 8.02 (33-167) 25.1 (52-148) 34.4 (51-149) 50.1 (57-143)	All samples in SDG 20F0300	J (all 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 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 20F0300

Sample	Compound	Flag	A or P	Reason
LDW20-SS340 LDW20-SS353 LDW20-SS345 LDW20-SS342 LDW20-SS351 LDW20-SS348 LDW20-SS349 LDW20-SS346 LDW20-SS160 LDW20-SS204 LDW20-SS210	Phenol Naphthalene Acenaphthylene Acenaphthene Anthracene	J (all detects) UJ (all non-detects)	P	Standard reference materials (%R)

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0300

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0300

No Sample Data Qualified in this SDG

LDC #: 48765H2a

SDG #: 20F0300

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 8/14/20

Page: 1 of 1

Reviewer: Q

2nd Reviewer: M

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	A	Temp @ 6.5 - 7.9°C - same day
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	RSD ≤ 20%. r^2. 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 /SRM	A/A/A	LCS
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-SS340	20F0300-01	Sediment	06/16/20
2	LDW20-SS353	20F0300-02	Sediment	06/16/20
3	LDW20-SS345	20F0300-03	Sediment	06/16/20
4	LDW20-SS342	20F0300-04	Sediment	06/16/20
5	LDW20-SS351	20F0300-05	Sediment	06/16/20
6	LDW20-SS348	20F0300-06	Sediment	06/16/20
7	LDW20-SS349	20F0300-07	Sediment	06/16/20
8	LDW20-SS346	20F0300-08	Sediment	06/16/20
9	LDW20-SS160	20F0300-09	Sediment	06/16/20
10	LDW20-SS204	20F0300-10	Sediment	06/16/20
11	LDW20-SS210	20F0300-11	Sediment	06/16/20
12	LDW20-SS340MS	20F0300-01MS	Sediment	06/16/20
13	LDW20-SS340MSD	20F0300-01MSD	Sediment	06/16/20
14				

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

A. Phenol	T. 4-Chloroaniline	MM. 4-Chlorophenyl-phenyl ether	FFF. Di-n-octylphthalate	YYY. 2,3,5-Trimethylnaphthalene
B. Bis (2-chloroethyl) ether	U. Hexachlorobutadiene	NN. Fluorene	GGG. Benzo(b)fluoranthene	ZZZ. Perylene
C. 2-Chlorophenol	V. 4-Chloro-3-methylphenol	OO. 4-Nitroaniline	HHH. Benzo(k)fluoranthene	AAAA. Dibenzothiophene
D. 1,3-Dichlorobenzene	W. 2-Methylnaphthalene	PP. 4,6-Dinitro-2-methylphenol	III. Benzo(a)pyrene	BBBB. Benzo(a)fluoranthene
E. 1,4-Dichlorobenzene	X. Hexachlorocyclopentadiene	QQ. N-Nitrosodiphenylamine	JJJ. Indeno(1,2,3-cd)pyrene	CCCC. Benzo(b)fluorene
F. 1,2-Dichlorobenzene	Y. 2,4,6-Trichlorophenol	RR. 4-Bromophenyl-phenylether	KKK. Dibenz(a,h)anthracene	DDDD. cis/trans-Decalin
G. 2-Methylphenol	Z. 2,4,5-Trichlorophenol	SS. Hexachlorobenzene	LLL. Benzo(g,h,i)perylene	EEEE. Biphenyl
H. 2,2'-Oxybis(1-chloropropane)	AA. 2-Chloronaphthalene	TT. Pentachlorophenol	MMM. Bis(2-Chloroisopropyl)ether	FFFF. Retene
I. 4-Methylphenol	BB. 2-Nitroaniline	UU. Phenanthrene	NNN. Aniline	GGGG. C30-Hopane
J. N-Nitroso-di-n-propylamine	CC. Dimethylphthalate	VV. Anthracene	OOO. N-Nitrosodimethylamine	HHHH. 1-Methylphenanthrene
K. Hexachloroethane	DD. Acenaphthylene	WW. Carbazole	PPP. Benzoic Acid	IIII. 1,4-Dioxane
L. Nitrobenzene	EE. 2,6-Dinitrotoluene	XX. Di-n-butylphthalate	QQQ. Benzyl alcohol	JJJJ. Acetophenone
M. Isophorone	FF. 3-Nitroaniline	YY. Fluoranthene	RRR. Pyridine	KKKK. Atrazine
N. 2-Nitrophenol	GG. Acenaphthene	ZZ. Pyrene	SSS. Benzidine	LLLL. Benzaldehyde
O. 2,4-Dimethylphenol	HH. 2,4-Dinitrophenol	AAA. Butylbenzylphthalate	TTT. 1-Methylnaphthalene	MMMM. Caprolactam
P. Bis(2-chloroethoxy)methane	II. 4-Nitrophenol	BBB. 3,3'-Dichlorobenzidine	UUU.Benzo(b)thiophene	NNNN.
Q. 2,4-Dichlorophenol	JJ. Dibenzofuran	CCC. Benzo(a)anthracene	VVV.Benzonaphthothiophene	OOOO.
R. 1,2,4-Trichlorobenzene	KK. 2,4-Dinitrotoluene	DDD. Chrysene	WWW.Benzo(e)pyrene	PPPP.
S. Naphthalene	LL. Diethylphthalate	EEE. Bis(2-ethylhexyl)phthalate	XXX. 2,6-Dimethylnaphthalene	QQQQ.

LDC #: 48765H2a

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS)

Page: 1 of 1
Reviewer: Q
2nd Reviewer: 7

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

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?

#	Date	LCS/LCSD ID	Compound	~~LCS~~ SRM %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		BIF0688-SRM1	A	39.5 (42-158)	( )	( )	All (dets + ND)	J/UJ/P
			S	8.02 (33-167)	( )	( )		
			DD	25.1 (52-148)	( )	( )		
			FF	34.4 (51-149)	( )	( )		
			VV	50.1 (57-143)	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0300

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS340	20F0300-01	Sediment	06/16/20
LDW20-SS353	20F0300-02	Sediment	06/16/20
LDW20-SS345	20F0300-03	Sediment	06/16/20
LDW20-SS342	20F0300-04	Sediment	06/16/20
LDW20-SS351	20F0300-05	Sediment	06/16/20
LDW20-SS348	20F0300-06	Sediment	06/16/20
LDW20-SS349	20F0300-07	Sediment	06/16/20
LDW20-SS346	20F0300-08	Sediment	06/16/20
LDW20-SS160	20F0300-09	Sediment	06/16/20
LDW20-SS204	20F0300-10	Sediment	06/16/20
LDW20-SS210	20F0300-11	Sediment	06/16/20
LDW20-SS340MS	20F0300-01MS	Sediment	06/16/20
LDW20-SS340MSD	20F0300-01MSD	Sediment	06/16/20

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 temperature for samples in this SDG were reported between 6.5°C and 7.9°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	65.7	All samples in SDG 20F0300	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
07/07/20	Pentachlorophenol	25.9	All samples in SDG 20F0300	J (all detects) UJ (all non-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
BIF0688-SRM2	1,4-Dichlorobenzene 1,2-Dichlorobenzene 2,4-Dimethylphenol 1,2,4-Trichlorobenzene	6.95 (34-166) 5.23 (36-162) 19.2 (40-160) 13.9 (38-162)	All samples in SDG 20F0300	J (all 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 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 20F0300

Sample	Compound	Flag	A or P	Reason
LDW20-SS340 LDW20-SS353 LDW20-SS345 LDW20-SS342 LDW20-SS351 LDW20-SS348 LDW20-SS349 LDW20-SS346 LDW20-SS160 LDW20-SS204 LDW20-SS210	N-Nitrosodiphenylamine	J (all detects) UJ (all non-detects)	A	Initial calibration verification (%D)
LDW20-SS340 LDW20-SS353 LDW20-SS345 LDW20-SS342 LDW20-SS351 LDW20-SS348 LDW20-SS349 LDW20-SS346 LDW20-SS160 LDW20-SS204 LDW20-SS210	Pentachlorophenol	J (all detects) UJ (all non-detects)	A	Continuing calibration (%D)
LDW20-SS340 LDW20-SS353 LDW20-SS345 LDW20-SS342 LDW20-SS351 LDW20-SS348 LDW20-SS349 LDW20-SS346 LDW20-SS160 LDW20-SS204 LDW20-SS210	1,4-Dichlorobenzene 1,2-Dichlorobenzene 2,4-Dimethylphenol 1,2,4-Trichlorobenzene	J (all detects) UJ (all non-detects)	P	Standard reference materials (%R)

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0300

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0300

No Sample Data Qualified in this SDG

LDC #: 48765H2b

SDG #: 20F0300

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 8/4/20

Page: 1 of 1

Reviewer: [illegible]

2nd Reviewer: [illegible]

METHOD: GC/MS Polynuclear Aromatic Hydrocarbons (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	A	Temp @ 6.5 - 7.9°C - same day
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/SW	RSD ≤ 20% or r² ≥ 0.990
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 LCS/LCSD	A/SW	LCS
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-SS340	20F0300-01	Sediment	06/16/20
2	LDW20-SS353	20F0300-02	Sediment	06/16/20
3	LDW20-SS345	20F0300-03	Sediment	06/16/20
4	LDW20-SS342	20F0300-04	Sediment	06/16/20
5	LDW20-SS351	20F0300-05	Sediment	06/16/20
6	LDW20-SS348	20F0300-06	Sediment	06/16/20
7	LDW20-SS349	20F0300-07	Sediment	06/16/20
8	LDW20-SS346	20F0300-08	Sediment	06/16/20
9	LDW20-SS160	20F0300-09	Sediment	06/16/20
10	LDW20-SS204	20F0300-10	Sediment	06/16/20
11	LDW20-SS210	20F0300-11	Sediment	06/16/20
12	LDW20-SS340MS	20F0300-01MS	Sediment	06/16/20
13	LDW20-SS340MSD	20F0300-01MSD	Sediment	06/16/20
14				

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

A. Phenol	CC. Dimethylphthalate	EEE. Bis(2-ethylhexyl)phthalate	GGGG. C30-Hopane	I1. Methyl methanesulfonate
B. Bis (2-chloroethyl) ether	DD. Acenaphthylene	FFF. Di-n-octylphthalate	HHHH. 1-Methylphenanthrene	J1. Ethyl methanesulfonate
C. 2-Chlorophenol	EE. 2,6-Dinitrotoluene	GGG. Benzo(b)fluoranthene	IIII. 1,4-Dioxane	K1. o,o',o"-Triethylphosphorothioate
D. 1,3-Dichlorobenzene	FF. 3-Nitroaniline	HHH. Benzo(k)fluoranthene	JJJJ. Acetophenone	L1. n-Phenylene diamine
E. 1,4-Dichlorobenzene	GG. Acenaphthene	III. Benzo(a)pyrene	KKKK. Atrazine	M1. 1,4-Naphthoquinone
F. 1,2-Dichlorobenzene	HH. 2,4-Dinitrophenol	JJJ. Indeno(1,2,3-cd)pyrene	LLLL. Benzaldehyde	N1. N-Nitro-o-toluidine
G. 2-Methylphenol	II. 4-Nitrophenol	KKK. Dibenz(a,h)anthracene	MMMM. Caprolactam	O1. 1,3,5-Trinitrobenzene
H. 2,2'-Oxybis(1-chloropropane)	JJ. Dibenzofuran	LLL. Benzo(g,h,i)perylene	NNNN. 2,6-Dichlorophenol	P1. Pentachlorobenzene
I. 4-Methylphenol	KK. 2,4-Dinitrotoluene	MMM. Bis(2-Chloroisopropyl)ether	OOOO. 1,2-Diphenylhydrazine	Q1. 4-Aminobiphenyl
J. N-Nitroso-di-n-propylamine	LL. Diethylphthalate	NNN. Aniline	PPPP. 3-Methylphenol	R1. 2-Naphthylamine
K. Hexachloroethane	MM. 4-Chlorophenyl-phenyl ether	OOO. N-Nitrosodimethylamine	QQQQ. 3&4-Methylphenol	S1. Triphenylene
L. Nitrobenzene	NN. Fluorene	PPP. Benzoic Acid	RRRR. 4-Dimethyldibenzothiophene (4MDT)	T1. Octachlorostyrene
M. Isophorone	OO. 4-Nitroaniline	QQQ. Benzyl alcohol	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	U1. Famphur
N. 2-Nitrophenol	PP. 4,6-Dinitro-2-methylphenol	RRR. Pyridine	TTTT. 1-Methyldibenzothiophene (1MDT)	V1. 1,4-phenylenediamine
O. 2,4-Dimethylphenol	QQ. N-Nitrosodiphenylamine	SSS. Benzidine	UUUU.. 2,3,4,6-Tetrachlorophenol	W1. Methapyrilene
P. Bis(2-chloroethoxy)methane	RR. 4-Bromophenyl-phenylether	TTT. 1-Methylnaphthalene	VVVV. 1,2,4,5-Tetrachlorobenzene	X1. Pentachloroethane
Q. 2,4-Dichlorophenol	SS. Hexachlorobenzene	UUU.Benzo(b)thiophene	WWWW.. 2-Picoline	Y1. 3,3'-Dimethylbenzidine
R. 1,2,4-Trichlorobenzene	TT. Pentachlorophenol	VVV.Benzonaphthothiophene	XXXX. 3-Methylcholanthrene	Z1. o-Toluidine
S. Naphthalene	UU. Phenanthrene	WWW.Benzo(e)pyrene	YYYY. a,a-Dimethylphenethylamine	A2. 1-Naphthylamine
T. 4-Chloroaniline	VV. Anthracene	XXX. 2,6-Dimethylnaphthalene	ZZZZ. Hexachloropropene	B2. 4-Aminobiphenyl
U. Hexachlorobutadiene	WW. Carbazole	YYY. 2,3,5-Trimethylnaphthalene	A1. N-Nitrosodiethylamine	C2. 4-Nitroquinoline-1-oxide
V. 4-Chloro-3-methylphenol	XX. Di-n-butylphthalate	ZZZ. Perylene	B1. N-Nitrosodi-n-butylamine	D2. Hexachloropene
W. 2-Methylnaphthalene	YY. Fluoranthene	AAAA. Dibenzothiophene	C1. N-Nitrosomethylethylamine	E2. Bis (2-chloro-1-methylethyl) ether
X. Hexachlorocyclopentadiene	ZZ. Pyrene	BBBB. Benzo(a)fluoranthene	D1. N-Nitrosomorpholine	F2. Bifenthrin
Y. 2,4,6-Trichlorophenol	AAA. Butylbenzylphthalate	CCCC. Benzo(b)fluorene	E1. N-Nitrosopyrrolidine	G2. Cyfluthrin
Z. 2,4,5-Trichlorophenol	BBB. 3,3'-Dichlorobenzidine	DDDD. cis/trans-Decalin	F1. Phenacetin	H2. Cypermethrin
AA. 2-Chloronaphthalene	CCC. Benzo(a)anthracene	EEEE. Biphenyl	G1. 2-Acetylaminofluorene	I2. Permethrin (cis/trans)
BB. 2-Nitroaniline	DDD. Chrysene	FFFF. Retene	H1. Pronamide	J2. 5-Nitro-o-toluidine

LDC #: 48765H2b

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

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

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 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 %D ?

#	Date	Standard ID	Compound	Finding %D (Limit: ≤20.0%)	Associated Samples	Qualifications
	6/26/20	S1F0395-SCV1	Q	65.7	All (dets + ND)	J/UJ/A

LDC #: 48765H6b

VALIDATION FINDINGS WORKSHEET

Continuing Calibration

Page: 1 of 1
Reviewer: 9
2nd Reviewer: ℭ

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

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 for each instrument?

Y (N) N/A Were percent differences (%D) ≤20 % and relative response factors (RRF) within the method criteria?

#	Date	Standard ID	Compound	Finding %D (Limit: ≤20.0%)	Finding RRF (Limit)	Associated Samples	Qualifications
	7/7/20	NTK20070703S	TT	25.9		All (dets+ND)	J/UJ/A

CONCAL.2SD

Privileged and Confidential

LDC #: 48765H3b

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS)

Page: 1 of 1
Reviewer:
2nd Reviewer:

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

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?

#	Date	LCS/LCSD ID	Compound	~~LCS~~ SPM %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		B1F0688-SRM2	E	6.95 (34-166)	( )	( )	All (dets + ND)	J/UJ/P
			F	5.23 (36-164)	( )	( )		↓
			O	19.2 (40-160)	( )	( )		
			R	13.9 (38-162)	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
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Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Hexachlorobenzene

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0300

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS340	20F0300-01	Sediment	06/16/20
LDW20-SS353	20F0300-02	Sediment	06/16/20
LDW20-SS345	20F0300-03	Sediment	06/16/20
LDW20-SS342	20F0300-04	Sediment	06/16/20
LDW20-SS351	20F0300-05	Sediment	06/16/20
LDW20-SS348	20F0300-06	Sediment	06/16/20
LDW20-SS349	20F0300-07	Sediment	06/16/20
LDW20-SS346	20F0300-08	Sediment	06/16/20
LDW20-SS160	20F0300-09	Sediment	06/16/20
LDW20-SS204	20F0300-10	Sediment	06/16/20
LDW20-SS210	20F0300-11	Sediment	06/16/20
LDW20-SS340MS	20F0300-01MS	Sediment	06/16/20
LDW20-SS340MSD	20F0300-01MSD	Sediment	06/16/20

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 temperature for samples in this SDG were reported between 6.5°C and 7.9°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 20F0300

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Laboratory Blank Data Qualification Summary - SDG 20F0300

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Field Blank Data Qualification Summary - SDG 20F0300

No Sample Data Qualified in this SDG

LDC #: 48765H3a
SDG #: 20F0300
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 8/14/20
Page: 1 of 1
Reviewer: 1
2nd Reviewer: 1

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	A	Temp @ 6.5 - 7.9°C - same day
II.	GC Instrument Performance Check	A	
III.	Initial calibration/ICV	A / A	RSD ≤ 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-SS340	20F0300-01	Sediment	06/16/20
2	LDW20-SS353	20F0300-02	Sediment	06/16/20
3	LDW20-SS345	20F0300-03	Sediment	06/16/20
4	LDW20-SS342	20F0300-04	Sediment	06/16/20
5	LDW20-SS351	20F0300-05	Sediment	06/16/20
6	LDW20-SS348	20F0300-06	Sediment	06/16/20
7	LDW20-SS349	20F0300-07	Sediment	06/16/20
8	LDW20-SS346	20F0300-08	Sediment	06/16/20
9	LDW20-SS160	20F0300-09	Sediment	06/16/20
10	LDW20-SS204	20F0300-10	Sediment	06/16/20
11	LDW20-SS210	20F0300-11	Sediment	06/16/20
12	LDW20-SS340MS	20F0300-01MS	Sediment	06/16/20
13	LDW20-SS340MSD	20F0300-01MSD	Sediment	06/16/20
14				
15				

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0300

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS340	20F0300-01	Sediment	06/16/20
LDW20-SS353	20F0300-02	Sediment	06/16/20
LDW20-SS345	20F0300-03	Sediment	06/16/20
LDW20-SS342	20F0300-04	Sediment	06/16/20
LDW20-SS351	20F0300-05	Sediment	06/16/20
LDW20-SS348	20F0300-06	Sediment	06/16/20
LDW20-SS349	20F0300-07	Sediment	06/16/20
LDW20-SS346	20F0300-08	Sediment	06/16/20
LDW20-SS160	20F0300-09	Sediment	06/16/20
LDW20-SS204	20F0300-10	Sediment	06/16/20
LDW20-SS210	20F0300-11	Sediment	06/16/20
LDW20-SS204MS	20F0300-10MS	Sediment	06/16/20
LDW20-SS204MSD	20F0300-10MSD	Sediment	06/16/20

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 6.5°C and 7.9°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 20F0300	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

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) 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-SS340	Aroclor-1254 Aroclor-1260	45.5 46.8	J (all detects) J (all detects)	A
LDW20-SS353	Aroclor-1248 Aroclor-1254 Aroclor-1260	45.5 47.1 50.3	J (all detects) J (all detects) J (all detects)	A
LDW20-SS345	Aroclor-1260	43.8	J (all detects)	A
LDW20-SS342	Aroclor-1248 Aroclor-1254 Aroclor-1260	41.1 42.4 42.9	J (all detects) J (all detects)	A
LDW20-SS351	Aroclor-1248 Aroclor-1254 Aroclor-1260	42.4 47.7 49.7	J (all detects) J (all detects) J (all detects)	A
LDW20-SS348	Aroclor-1248 Aroclor-1254 Aroclor-1260	42 48.1 49.5	J (all detects) J (all detects) J (all detects)	A
LDW20-SS349	Aroclor-1248 Aroclor-1254 Aroclor-1260	42 48.8 45.8	J (all detects) J (all detects) J (all detects)	A

Sample	Compound	RPD	Flag	A or P
LDW20-SS346	Aroclor-1248 Aroclor-1254 Aroclor-1260	42.2 46.4 56.2	J (all detects) 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 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 20F0300

Sample	Compound	Flag	A or P	Reason
LDW20-SS340 LDW20-SS353 LDW20-SS345 LDW20-SS342 LDW20-SS351 LDW20-SS348 LDW20-SS349 LDW20-SS346 LDW20-SS160 LDW20-SS204 LDW20-SS210	Aroclor-1260	J (all detects)	A	Initial calibration verification (%D)
LDW20-SS340	Aroclor-1254 Aroclor-1260	J (all detects) J (all detects)	A	Compound quantitation (RPD between two columns)
LDW20-SS353 LDW20-SS342 LDW20-SS351 LDW20-SS348 LDW20-SS349 LDW20-SS346	Aroclor-1248 Aroclor-1254 Aroclor-1260	J (all detects) J (all detects) J (all detects)	A	Compound quantitation (RPD between two columns)
LDW20-SS345	Aroclor-1260	J (all detects)	A	Compound quantitation (RPD between two columns)

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 20F0300

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 20F0300

No Sample Data Qualified in this SDG

LDC #: 48765H3b
SDG #: 20F0300
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 8/4/20
Page: 1 of 1
Reviewer: 1
2nd Reviewer: M

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	A	Temp @ 6.5 - 7.9°C - same day
II.	Initial calibration/ICV	A/SW	RSD ≤ 20%. %R ≤ 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 ~~LCSD~~	A/A	LCS
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-SS340	20F0300-01	Sediment	06/16/20
2	LDW20-SS353	20F0300-02	Sediment	06/16/20
3	LDW20-SS345	20F0300-03	Sediment	06/16/20
4	LDW20-SS342	20F0300-04	Sediment	06/16/20
5	LDW20-SS351	20F0300-05	Sediment	06/16/20
6	LDW20-SS348	20F0300-06	Sediment	06/16/20
7	LDW20-SS349	20F0300-07	Sediment	06/16/20
8	LDW20-SS346	20F0300-08	Sediment	06/16/20
9	LDW20-SS160	20F0300-09	Sediment	06/16/20
10	LDW20-SS204	20F0300-10	Sediment	06/16/20
11	LDW20-SS210	20F0300-11	Sediment	06/16/20
12	LDW20-SS204MS	20F0300-10MS	Sediment	06/16/20
13	LDW20-SS204MSD	20F0300-10MSD	Sediment	06/16/20
14				
15				
16				
17				

VALIDATION FINDINGS WORKSHEET

METHOD: Pesticides

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

Notes:_____

LDC #: 18765H36

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

Page: 1 of 1
Reviewer: 9
2nd Reviewer: 9

METHOD: ✓ GC ___ HPLC

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
	7/30	3140056-5A1	1C	BB	21.3	All (dets)	J/UJ/A

ICV-gc.wpd

LDC #: 48765H36

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Reviewer: 9
2nd Reviewer: 0K

METHOD: ✓ GC ___ HPLC

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 relative percent differences of detected compounds between two columns/detectors ≤40%?
If no, please see findings bellow.

#	Compound Name	Sample ID	%RPD Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	AA	1	45.5	J (all detects) / A
	BB		46.8	
	2	2	45.5	
	AA		47.1	
	BB		50.3	
	BB	3	43.8	
	2	4	41.1	
	AA		42.4	
	BB		42.9	
	2	5	42.4	
	AA		47.7	
	BB		49.7	
	2	6	42	
	AA		48.1	
	BB		49.5	

LDC #: 48765H6

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Reviewer: 9
2nd Reviewer: 9

METHOD: ✓ GC __ HPLC

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 relative percent differences of detected compounds between two columns/detectors ≤40%?
If no, please see findings bellow.

#	Compound Name	Sample ID	%RPD Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	2	7	42	J+ (3/A)
	AA		48.8	
	BB		45.8	
	2	8	42.2	
	AA		46.4	
	BB		36.2	

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Metals

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0300

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS340	20F0300-01	Sediment	06/16/20
LDW20-SS353	20F0300-02	Sediment	06/16/20
LDW20-SS345	20F0300-03	Sediment	06/16/20
LDW20-SS342	20F0300-04	Sediment	06/16/20
LDW20-SS351	20F0300-05	Sediment	06/16/20
LDW20-SS348	20F0300-06	Sediment	06/16/20
LDW20-SS349	20F0300-07	Sediment	06/16/20
LDW20-SS346	20F0300-08	Sediment	06/16/20
LDW20-SS160	20F0300-09	Sediment	06/16/20
LDW20-SS204	20F0300-10	Sediment	06/16/20
LDW20-SS210	20F0300-11	Sediment	06/16/20
LDW20-SS340MS	20F0300-01MS	Sediment	06/16/20
LDW20-SS340MSD	20F0300-01MSD	Sediment	06/16/20
LDW20-SS340DUP	20F0300-01DUP	Sediment	06/16/20

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	0.017 ug/L	All samples in SDG 20F0300

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-SS340	Silver	0.2 ug/L	0.2U ug/L
LDW20-SS353	Silver	0.25 ug/L	0.25U ug/L
LDW20-SS345	Silver	0.24 ug/L	0.24U ug/L
LDW20-SS342	Silver	0.23 ug/L	0.23U ug/L

Sample	Analyte	Reported Concentration	Modified Final Concentration
LDW20-SS351	Silver	0.27 ug/L	0.27U ug/L
LDW20-SS348	Silver	0.26 ug/L	0.26U ug/L
LDW20-SS349	Silver	0.25 ug/L	0.25U ug/L
LDW20-SS346	Silver	0.24 ug/L	0.24U ug/L
LDW20-SS160	Silver	0.1 ug/L	0.1U ug/L
LDW20-SS204	Silver	0.04 ug/L	0.04U ug/L
LDW20-SS210	Silver	0.08 ug/L	0.08U ug/L

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)

ICP-MS was not utilized in this SDG.

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 eleven samples.

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

Duwamish AOC4
Metals - Data Qualification Summary - SDG 20F0300

No Sample Data Qualified in this SDG

Duwamish AOC4
Metals - Laboratory Blank Data Qualification Summary - SDG 20F0300

Sample	Analyte	Modified Final Concentration	A or P
LDW20-SS340	Silver	0.2U ug/L	A
LDW20-SS353	Silver	0.25U ug/L	A
LDW20-SS345	Silver	0.24U ug/L	A
LDW20-SS342	Silver	0.23U ug/L	A
LDW20-SS351	Silver	0.27U ug/L	A
LDW20-SS348	Silver	0.26U ug/L	A
LDW20-SS349	Silver	0.25U ug/L	A
LDW20-SS346	Silver	0.24U ug/L	A
LDW20-SS160	Silver	0.1U ug/L	A
LDW20-SS204	Silver	0.04U ug/L	A
LDW20-SS210	Silver	0.08U ug/L	A

Duwamish AOC4
Metals - Field Blank Data Qualification Summary - SDG 20F0300

No Sample Data Qualified in this SDG

LDC #: 48765H4a

SDG #: 20F0300

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 8/17/20

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	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-SS340	20F0300-01	Sediment	06/16/20
2	LDW20-SS353	20F0300-02	Sediment	06/16/20
3	LDW20-SS345	20F0300-03	Sediment	06/16/20
4	LDW20-SS342	20F0300-04	Sediment	06/16/20
5	LDW20-SS351	20F0300-05	Sediment	06/16/20
6	LDW20-SS348	20F0300-06	Sediment	06/16/20
7	LDW20-SS349	20F0300-07	Sediment	06/16/20
8	LDW20-SS346	20F0300-08	Sediment	06/16/20
9	LDW20-SS160	20F0300-09	Sediment	06/16/20
10	LDW20-SS204	20F0300-10	Sediment	06/16/20
11	LDW20-SS210	20F0300-11	Sediment	06/16/20
12	LDW20-SS340MS	20F0300-01MS	Sediment	06/16/20
13	LDW20-SS340MSD	20F0300-01MSD	Sediment	06/16/20
14	LDW20-SS340DUP	20F0300-01DUP	Sediment	06/16/20
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	Hg

Analysis Method

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

Laboratory Blank Contamination (PB/ICB/CCB) Reviewer:CR

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

				Sample Identification										
Analyte	**PB (units)**	**Maximum ICB/CCB (ug/L)**	**Action Level**	1	2	3	4	5	6	7	8	9	10	11
Ag		0.017		0.2	0.25	0.24	0.23	0.27	0.26	0.25	0.24	0.1	0.04	0.08

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 17, 2020

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0300

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS340	20F0300-01	Sediment	06/16/20
LDW20-SS353	20F0300-02	Sediment	06/16/20
LDW20-SS345	20F0300-03	Sediment	06/16/20
LDW20-SS342	20F0300-04	Sediment	06/16/20
LDW20-SS351	20F0300-05	Sediment	06/16/20
LDW20-SS348	20F0300-06	Sediment	06/16/20
LDW20-SS349	20F0300-07	Sediment	06/16/20
LDW20-SS346	20F0300-08	Sediment	06/16/20
LDW20-SS160	20F0300-09	Sediment	06/16/20
LDW20-SS204	20F0300-10	Sediment	06/16/20
LDW20-SS210	20F0300-11	Sediment	06/16/20
LDW20-SS340DUP	20F0300-01DUP	Sediment	06/16/20

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

Laboratory control samples (LCS) were analyzed as required by the methods. Percent recoveries (%R) 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 20F0300

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 20F0300

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 20F0300

No Sample Data Qualified in this SDG

LDC #: 48765H6
SDG #: 20F0300
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 8/17/20
Page: 1 of 1
Reviewer: CR
2nd Reviewer: A

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
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-SS340	20F0300-01	Sediment	06/16/20
2	LDW20-SS353	20F0300-02	Sediment	06/16/20
3	LDW20-SS345	20F0300-03	Sediment	06/16/20
4	LDW20-SS342	20F0300-04	Sediment	06/16/20
5	LDW20-SS351	20F0300-05	Sediment	06/16/20
6	LDW20-SS348	20F0300-06	Sediment	06/16/20
7	LDW20-SS349	20F0300-07	Sediment	06/16/20
8	LDW20-SS346	20F0300-08	Sediment	06/16/20
9	LDW20-SS160	20F0300-09	Sediment	06/16/20
10	LDW20-SS204	20F0300-10	Sediment	06/16/20
11	LDW20-SS210	20F0300-11	Sediment	06/16/20
12	LDW20-SS340DUP	20F0300-01DUP	Sediment	06/16/20
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
QC: 12	TS

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Polychlorinated Dioxins/Dibenzofurans

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0300

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS353	20F0300-02	Sediment	06/16/20
LDW20-SS351	20F0300-05	Sediment	06/16/20
LDW20-SS349	20F0300-07	Sediment	06/16/20
LDW20-SS210	20F0300-11	Sediment	06/16/20

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 were reported between 6.5°C and 7.9°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 Total HpCDD	0.140 ng/Kg 0.0330 ng/Kg 0.535 ng/Kg 1.37 ng/Kg 6.33 ng/Kg 0.284 ng/Kg	All samples in SDG 20F0300

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-SS210	1,2,3,4,7,8,9-HpCDF	0.654 ng/Kg	0.654U 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 20F0300	All compounds reported as estimated maximum possible concentration (EMPC) and greater than the reporting limit.	J (all detects)	A
All samples in SDG 20F0300	All compounds reported as estimated maximum possible concentration (EMPC) and less than the reporting limit.	U (all non-detects)	A
All samples in SDG 20F0300	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 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 20F0300

Sample	Compound	Flag	A or P	Reason
LDW20-SS353 LDW20-SS351 LDW20-SS349 LDW20-SS210	All compounds reported as estimated maximum possible concentration (EMPC) and greater than the reporting limit.	J (all detects)	A	Compound quantitation (EMPC)
LDW20-SS353 LDW20-SS351 LDW20-SS349 LDW20-SS210	All compounds reported as estimated maximum possible concentration (EMPC) and less than the reporting limit.	U (all non-detects)	A	Compound quantitation (EMPC)
LDW20-SS353 LDW20-SS351 LDW20-SS349 LDW20-SS210	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 20F0300

Sample	Compound	Modified Final Concentration	A or P
LDW20-SS210	1,2,3,4,7,8,9-HpCDF	0.654U ng/Kg	A

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Field Blank Data Qualification Summary - SDG 20F0300

No Sample Data Qualified in this SDG

LDC #: 48765H21 **VALIDATION COMPLETENESS WORKSHEET** Date: 8/12/20
SDG #: 20F0300 Stage 2B Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer: [illegible]
2nd Reviewer: [illegible]

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	A	Temp @ 6.5-7.9°C - Same day
II.	HRGC/HRMS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	RSD ≤ 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 / SRM	A	LCS
IX.	Field duplicates	N	
X.	Labeled Compounds	A	
XI.	Compound quantitation RL/LOQ/LODs	SW	
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-SS353	20F0300-02	Sediment	06/16/20
2	LDW20-SS351	20F0300-05	Sediment	06/16/20
3	LDW20-SS349	20F0300-07	Sediment	06/16/20
4	LDW20-SS210	20F0300-11	Sediment	06/16/20
5				
6				
7				
8				
9				
10				

Notes:

VALIDATION FINDINGS WORKSHEET

METHOD: HRGC/HRMS Dioxins/Dibenzofurans

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 #: 48765H21

VALIDATION FINDINGS WOR/UHEET
Blanks

Reviewer: PG
2nd Reviewer:

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

Blank extraction date: 7/6/20 **Blank analysis date:** 7/9/20
Conc. units: ng/kg **Associated samples:** All qual U

Compound	Blank ID	Sample Identification											
	BIF0803-BLK1	5X	4										
O	0.140	0.7											
P	0.0330	0.165	0.654										
F	0.535	2.675											
Q	1.37	6.85											
G	6.33	31.65											
U	0.284	1.42											

LDC #: 48765i4/

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported RLs

Page: 1 of 1
Reviewer: CA
2nd Reviewer: AA

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
			↓ - PC		U/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

LDC Report# 48765I3b

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 14, 2020

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0337

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT416	20F0337-01	Sediment	06/17/20
LDW20-IT416DL	20F0337-01DL	Sediment	06/17/20
LDW20-IT418	20F0337-02	Sediment	06/17/20
LDW20-IT423	20F0337-03	Sediment	06/17/20
LDW20-IT424	20F0337-04	Sediment	06/17/20
LDW20-IT426	20F0337-05	Sediment	06/17/20
LDW20-IT419	20F0337-06	Sediment	06/17/20
LDW20-IT416MS	20F0337-01MS	Sediment	06/17/20
LDW20-IT416MSD	20F0337-01MSD	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:

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 10.4°C and 12.8°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
07/02/20	SIG0056-SCV1	1C	Aroclor-1260	21.8	All samples in SDG 20F0337	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 with the following exceptions:

Spike ID (Associated Samples)	Compound	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW20-IT416MS/MSD (LDW20-IT416 LDW20-IT416DL)	Aroclor-1016	197 (56-120)	193 (56-120)	NA	-

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

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-IT416	Aroclor-1254 Aroclor-1260	46.9 53.1	J (all detects) J (all detects)	A
LDW20-IT423	Aroclor-1248 Aroclor-1254 Aroclor-1260	55.3 43.2 51.7	J (all detects) J (all detects) J (all detects)	A
LDW20-IT426	Aroclor-1248 Aroclor-1254 Aroclor-1260	54.1 42.5 57.7	J (all detects) J (all detects) J (all detects)	A
LDW20-IT416DL	Aroclor-1254	47.1	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-IT416	Aroclor-1242	Results exceeded calibration range.	Not reportable	-
LDW20-IT416DL	All compounds except Aroclor-1242	Results from undiluted analyses were more usable.	Not reportable	-

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 20F0337

Sample	Compound	Flag	A or P	Reason
LDW20-IT416 LDW20-IT418 LDW20-IT423 LDW20-IT424 LDW20-IT426 LDW20-IT419	Aroclor-1260	J (all detects)	A	Initial calibration verification (%D)
LDW20-IT416	Aroclor-1254 Aroclor-1260	J (all detects) J (all detects)	A	Compound quantitation (RPD between two columns)
LDW20-IT423 LDW20-IT426	Aroclor-1248 Aroclor-1254 Aroclor-1260	J (all detects) J (all detects) J (all detects)	A	Compound quantitation (RPD between two columns)
LDW20-IT416DL	Aroclor-1254	J (all detects)	A	Compound quantitation (RPD between two columns)
LDW20-IT416	Aroclor-1242	Not reportable	-	Overall assessment of data
LDW20-IT416DL	All compounds except Aroclor-1242	Not reportable	-	Overall assessment of data

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 20F0337

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 20F0337

No Sample Data Qualified in this SDG

LDC #: 48765I3b
SDG #: 20F0337
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 8/12/20
Page: 1 of 1
Reviewer: CF
2nd Reviewer: MC

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	A	Temp @ 12.8, 10.4 °C - Same day
II.	Initial calibration/ICV	A/A	RSD ≤ 20%. ICV ≤ 20%
III.	Continuing calibration	A	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes /TS	A/A	
VII.	Matrix spike/Matrix spike duplicates	SW	
VIII.	Laboratory control samples /SRM	A	LCS/D
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-IT416	20F0337-01	Sediment	06/17/20
2	LDW20-IT416RE DL	20F0337-01RE DL	Sediment	06/17/20
3	LDW20-IT418	20F0337-02	Sediment	06/17/20
4	LDW20-IT423	20F0337-03	Sediment	06/17/20
5	LDW20-IT424	20F0337-04	Sediment	06/17/20
6	LDW20-IT426	20F0337-05	Sediment	06/17/20
7	LDW20-IT419	20F0337-06	Sediment	06/17/20
8	LDW20-IT416MS	20F0337-01MS	Sediment	06/17/20
9	LDW20-IT416MSD	20F0337-01MSD	Sediment	06/17/20
10				
11				
12				
13				

Notes:

VALIDATION FINDINGS WORKSHEET

METHOD: Pesticides

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

Notes:_____

LDC #: 18765136

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

Page: 1 of 1
Reviewer: 9
2nd Reviewer: 4

METHOD: V **GC** __ **HPLC**

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
	7/20	5/G0056SCV1	IC	BB	21.8	All (dets)	J/UN/D

LDC #: 48765136

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

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

METHOD: ✓ **GC** __ **HPLC**

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

[✓ Y] N N/A Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG?
[✓ Y] N N/A Was an MS/MSD analyzed every 20 samples for each matrix or whenever a sample extraction was performed?
Y [✓ N] N/A Were the MS/MSD percent recoveries (%R) and relative percent differences (RPD) within QC limits?

#	MS/MSD ID	Compound	MS %R (Limits)	MSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	8/9	V	197 (56-120)	193 (56-120)	( )	1-2 (ND)	Jdets/A
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
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			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		

LDC #: 48765/36

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Page: 1 of 1
Reviewer: 9
2nd Reviewer: 9

METHOD: / GC __ HPLC

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 relative percent differences of detected compounds between two columns/detectors ≤40%?
If no, please see findings bellow.

#	Compound Name	Sample ID	%RPD Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	AA	1	46.9	J+ b3 / A
	BB		53.1	
	Z	4	55.3	
	AA		43.2	
	BB		51.7	
	Z	6	54.1	
	AA		42.5	
	BB		57.7	
	AA	2	47.1	

LDC #: 18765136

VALIDATION FINDINGS WORKSHEET
Overall Assessment of Data

Page: 1 of 1
Reviewer: G
2nd Reviewer: AY

METHOD: / **GC** __ **HPLC**

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 Samples	Qualifications
	1	Y* = edib mage		NR/A
	2	All except * Y		A

Comments: _____

OVRNew.wpd

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Arsenic

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0337

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT416	20F0337-01	Sediment	06/17/20
LDW20-IT418	20F0337-02	Sediment	06/17/20
LDW20-IT423	20F0337-03	Sediment	06/17/20
LDW20-IT424	20F0337-04	Sediment	06/17/20
LDW20-IT426	20F0337-05	Sediment	06/17/20
LDW20-IT419	20F0337-06	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 method:

Arsenic by Environmental Protection Agency (EPA) SW 846 Method 6020A

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 method.

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 method. No contaminants were found in the 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. 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. Standard Reference Materials

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

XI. Field Duplicates

No field duplicates were identified in this SDG.

XII. Internal Standards (ICP-MS)

ICP-MS was not utilized in this SDG.

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 method. No results were rejected in this SDG.

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

Duwamish AOC4
Arsenic - Data Qualification Summary - SDG 20F0337

No Sample Data Qualified in this SDG

Duwamish AOC4
Arsenic - Laboratory Blank Data Qualification Summary - SDG 20F0337

No Sample Data Qualified in this SDG

Duwamish AOC4
Arsenic - Field Blank Data Qualification Summary - SDG 20F0337

No Sample Data Qualified in this SDG

LDC #: 48765l4a

SDG #: 20F0337

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 8/7/20

Page: 1 of 1

Reviewer: E

2nd Reviewer: A

METHOD: Arsenic ~~75~~ (EPA SW 846 Method 6020A)

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 4A	
II.	ICP/MS Tune	A	
III.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	A	
VI.	Field Blanks	N	
VII.	Matrix Spike/Matrix Spike Duplicates	N	CS
VIII.	Duplicate sample analysis	N	CS
IX.	Serial Dilution	N	
X.	Laboratory control samples	A	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-IT416	20F0337-01	Sediment	06/17/20
2	LDW20-IT418	20F0337-02	Sediment	06/17/20
3	LDW20-IT423	20F0337-03	Sediment	06/17/20
4	LDW20-IT424	20F0337-04	Sediment	06/17/20
5	LDW20-IT426	20F0337-05	Sediment	06/17/20
6	LDW20-IT419	20F0337-06	Sediment	06/17/20
7				
8				
9				
10				
11				
12				
13				

Notes:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0337

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT416	20F0337-01	Sediment	06/17/20
LDW20-IT418	20F0337-02	Sediment	06/17/20
LDW20-IT423	20F0337-03	Sediment	06/17/20
LDW20-IT424	20F0337-04	Sediment	06/17/20
LDW20-IT426	20F0337-05	Sediment	06/17/20
LDW20-IT419	20F0337-06	Sediment	06/17/20
LDW20-IT426MS	20F0337-05MS	Sediment	06/17/20
LDW20-IT426MSRE	20F0337-05MSRE	Sediment	06/17/20
LDW20-IT426DUP	20F0337-05DUP	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

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

Laboratory control samples (LCS) were analyzed as required by the methods. Percent recoveries (%R) 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 20F0337

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 20F0337

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 20F0337

No Sample Data Qualified in this SDG

LDC #: 48765I6
SDG #: 20F0337
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 8/17/20
Page: 1 of 1
Reviewer: CF
2nd Reviewer: CF

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	SW	
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	A	LCS
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-IT416	20F0337-01	Sediment	06/17/20
2	LDW20-IT418	20F0337-02	Sediment	06/17/20
3	LDW20-IT423	20F0337-03	Sediment	06/17/20
4	LDW20-IT424	20F0337-04	Sediment	06/17/20
5	LDW20-IT426	20F0337-05	Sediment	06/17/20
6	LDW20-IT419	20F0337-06	Sediment	06/17/20
7	LDW20-IT426MS	20F0337-05MS	Sediment	06/17/20
8	LDW20-IT426MSD	20F0337-05MSD	Sediment	06/17/20
9	LDW20-IT426DUP	20F0337-05DUP	Sediment	06/17/20
10				
11				
12				
13				
14				
15				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1 to 6	Total solids, TOC
QC: 7, 8	TOC
9	TS, TOC

METHOD: Inorganics

MS analysis was performed by the laboratory. All MS percent recoveries (%R) were within the acceptable limits with the following exceptions.

MS ID	Matrix	Analyte	MS %R	%R Limit	Assocaited	Qualification	Det/ND
7	s	TOC	147	75-125	5	No qual (re-analyzed and within QC limits)	Det

Comments:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Polychlorinated Dioxins/Dibenzofurans

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0337

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT419	20F0337-06	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 temperature for samples in this SDG was reported at 12.8°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.

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 Total HpCDD	0.140 ng/Kg 0.0330 ng/Kg 0.535 ng/Kg 1.37 ng/Kg 6.33 ng/Kg 0.284 ng/Kg	All samples in SDG 20F0337

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-IT419	1,2,3,4,7,8,9-HpCDF OCDF	0.099 ng/Kg 2.32 ng/Kg	0.099U ng/Kg 2.32U 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

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 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 20F0337

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG 20F0337

Sample	Compound	Modified Final Concentration	A or P
LDW20-IT419	1,2,3,4,7,8,9-HpCDF OCDF	0.099U ng/Kg 2.32U ng/Kg	A

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Field Blank Data Qualification Summary - SDG 20F0337

No Sample Data Qualified in this SDG

LDC #: 48765I21
SDG #: 20F0337
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 8/13/20
Page: 1 of 1
Reviewer: V
2nd Reviewer: M

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	A	Temp @ 12.8°C - same day
II.	HRGC/HRMS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	RSD ≤ 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	CS
VIII.	Laboratory control samples /SRM	A	LCS
IX.	Field duplicates	N	
X.	Labeled Compounds	A	
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-IT419	20F0337-06	Sediment	06/17/20
2				
3				
4				
5				
6				
7				
8				
9				
10				

Notes:

VALIDATION FINDINGS WORKSHEET

METHOD: HRGC/HRMS Dioxins/Dibenzofurans

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 #: 48765I21

VALIDATION FINDINGS WOR/UHEET
Blanks

Reviewer: PG
2nd Reviewer:

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

Blank extraction date: 7/6/20 **Blank analysis date:** 7/9/20
Conc. units: ng/kg **Associated samples:** All qual U

Compound	Blank ID	Sample Identification											
	BIF0803-BLK1	5X	1										
O	0.140	0.7											
P	0.0330	0.165	0.099										
F	0.535	2.675											
Q	1.37	6.85	2.32										
G	6.33	31.65											
U	0.284	1.42											

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 14, 2020

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0361

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT319	20F0361-01	Sediment	06/19/20
LDW20-IT319DL	20F0361-01DL	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 temperature for samples in this SDG was reported at 8.8°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
07/02/20	SIG0056-SCV1	1C	Aroclor-1260	21.8	All samples in SDG 20F0361	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 with the following exceptions:

Sample	Surrogate	%R (Limits)	Affected Compound	Flag	A or P
LDW20-IT319	Decachlorobiphenyl	146 (40-126)	All compounds	J (all detects)	A

All internal standard areas and retention times were within QC limits with the following exceptions:

Sample	Internal Standards	Area (Limits)	Affected Compound	Flag	A or P
LDW20-IT319	Hexabromobiphenyl	38 (50-200)	Aroclor-1260	J (all detects)	A

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.

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-IT319DL	All compounds	Results from undiluted analyses were more usable.	Not reportable	-

Due to ICV %D, surrogate %R, and internal standard area, 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 20F0361

Sample	Compound	Flag	A or P	Reason
LDW20-IT319	Aroclor-1260	J (all detects)	A	Initial calibration verification (%D)
LDW20-IT319	All compounds	J (all detects)	A	Surrogates (%R)
LDW20-IT319	Aroclor-1260	J (all detects)	A	Internal standards (area)
LDW20-IT319DL	All compounds	Not reportable	-	Overall assessment of data

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 20F0361

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 20F0361

No Sample Data Qualified in this SDG

LDC #: 48765J3b

SDG #: 20F0361

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 8/17/20

Page: 1 of 1

Reviewer:

2nd Reviewer: A

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	A	Temp @ 8.8°C
II.	Initial calibration/ICV	A/A	
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	CS
VIII.	Laboratory control samples / SRM	A/A	LCS
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-IT319	20F0361-01	Sediment	06/19/20
2	LDW20-IT319RE	20F0361-01RE	Sediment	06/19/20
3				
4				
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11				
12				
13				

Notes:

VALIDATION FINDINGS WORKSHEET

METHOD: Pesticides

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

Notes:_____

_____

LDC #: 48765136

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

Reviewer: 9
2nd Reviewer: 9

METHOD: ✓ GC __ HPLC

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
	7/6/20	SKF0056SCV1	1C	BB	21.3	All (dets)	J (all) / A
							~~J (all) 2, A, PB~~

LDC #: 43765-36

VALIDATION FINDINGS WORKSHEET
Surrogate Recovery

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

METHOD: ✓ GC __ HPLC

Are surrogates required by the method? Yes___ or No____.

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

Y N N/A Were surrogates spiked into all samples and blanks?

Y N N/A Did all surrogate recoveries (%R) meet the QC limits?

#	Sample ID	Detector/ Column	Surrogate Compound	%R (Limits)	Qualifications
	1 (dets+NDs)		O	0 146 (40-126)	dets/A
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	

	Surrogate Compound		Surrogate Compound		Surrogate Compound		Surrogate Compound		Surrogate Compound
A	Chlorobenzene (CBZ)	G	Octacosane	M	Benzo(e)Pyrene	S	1-Chloro-3-Nitrobenzene	Y	Tetrachloro-m- xylene
B	4-Bromofluorobenzene (BFB)	H	Ortho-Terphenyl	N	Terphenyl-D14	T	3,4-Dinitrotoluene	Z	1,2-Dinitrobenzene
C	a,a,a-Trifluorotoluene	I	Fluorobenzene (FBZ)	O	Decachlorobiphenyl (DCB)	U	Tripentyltin		
D	Bromochlorobenene	J	n-Triacontane	P	1-methylnaphthalene	V	Tri-n-propyltin		
E	1,4-Dichlorobutane	K	Hexacosane	Q	Dichlorophenyl Acetic Acid (DCAA)	W	Tributyl Phosphate		
F	1,4-Difluorobenzene (DFB)	L	Bromobenzene	R	4-Nitrophenol	X	Triphenyl Phosphate		

LDC #: 43765T2b

VALIDATION FINDINGS WORKSHEET
Internal Standards

Page: 1 of 1
Reviewer:
2nd Reviewer: GL

METHOD: LC/MS Perchlorate

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	Area (Limits)	RT (Limits)	Qualifications
		1 (Lot 5)	HBB	38 (50 - 200)		J (all samples) / A (BB)

HBB = Hexabromobiphenyl

LDC #: 48765j36

VALIDATION FINDINGS WORKSHEET
Overall Assessment of Data

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

METHOD: ✓ **GC** ___ **HPLC**

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 Samples	Qualifications
	2	All (diluted)		NR/A

Comments: _____

OVRNew.wpd

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Arsenic

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0361

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT319	20F0361-01	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 method:

Arsenic by Environmental Protection Agency (EPA) SW 846 Method 6020A

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 method.

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 method. No contaminants were found in the 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. 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

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)

ICP-MS was not utilized in this SDG.

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 method. No results were rejected in this SDG.

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

Duwamish AOC4
Arsenic - Data Qualification Summary - SDG 20F0361

No Sample Data Qualified in this SDG

Duwamish AOC4
Arsenic - Laboratory Blank Data Qualification Summary - SDG 20F0361

No Sample Data Qualified in this SDG

Duwamish AOC4
Arsenic - Field Blank Data Qualification Summary - SDG 20F0361

No Sample Data Qualified in this SDG

LDC #: 48765J4a

SDG #: 20F0361

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 8/7/20

Page: 1 of 1

Reviewer: G

2nd Reviewer: G

METHOD: Arsenic ~~75a~~ (EPA SW 846 Method 6020A)

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	A	
VI.	Field Blanks	N	
VII.	Matrix Spike/Matrix Spike Duplicates	N	CS
VIII.	~~Duplicate~~ sample analysis	N	CS
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-IT319	20F0361-01	Sediment	06/19/20
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Notes:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0361

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT319	20F0361-01	Sediment	06/19/20
LDW20-IT319DUP	20F0361-01DUP	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:

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 with the following exceptions:

Blank ID	Analyte	Maximum Concentration	Associated Samples
ICB/CCB	Total organic carbon	0.02%	All samples in SDG 20F0361

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.

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

Laboratory control samples (LCS) were analyzed as required by the methods. Percent recoveries (%R) 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 20F0361

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 20F0361

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 20F0361

No Sample Data Qualified in this SDG

LDC #: 48765J6 **VALIDATION COMPLETENESS WORKSHEET** Date: 8/7/20
SDG #: 20F0361 Stage 2B Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer: CG
2nd Reviewer: CG

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	SW	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	CS
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	A	LCS
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-IT319	20F0361-01	Sediment	06/19/20
2	LDW20-IT319DUP	20F0361-01DUP	Sediment	06/19/20
3				
4				
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14				
15				

Notes:

Sample Specific Element Reference

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1	Total solids, TOC
QC: 2	TS

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

Reviewer:CR

METHOD: Inorganics
Soil preparation factor applied (if applicable):

Sample Concentration, unless otherwise noted: % Associated Samples: All

				Sample Identification								
Analyte	**PB (units)**	**Maximum ICB/CCB (%)**	**Action Level**	No qualifiers								
TOC		0.02	0.2									

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

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 14, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0405

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT383	20F0405-01	Sediment	06/23/20
LDW20-IT383MS	20F0405-01MS	Sediment	06/23/20
LDW20-IT383MSD	20F0405-01MSD	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 temperature for samples in this SDG was reported at 7.2°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%.

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 20F0405

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0405

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0405

No Sample Data Qualified in this SDG

LDC #: 48765K2b
SDG #: 20F0405
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 8/14/20
Page: 1 of 1
Reviewer: C
2nd Reviewer: C

METHOD: GC/MS Polynuclear Aromatic Hydrocarbons (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	A	Temp @ 7.2°C - Same day
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	RSD≤20%. ICV≤30%
IV.	Continuing calibration	A	CCV≤30% 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples /SRM	A/A	LCS
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-IT383	20F0405-01	Sediment	06/23/20
2	LDW20-IT383MS	20F0405-01MS	Sediment	06/23/20
3	LDW20-IT383MSD	20F0405-01MSD	Sediment	06/23/20
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Notes:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 14, 2020

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0405

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT383	20F0405-01	Sediment	06/23/20
LDW20-IT313	20F0405-02	Sediment	06/23/20
LDW20-IT313DL	20F0405-02DL	Sediment	06/23/20
LDW20-IT304	20F0405-03	Sediment	06/23/20
LDW20-IT304DL	20F0405-03DL	Sediment	06/23/20
LDW20-IT415	20F0405-04	Sediment	06/23/20
LDW20-IT415DL	20F0405-04DL	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 between 6.4°C and 7.2°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 20F0405	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	Internal Standards	Area (Limits)	Affected Compound	Flag	A or P
LDW20-IT383	Hexabromobiphenyl	48 (50-200)	Aroclor-1260	J (all detects)	P

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-IT383	Aroclor-1248	58.2	J (all detects)	A
LDW20-IT415	Aroclor-1254 Aroclor-1260	56.8 40.4	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-IT313	Aroclor-1254	Results exceeded calibration range.	Not reportable	-
LDW20-IT313DL	All compounds except Aroclor-1254	Results from undiluted analyses were more usable.	Not reportable	-
LDW20-IT304	Aroclor-1248 Aroclor-1254 Aroclor-1260	Results exceeded calibration range.	Not reportable	-
LDW20-IT304DL	All compounds except Aroclor-1248 Aroclor-1254 Aroclor-1260	Results from undiluted analyses were more usable.	Not reportable	-
LDW20-IT415	Aroclor-1248 Aroclor-1254	Results exceeded calibration range.	Not reportable	-
LDW20-IT415DL	All compounds except Aroclor-1248 Aroclor-1254	Results from undiluted analyses were more usable.	Not reportable	-

Due to ICV %D, internal standard area, and RPD between two columns, data were qualified as estimated in four 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 20F0405

Sample	Compound	Flag	A or P	Reason
LDW20-IT383 LDW20-IT313 LDW20-IT304DL LDW20-IT415	Aroclor-1260	J (all detects)	A	Initial calibration verification (%D)
LDW20-IT383	Aroclor-1260	J (all detects)	P	Internal standards (area)
LDW20-IT383	Aroclor-1248	J (all detects)	A	Compound quantitation (RPD between two columns)
LDW20-IT415	Aroclor-1260	J (all detects)	A	Compound quantitation (RPD between two columns)
LDW20-IT313	Aroclor-1254	Not reportable	-	Overall assessment of data
LDW20-IT313DL	All compounds except Aroclor-1254	Not reportable	-	Overall assessment of data
LDW20-IT304	Aroclor-1248 Aroclor-1254 Aroclor-1260	Not reportable	-	Overall assessment of data
LDW20-IT304DL	All compounds except Aroclor-1248 Aroclor-1254 Aroclor-1260	Not reportable	-	Overall assessment of data
LDW20-IT415	Aroclor-1248 Aroclor-1254	Not reportable	-	Overall assessment of data
LDW20-IT415DL	All compounds except Aroclor-1248 Aroclor-1254	Not reportable	-	Overall assessment of data

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 20F0405

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 20F0405

No Sample Data Qualified in this SDG

LDC #: 48765K3b
SDG #: 20F0405
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 8/12/20
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	A	Temp @ 6.4-7.2°C - Same day
II.	Initial calibration/ICV	A/SW	RSDs ≤ 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	N	CS
VIII.	Laboratory control samples /SRM	A/A	LCS
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-IT383	20F0405-01	Sediment	06/23/20
2	LDW20-IT313	20F0405-02	Sediment	06/23/20
3	LDW20-IT313RE DL	20F0405-02RE DL	Sediment	06/23/20
4	LDW20-IT304	20F0405-03	Sediment	06/23/20
5	LDW20-IT304RE DL	20F0405-03RE DL	Sediment	06/23/20
6	LDW20-IT415	20F0405-04	Sediment	06/23/20
7	LDW20-IT415RE	20F0405-04RE	Sediment	06/23/20
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9				
10				
11				
12				
13				

Notes:

VALIDATION FINDINGS WORKSHEET

METHOD: Pesticides

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

Notes:_____

LDC #: 43766k36

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

Page: 1 of 1
Reviewer: 9
2nd Reviewer: 9

METHOD: ✓ GC ___ HPLC

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
	7/7/20	5140056-CV1	IC	BB	21.8	All (dets)	J/UJ/A

ICV-qc.wpd

LDC #: 48765K36

VALIDATION FINDINGS WORKSHEET
Internal Standards

Page: 1 of 1
Reviewer: 4
2nd Reviewer: 2

METHOD: LC/MS Perchlorate

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	Area (Limits)	RT (Limits)	Qualifications
		1 (duty)	HBB	48 (50-200)		J (all detects) (BB)

HBB= Hexabromobiphenyl

LDC #: 48765K2b

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Page: 1 of 1
Reviewer:
2nd Reviewer:

METHOD: ✓ GC __ HPLC

Level IV/D Only

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

#	Compound Name	Sample ID	%RPD Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	2	1	58.2	J/dets/P
	AA	6	56.8	↓
	BB		40.4	↓

LDC #: 48765R3b

VALIDATION FINDINGS WORKSHEET
Overall Assessment of Data

Page: 1 of 1
Reviewer: 9
2nd Reviewer: 9

METHOD: ✓ **GC** __ **HPLC**

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 Samples	Qualifications
	2	AA > calib range		NR/J
	3	All except AA		
	4	Z. AA. BB > calib range		
	5	All except Z. AA, BB		
	~~2~~ ~~6~~	~~All~~ Z. AA ~~*~~ > calib range		
	7	All except Z. AA		

Comments: _____

OVRNew.wpd

LDC Report# 48765K4a

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Arsenic

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0405

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT383	20F0405-01	Sediment	06/23/20
LDW20-IT313	20F0405-02	Sediment	06/23/20
LDW20-IT304	20F0405-03	Sediment	06/23/20
LDW20-IT415	20F0405-04	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 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 method:

Arsenic by Environmental Protection Agency (EPA) SW 846 Method 6020A

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 method.

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 method. No contaminants were found in the 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. 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

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)

ICP-MS was not utilized in this SDG.

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 method. No results were rejected in this SDG.

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

Duwamish AOC4
Arsenic - Data Qualification Summary - SDG 20F0405

No Sample Data Qualified in this SDG

Duwamish AOC4
Arsenic - Laboratory Blank Data Qualification Summary - SDG 20F0405

No Sample Data Qualified in this SDG

Duwamish AOC4
Arsenic - Field Blank Data Qualification Summary - SDG 20F0405

No Sample Data Qualified in this SDG

LDC #: 48765K4a
SDG #: 20F0405
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 8/17/20
Page: 1 of 1
Reviewer:
2nd Reviewer:

METHOD: Arsenic ~~75a~~ (EPA SW 846 Method 6020A)

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	A	
VI.	Field Blanks	N	
VII.	Matrix Spike/Matrix Spike Duplicates	N	CS
VIII.	Duplicate sample analysis	N	CS
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-IT383	20F0405-01	Sediment	06/23/20
2	LDW20-IT313	20F0405-02	Sediment	06/23/20
3	LDW20-IT304	20F0405-03	Sediment	06/23/20
4	LDW20-IT415	20F0405-04	Sediment	06/23/20
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Notes:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0405

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT383	20F0405-01	Sediment	06/23/20
LDW20-IT313	20F0405-02	Sediment	06/23/20
LDW20-IT304	20F0405-03	Sediment	06/23/20
LDW20-IT415	20F0405-04	Sediment	06/23/20
LDW20-IT304MS	20F0405-03MS	Sediment	06/23/20
LDW20-IT304DUP	20F0405-03DUP	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

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 20F0405

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 20F0405

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 20F0405

No Sample Data Qualified in this SDG

LDC #: 48765K6
SDG #: 20F0405
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 8/17/20
Page: 1 of 1
Reviewer: CT
2nd Reviewer: CT

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-IT383	20F0405-01	Sediment	06/23/20
2	LDW20-IT313	20F0405-02	Sediment	06/23/20
3	LDW20-IT304	20F0405-03	Sediment	06/23/20
4	LDW20-IT415	20F0405-04	Sediment	06/23/20
5	LDW20-IT304MS	20F0405-03MS	Sediment	06/23/20
6	LDW20-IT304DUP	20F0405-03DUP	Sediment	06/23/20
7				
8				
9				
10				
11				
12				
13				
14				
15				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1 to 4	Total solids, TOC
QC: 5, 6	TOC

LDC Report# 48765K21

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Polychlorinated Dioxins/Dibenzofurans

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0405

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT304	20F0405-03	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 temperature for samples in this SDG was reported at 7.2°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 Total HpCDD	0.140 ng/Kg 0.0330 ng/Kg 0.535 ng/Kg 1.37 ng/Kg 6.33 ng/Kg 0.284 ng/Kg	All samples in SDG 20F0405

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 20F0405	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A

Sample	Finding	Flag	A or P
All samples in SDG 20F0405	All results flagged "X" by the laboratory 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 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 20F0405

Sample	Compound	Flag	A or P	Reason
LDW20-IT304	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A	Compound quantitation (EMPC)
LDW20-IT304	All results flagged "X" by the laboratory 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 20F0405

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Field Blank Data Qualification Summary - SDG 20F0405

No Sample Data Qualified in this SDG

LDC #: 48765K21 **VALIDATION COMPLETENESS WORKSHEET** Date: 8/18/20
SDG #: 20F0405 Stage 2B Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer: 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	A	7.2°C
II.	HRGC/HRMS Instrument performance check	A	
III.	Initial calibration/ICV	A A	RSD≤20/35%. ~~Rec~~ ICV≤RC limits
IV.	Continuing calibration	A	CCV≤RC limits
V.	Laboratory Blanks	SW	
VI.	Field blanks	N	
VII.	Matrix spike/Matrix spike duplicates	N	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	N	
X.	Labeled Compounds / SRM	A	
XI.	Compound quantitation RL/LOQ/LODs	A 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-IT304	20F0405-03	Sediment	06/23/20
2				
3				
4				
5				
6				
7				
8				
9				
10				

Notes:

VALIDATION FINDINGS WORKSHEET

METHOD: HRGC/HRMS Dioxins/Dibenzofurans

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 #: 48765K21

VALIDATION FINDINGS WOR/UHEET
Blanks

Reviewer: PG
2nd Reviewer:

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

Blank extraction date: 7/6/20 **Blank analysis date:** 7/9/20
Conc. units: ng/kg **Associated samples:** All qual U

Compound	Blank ID	Sample Identification											
	BIF0803-BLK1	5X											
O	0.140	0.7											
P	0.0330	0.165											
F	0.535	2.675											
Q	1.37	6.85											
G	6.33	31.65											
U	0.284	1.42											

LDC #: 48766c2

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported RLs

Page: 1 of 1
Reviewer: 9
2nd Reviewer: 47

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